EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
FLIGHT OPERATIONS PLAN

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INTEGRAL
FLIGHT OPERATIONS PLAN

Volume 2
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Book 1
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30/11/10	2/7		Replaced DEBWHI00 by DEBWHI01 Added EDs RET1ON00, RET1OF00 Changed 5minutes to 8 minutes in EENTRY03. Updated FCP_MPS_0003.	

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2.1 Book 1: Mission Planning

2.1.1 Planning Concept Overview

2.1.1.1 Background

This chapter provides an overview of the INTEGRAL Scheduling Scheme. It concentrates on the operations related scheduling activities. The scientific related aspects are not considered.

The tasks concerning the scheduling of the INTEGRAL mission are basically split between the following entities:

- MOC for the planning of the overall Satellite resources and of the ESA ground stations and of the operational resources such as communications;
- INTEGRAL Science Operations Centre (ISOC) for the planning of scientific observations and payload settings;
- JPL for the planning of Goldstone resources.

The third major element of the INTEGRAL Ground Segment, the INTEGRAL Science Data Centre (ISDC), is not directly involved in the scheduling activities. ISDC may alert ISOC regarding objects of scientific interest, the so-called Target Of Opportunities (TOO), which might trigger a re-planning of activities.

The planning I/F between MOC and ISOC concerns the planning of the operational activities and the satellite configuration. It consists primarily of the exchange of files. The planning is done on revolution level, i.e. one file of each file type (see below) will be produced per revolution. At each stage of the planning cycle more information is added to the planning files.

The following sections of this Book are particularly relevant to ISOC:

2.1.1 Planning Concept Overview

2.1.2.2 Events, Windows and Intervals for Satellite Operations

2.1.2.3 Creation of POS / EPOS from PSF(except 2.1.2.3.2.2.10; 2.1.2.3.5; 2.1.2.3.7 and 2.1.2.3.8)

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2.1.2.6.3 FCP_MPS_0003: Replanning in case of RPOS

The planning I/F concerning the Goldstone resources follows in principle the JPL planning scheme.

The various scheduling activities involve basically the following personnel:

- ESOC Scheduling Office (SCHEDO), which is mainly in charge of scheduling the ESOC and ESA ground station resources as required by the Flight Control Team (FCT) and in addition it interfaces to the JPL Resource Allocation Office;
- Flight Dynamics Team, which is to determine the planning skeleton and to merge the Payload (PL) with the Service Module (SVM) related operations;

- S/C Operations Engineer (SOE) of the FCT, in charge of scheduling activities, who is to co-ordinate activities and to handle short term planning changes;
- S/C Operations Manager (SOM), who is to approve the final operational timeline;
- JPL Resource Allocation Office.

The INTEGRAL mission does not have a dedicated scheduling function at MOC for the operations that is manned 24 hours per day and 7 days per week. The co-ordination of the various scheduling activities is performed by the S/C Operations Engineers of the FCT during normal working hours only.

2.1.1.2 Scheduling Cycle & Scheduling Products

2.1.1.2.1 Overview

An overview of the scheduling process is provided in Table 1.

STEP	TIME	ACTIVITY	INIT	REC	DATA PRODUCT	INPUT	FREQ	LEAD TIME	Comments
1	T0-6 months	Long Term Planning	MOC FD	MOC SO	Long Term Event File (LTEF)		6 months	6 months	Contains coverage and altitude crossing info
2	T0-6 months	Goldstone Scheduling Request	MOC SO	JPL	Network Information Server (NIS) Schedule Request	LTEF	6 months	6 months	45 min margin either side of AOS/LOS (RED) in LTEF
3	T0-6 months	Long Term SPK File	MOC FD	JPL	Satellite Planet Kernel (SPK)		6 months		
4	T0-10 weeks	Generation of SAF File	JPL	MOC SO (FD)	Allocation File (SAF)	LTEF, SPK	2 weeks	10 weeks	Lead time may be longer (4 months) for CP/PV phase.
5	T0-1 month	Generation of PSF and Provision of PSF to ISOC	MOC FD	ISOC	Planning Skeleton File (PSF)	SAF, orbit prod (inc. STEF)	1 week	1 month	Recommended GSHO scheduled in order to maximise REDU support
6	T0-1 month	Update of Goldstone Scheduling Request	MOC SO	JPL	NIS Schedule Request	STEF (Short Term Event File)			
7	T0-1 month	Update of SAF File	JPL	MOC SO (FD)	Allocation File (SAF)	STEF, NIS request	2 weeks	10 weeks	
8	T0- 2 weeks	Generation of POS and Provision of POS to MOC	ISOC	MOC FD	Preferred Observation Sequence (POS) +ICP	PSF, orbit products, observation DB	1 week	2 weeks	GSHO scheduled by ISOC during overlap period
9	T0- 2 weeks	Processing of POS and Generation of EPOS	MOC FD	MOC FCT + ISDC	Enhanced Preferred Observation Sequence (EPOS) + APF/ESM/PAF (to ISDC)	POS, ICP, Orbit products	1 week	2 weeks	
10	T0- 2 weeks	Update of Goldstone Scheduling Request	MOC SO	JPL	NIS Schedule Request	POS	1 week	2 weeks	Reduction of support based on scheduled GSHO in POS

STEP	TIME	ACTIVITY	INIT	REC	DATA PRODUCT	INPUT	FREQ	LEAD TIME	Comments
11	T0- 2 weeks	Generation of SPK File	MOC FD	JPL	Satellite Planet Kernel (SPK)				
12	T0-2 weeks	Update of SAF File	JPL	MOC SO (FD)	Allocation File (SAF)	STEF, NIS request, updated viewperiods	2 weeks	10 weeks	
12	T0- 1 week	Generation of Operational Timeline	MOC FCT	MOC FCT, ISDC, ISOC	Timeline and Timeline Summary File	EPOS, APF, ESM	1 week	1 week	
13	Every Thu for following Mon-Sun	Download of SDS	MOC GCR	MOC SO, MOC FCT	Seven Day Schedule / Forecast	SAF	1 week	3 days	Cycle of SDS based on day of week, so 1 revolution may cross over an SDS. In this case, the seven day forecast must also be used. The SDS and SDF should correspond to the latest issued SAF.
14	T0- 3days	Generation of Command Schedule	MOC FCT	MOC FCT	Command Schedule	TL	1 orbit	1 orbit	
15	T0- 3days	Generation of SICF	MOC GCR	MOC SO, MOC FCT	Service Instance Configuration File (SICF)	SAF/SDS			This is checked against the SAF and the EPOS
16	T0- 3days	Generation of OMS11	MOC SO	MOC FCT, MOC GCR		SAF/SDS			This is checked against the SAF and the EPOS
17	T0	Start of the Operations							

Table 1. Overview of scheduling cycle

2.1.1.2.2 Planning Skeleton File

The operations related scheduling starts with the generation of the Planning Skeleton File (PSF). The Flight Dynamics Team generate the PSF, one file per revolution, using the Flight Dynamics System (FDS). The PSF is generated about 30 days in advance of the start of the planning period (revolution) and a set of PSFs covering 2-3 revolutions are produced every week. In addition, long term PSFs may be sent up to two months in advance to enable the long term planning of observations at ISOC.

The PSF defines the skeleton of the operational activities for a revolution. It identifies

- orbit related events, such as Eclipses or Perigee Passages;
- time windows for necessary Satellite operations, e.g. manoeuvres;
- time windows available for science related activities.

The PSF defines basically the constraints that are to be considered by ISOC for the planning of the science related activities. ISOC will associate science operations to the allocated windows during the next stage of the planning process.

2.1.1.2.3 Preferred Observation Sequence

ISOC will receive the PSFs and will add the information concerning the scientific related operations. This includes basically the identification of the targets / pointings and the corresponding instrument configurations.
This process results in two files, the Preferred Observation Sequence (POS) and the Instrument Command Parameter (ICP) File.
The POS corresponds to the PSF structure but contains additional information. The instrument configurations are defined using the so called Event Designators (ED), which are equivalent to a high level definition of command procedures.
The second file is the ICP, which defines the detailed settings of the command parameters that are related to the EDs.

ISOC will provide a set of files covering two weeks about two weeks in advance of the concerned period. This means that this set covers a period from two weeks until 4 weeks in advance.

2.1.1.2.4 Enhanced Preferred Observation Sequence

The POS will be provided to the Flight Dynamics System (FDS) at ESOC. The FDS checks that the POS has considered the various satellite constraints, e.g. sun pointing constraint. If the checks are successful the necessary satellite operations are added, e.g. the operations needed to pass an Eclipse.
The result of this process are again two files, the Enhanced POS (EPOS) and the Attitude Parameter File (APF).
The EPOS has the same structure as the POS but contains additional information. Here again EDs are used to define the relevant information.
The second file is the APF. The name is a little bit misleading because it does not define only the attitude parameters but defines the content of all command parameters that are defined in the EPOS. It is equivalent to the ICP but contains additional information regarding the Service Module and Instrument related operations.

The EPOS and the APF are provided to the Flight Control Team when available, i.e. a few days after reception of the POS.

2.1.1.2.5 Operational Timeline & Command Schedule

The EPOS and the APF are converted by the FCT into the Operational Timeline using the INTEGRAL Mission Control System (IMCS). The Operational Timeline is an intermediate product that is used to generate the Command Schedule. At this step the EDs are converted into the actual telecommands using the Operational Database.

It is envisaged to produce the Operational Timeline / Command Schedule about one week in advance to the relevant orbit so that there is sufficient time for ISOC to approve the Timeline with respect to the science related operations.

The actual command schedule is loaded on the command system of the IMCS at Perigee, i.e. during the outage period.

2.1.1.3 Replanning

In case a Target of Opportunity (TOO) is identified, a TOO Alert is raised and a replanning is performed at short notice in order to generate a new Timeline which includes the desired observation. A replanning may also be required in case of a satellite anomaly.

Under this scenario, a Replanned Preferred Observation Sequence (RPOS) is created by ISOC and transferred to MOC. MOC processes this RPOS in order to generate the replanned Timeline. The criteria for using the RPOS mechanism to execute a replanning of the Timeline are as follows:
- The timeline for the revolution is already executing;
- The revolution starts in a few hours;
- The revolution starts on a non-working day.

Certain constraints apply to the RPOS, such as:
- The RPOS must be received at MOC at least 8 hours before start of execution of the replanned Timeline;
- A Reaction Wheel Bias must be the first activity following the time at which the original and the replanned Timelines diverge (the latest time at which execution of the replanned Timeline can begin);
- Only one RPOS may be issued per revolution.

Detailed constraints and handling of an RPOS are covered in the procedure for replanning using an RPOS (FCP_MPS_0003), Section 2.1.2.6.3.

2.1.1.4 Special Considerations regarding Goldstone Services

This chapter provides a collection of some information that is relevant for the planning I/F with JPL. Further details are also provided in Vol.4, where the scheduling of Goldstone resources is addressed.

ESOC will provide the required long term scheduling requests to JPL every 6 months according to the long term scheduling concept of JPL. This long term request is basically based on the following rules:
- The utilisation of Redu is maximised. This means that Redu will be kept as long as possible and the switch-over to Redu will be done as soon as possible.
- A margin of about 40 minutes is envisaged at both ends to provide ISOC with some flexibility in allocating the station handover.

Note: This is necessary because commanding is not possible during the handover period of 10 minutes and it should be avoided to impact the dithering pattern, which is needed for the scientific observations.

This long term schedule is used by ESOC to produce the PSF.
The PSF will contain recommended handover windows according to the above rules. However, ISOC has the capability to move the windows according to their needs.

The POS will include an identification of the hand-over windows. As soon as the POS is available ESOC will interface to the JPL Resource Scheduling Office to update the Goldstone schedule. This will take place about two weeks in advance. At this stage the ESOC requests are rather stable regarding the utilisation of Goldstone.
It is emphasized that there is only limited flexibility available to accommodate late changes without impacting the science and without requiring significant replanning.

It is assumed that the commitments from Goldstone are very stable at this stage. Therefore the Goldstone schedule is considered for the production of the Operational Timeline. As soon as the 7 days schedule is available ESOC will download this schedule and will produce the Service Instance Configuration File (SICF). The ESOC Operations Engineer will verify that the SICF, which is the basis for the utilisation of the ground stations is in line with the command schedule. To this purpose a flag will be set in the SICF.

ESOC has two options to cope with late changes of the services or with interruptions.

The first method is to interrupt the commanding and to delay the operations by up to 5 minutes. The ESOC S/C Controller (SPACON) is to resynchronise the commanding with the initially planned execution times at an appropriate point of time. This method cannot be applied to FD related activities because the FDS would get out of synch.
The second method is used in case of longer interruptions of the services or in case of very late changes of the station availability, which makes it impossible to perform a replanning cycle with ISOC. In this case the command schedule will be interrupted and the nominal timeline will be re-entered at predefined re-entry points, which are marked by the so called Conditional Configuration Change Flags (CCCF). These re-entry points are planned by ISOC and are a few hours apart from each others. This means that the utilisation of this mechanism will impact significantly the INTEGRAL mission. This can lead

- either to the loss of several hours of scientific observations
- or to the loss of essential S/C operations.

The second case could cause in a worst case the triggering of the on-board safety mechanism, the so called Emergency Sun Acquisition Mode (ESAM).

2.1.2 Reference Orbit Definition

2.1.2.1 Introduction

This document defines the nominal Reference Orbit Operations of the Integral Spacecraft. It defines pre-planned activities executed via the automatic timeline, which is generated using the Mission Planning facilities, as well as both regular and irregular nominal activities executed manually.

There are three categories of reference orbit for Integral depending on the season: Winter orbit with Eclipse (eclipse post-perigee); Summer Orbit with Eclipse (eclipse pre-perigee) and orbits without an eclipse. The impact of the presence and location of eclipses in the orbit on the skeleton timeline are indicated in the Integral User Manual Section 4.6.

In addition, general S/C constraints which are applicable and have been taken into account in the development of the sequences to be executed by the automatic Timeline, the structure of the mission planning files and the safety checks performed by the mission planning tools are described in the Integral User Manual Section 4.5.

2.1.2.2 Events, Windows and Intervals for Satellite Operations

Windows, intervals and events are inserted in the PSF by Flight Dynamics in order to mark key orbital events such as coverage, AOS (TC) and eclipses as well as to reserve parts of the revolution for certain operations with particular constraints. In addition, certain windows and intervals are inserted by ISOC when generating the POS. In doing so, and in scheduling the other activities in the POS, ISOC must comply with the constraints imposed by the definition of these events, intervals and windows, as detailed in this section. These constraints must also be applied when scheduling the activities in the EPOS at MOC.
The three types of keywords appearing in the PSF are as follows:

- **Event**: This marks an orbit-determined point such as acquisition of TC uplink capability or the start of the period in which coverage from two ground stations overlap.
- **Window**: A section of the revolution reserved for a particular type of activity and in which certain constraints apply. Windows are mutually exclusive to one another (they may not overlap), and the close of one window must coincide with the opening of another, except at the start and end of the revolution. Windows begin and end with OPEN and CLOSE extensions to the window name, e.g. INSTRUMENT_OPEN and INSTRUMENT_CLOSE.
- **Interval**: A section of the revolution in which a particular activity should be carried out. Intervals may also have particular constraints which apply within them. Intervals begin and end with _START and _STOP extensions to the interval name, e.g. HANDOVER_START and HANDOVER_STOP.

2.1.2.2.1 Events

The following keywords appear in the PSF indicating orbital event as described below.

Keyword	Event
PSF_START	Time of perigee passage at the start of the revolution
AOS/LOS_TC	Time acquisition or loss of TC uplink capability from the station
AOS/LOS_TM	Time of acquisition or loss of TM signal at the station
OVERLAP_START	Start of double station coverage
OVERLAP_STOP	End of double station coverage
IMMINENT_ECL_FLAG	Time at which the imminent eclipse flag is set.
E_ECLIP_START	Start of Earth eclipse (Penumbra)
L_ECLIP_START	Start of lunar eclipse (Penumbra)
E_ECLIP_STOP	End of Earth eclipse (Penumbra)
L_ECLIP_STOP	End of lunar eclipse (Penumbra)
STATION_TC_START/STOP	Time at which the station should be commanded to start/stop TC uplink
STR_START	Earliest time start tracker can be used for mapping
(R)PERIGEE_EXIT	Earliest time when slews can start, parameters contain the recommended perigee passage attitude
FIRST_SLEW_START	Earliest time at which slewing can occur
R_OBM	Time at which the MOUT 'Report and reset OBM' should be placed in the EPOS
FIRST_SLEW_STOP	Earliest time at which the first slew after perigee can stop
CRIT_INST_ALT_ASC	Critical Instrument Altitude Ascending

Keyword	Event
	(Radiation Belts Exit)
X_START	Earliest time for science observations from instrument X
CRIT_INST_ALT_DESC	Critical Instrument Altitude Descending (Radiation Belts Entry)
X_STOP	Latest time for science observations from instrument X
IMU_HEALTH_CHK	15 minutes before IMU Health Check should be performed in eclipse season.
LAST_SLEW_STOP	Latest time by which slew to perigee passage attitude (last slew in the revolution) must be completed
(R)PERIGEE_ENTRY	Latest time by which S/C must be in perigee passage attitude; parameters contain the recommended attitude for entering the perigee pass at the end of the revolution
STATION_TM_START/STOP	Time at which the station should be commanded to start/stop TM acquisition
STR_STOP	Latest time start tracker can be used for mapping
PSF_STOP	Time of perigee passage at the end of the revolution

2.1.2.2.2 Windows

The following table (Table 2) contains the definitions of the windows contained in the PSF and POS.

Window	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
AOS_CHK	At first AOS, to execute post perigee pass status/health check, to report and reset on-board buffers and to select IREM Ground Link On	25 min	At AOS_TC after Perigee	None: this window has higher priority than all other windows with which it could possibly coincide	No Slews or ISOC activities	Establish and verify TC/TM link (manual); Check S/C health, OOLs, status following Perigee / LOS (manual); Report OBDH and ACC Buffers (TL ED JEDMP100); Reset OBDH and ACC OEM Buffers following successful completion of report (manual); Check for anomalous / unexpected OEMs and OBM Limit Check violations (manual); Set IREM Ground Link On (TL ED UEGRON01); SPI OR Telemetry reporting (unless during eclipse) (TL ED EEORTM01); Check execution of any time-tagged TCs scheduled for execution during perigee pass; Assign TM bandwidth for patch and dump (TL ED DEBWHI01)	15 minutes margin is allowed in this window before starting command activities to be able to establish stable TM / TC links. The commands to reset the buffers will only be sent after confirmation that the dump of the on-board buffers was successful.
POST_ECLIPSE	S/C reconfiguration after Eclipse	30 min	ASAP after each eclipse (E_ECLIP_STOP), but see Constraints on Placement	Lower priority than LOS_CHK and AOS_CHK but higher priority than other windows	No slews or ISOC activities	Perform status consistency check (manual); Limit check (manual); Check of correct execution of PDU PROM sequence (manual); Disable SECL S/W before instrument activation (TL ED DESCLD00); Disable nominal heaters and switch-on P/L units (TL EDs **CLEX**)	
NEXT_ECLIPSE	Load AOCS Timers and time-tag Buffer to prepare for next eclipse	15 min	ASAP after the POST_ECLIPSE window, but see Constraints on Placement	Lower priority than LOS_CHK and AOS_CHK but higher priority than other windows	No slews or ISOC activities	Set AOCS eclipse timers (TL EDs); Load TT command queue for subsequent eclipse (TL EDs); Report TT buffer (TL ED DETREP00)	In the last revolution before an eclipse season starts a NEXT_ECLIPSE window will be inserted in the PSF to accommodate loading of Time-tagged TCs and AOCS timers in preparation for the first eclipse of the upcoming eclipse season in the subsequent revolution. After the last eclipse in an eclipse season this window will be suppressed by FD, and will not appear in the PSF.
WHEEL_BIAS (SOPS)	To execute a Reaction Wheel Bias manoeuvre	22 mins	Variable (see Remarks)	PSF: In the event of a clash with POST_ECLIPSE window, this window has lower priority. POS: When ISOC places a	No slews or ISOC activities	a)Change of Guide Star via TL ED AECGS_00 (112sec) The TL ED AERWB_00 which executes the following: b) Manoeuvre preparation (111 sec) c) Wheel bias execution (390 sec) d) On-modulation (100 sec) e) Tranquillisation (100 sec) f) Controller Tranquillisation (300 sec) g) Following this an attitude reconstruction is performed by	PSF: The 1st WHEEL_BIAS window is placed in the PSF as soon as possible after AOS_CHK and another WHEEL_BIAS window is placed as late as possible before LOS_CHK (see however Constraints on Placement). An RSOPS (WHEEL_BIAS) keyword indicating a recommended WHEEL_BIAS window will be placed in the PSF close to apogee to ensure that at least 3

Window	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
				WHEEL_BIAS window in the POS, they may only do so during an INSTRUMENT or DUMMY window.		the FDS before the next AOCS ED (160 sec) The duration of point c) depends on the actual unload to be performed and may last longer than the 390sec stated. The TM link can be used also to downlink science data – however the OTF flag will be low during the RWB. The next slew cannot take place earlier than 160 seconds after the end of the wheel bias manoeuvre because this is the time needed by the MOC to determine the slew parameters considering the actual attitude, thus this time is included within the WHEEL_BIAS window. **N.B**. In the case of the 1st wheel bias of the revolution, the ED AECGS_00 to perform the change of guide star is not inserted as it is performed during the LOS_CHK window of the previous revolution.	RWB windows are present in any orbit. POS: The actual placing of the 2nd window is done by ISOC in the POS and may be displaced with respect to the RSOPS by as much as the offset parameter given in the RSOPS. Additional WHEEL_BIAS windows will be placed by ISOC where required, depending on the type and distribution of slews. In particular, a WHEEL_BIAS will be placed before any slew > 45 degrees and after a certain number of slews in a GPS (currently after 10 slews of a GPS).
SATENG	To provide a window for either periodic or 'one-off' Satellite engineering activities.	40 mins (for the periodic one at the start of the revolution)	ASAP after 1st WHEEL_BIAS after Perigee		No instruments TCs	Satellite engineering activities, e.g.: - Load of new Polling Sequence Table (PST); - Load new On-Board Monitoring (OBM) Table entries; - S/W load and dump including modification of S/W parameters; - IBIS ISGRI Table Loading	The operations depend on the conditions and non-predictable events and will be different from revolution to revolution.
IBIS_CAL	To execute the IBIS calibration activities before the INSTRUMENT window opens.	25 mins	Latest of: - 25 minutes before Critical Altitude crossing after perigee - Immediately after the SATENG window		No Instrument commanding by ISOC	Execute IBIS ISGRI Calibration (TL ED GEISCL03); JEM-X Anode Electronic Cal at perigee exit (TL EDs KEACAL01/LEACAL01)	This window is necessary to prevent ISOC commanding to IBIS while the calibration is on-going.
POST_BELT_CONF	To configure the instruments after rad belt exit and load BCPKT group 1 parameters.	15 mins	Crossing of the Critical Altitude post perigee (CRIT_INST_ALT_ASC), but see Constraints on Placement	This window has a lower priority than the AOS_CHK, POST_ECLIPSE, WHEEL_BIAS, SAT_ENG and IBIS_CAL windows and so will be delayed if there is a clash (e.g. in	No Instrument commanding by ISOC	Load time-tagged TCs to put IBIS in Safe configuration at next radiation belts entry (TL ED GEBENT02); OMC reset ROE (TL ED MEBEXT01); IBIS Reconfiguration after belts exit (TL ED GEBEXT01); Remove TM bandwidth for patch & dump (TL ED DEBWLO00); Load Broadcast packet Group 1 parameters (TL ED DEBPG100);	In parallel to these activities the Post perigee slew may also be started. This window is needed to exclude ISOC TCs to the instruments while the reconfiguration activities are on-going

Window	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
				winter eclipse season).			
INSTRUMENT	Window in which scientific observations can be performed	Orbit dependant, and variable throughout the revolution.	Immediately after POST_BELT_CONF window	This window may be interrupted by higher priority windows, such as SOPS windows.		Operations for scientific observations including: - Instrument Configuration - Execution of slews - Changes of PST	The activities performed in this window are planned by ISOC. ISOC will split the INSTRUMENT window in order to place SOPS (WHEEL_BIAS) windows within this period to execute RWBs as needed. The positioning of these activities is dependant upon the sequence of manoeuvres scheduled by ISOC, see row for WHEEL_BIAS (SOPS) windows. Unless it is cut short e.g. by LOS_CHK or PRE_ECLIPSE (in summer eclipse season), the last INSTRUMENT window in a revolution will end at CRIT_INST_ALT_DESC.
LOS_CHK	To verify S/C configuration and prepare for LOS and perigee pass	25 mins	As late as possible before loss of TC Link before perigee pass		No slews or other ISOC activities	Check S/C health, status for upcoming Perigee / LOS (manual); Report OBDH and ACC Buffers (TL ED JEDMP100); Set IREM Ground Link Off (TL ED UEGROF01); Reset OBDH and ACC OEM Buffers following successful completion of report (manual); Change of guide star in preparation for wheel bias at the start of the next revolution (TL ED AECGS_00); Stop TC uplink (manual)	
PRE_ECLIPSE (SOPS)	Special pre-eclipse window to ensure that no slew takes place in the period from 15 minutes before the eclipse imminent flag is set until the eclipse entry (or LOS) time.	Orbit dependant (see Constraints on Placement)	15 minutes before the imminent eclipse flag is set, but see also Constraints on Placement	This window is only placed if there is coverage in the relevant period and it may be delayed if it conflicts with a window of higher priority. If placed, this window closes at the earliest of eclipse entry or LOS_CHK_OPEN.	No slews and no instrument EDs to be inserted by ISOC	No EDs scheduled in this window. However when this window is scheduled (normally only in the summer eclipse season) the IMU calibration and the execution of the Pre-eclipse time-tagged TCs would occur in this window.	Before the eclipse imminent flag is set, any transition from TCM(A) to TCM(B) following a momentum dump must be completed (at least 15 minutes before the eclipse imminent flag is set) and the ACC must be commanded to IPS. The most restrictive of these two constraints is the first. The transition to TCM-A can occur at the latest 507s before the end of a 22 minute RWB window. Therefore the RWB window must finish at least 393 seconds before the eclipse imminent flag is set. Any open loop or closed loop slew must be completed at least 15 minutes before the eclipse imminent flag is set.
ECLIPSE (SOPS)	Special eclipse window to cover periods during eclipse when no other window is specified.	Variable and not all revolutions with eclipse contain this window (see Constraints on	Earliest start time is coincident with the E_ECLIP_START keyword designating	Only placed during eclipse under coverage when no other window is placed. If placed, the latest possible end time is Penumbra exit	No slews or instrument EDs to be scheduled by ISOC	Empty	

Window	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
		Placement)	Penumbra entry (L_ECLIP_START in the case of a lunar eclipse)	(E_ECLIP_STOP or L_ECLIP_STOP keyword).			
DUMMY	This window is placed in the PSF as a 'filler', when no other windows are scheduled.	Variable			This time cannot be counted for science time.	Activities such as slews, RWBs or instrument configuration in preparation for science observations can be scheduled.	

Table 2. Definition of windows in mission planning files

2.1.2.2.3 Intervals

The following table (Table 3) contains the definition of the intervals in the PSF and POS. Note that the start and end keywords for events (listed in Section 2.1.2.2.1) such as double station coverage also define an interval. However, the intervals listed below are those for which there is an element of choice in their exact positioning in the generation of the planning files.

Interval	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
RHANDOVER	Recommended interval to perform the Ground Station Handover (to reconfigure TC/TM links between supporting Ground Stations)	15 mins (nominal, but see Remarks)	Placed in PSF during a station overlap period such as to maximise use of ESA Ground Stations, provided overlap is larger than 10minutes (otherwise see Remarks)	See remarks			Fifteen minutes is the nominal duration of this interval, so long as the coverage overlap between the stations is: o > 2 mins when station handover is ESA to NASA o > 5 mins when station handover is NASA to ESA This is because a NASA station requires 10minutes contact with the MOC within the HANDOVER interval, either for starting or terminating service, while an ESA station requires 2 minutes when terminating service 5 minutes when starting service. If there is sufficient overlap, these activities can be executed in parallel. In this case, and if the overlap is less than 10mins, the RHANDOVER is centred at the centre of the overlap. If there is insufficient overlap this interval must start 2 minutes before LOS TC at the old ground station if it is an ESA station, or 10 minutes before LOS TC at the old ground station if it is a NASA station. It must end 5 minutes after AOS TC with the new ground station if it is an ESA station, or 10 minutes after AOS TC if it is a NASA station. Thus, in the case of insufficient overlap, the interval can have a duration of up to 15 minutes.
HANDOVER	Interval to perform a Ground Station Handover (to reconfigure TC/TM links between supporting Ground Stations)	Variable (see remarks)	Variable (see remarks)	See remarks	No TC operations allowed for science operations - Possible Downlink interruptions - No slews allowed	The following activities take place during this window: - Set Broadcast Packet HANDOVER flag - Perform antenna switchover (if required) - Re-configure links to station. - Reset Broadcast Packet HANDOVER flag* *This is currently the only ED which can be inserted by ISOC in a MOC interval	When creating the POS ISOC places a HANDOVER interval for every RHANDOVER contained in the PSF. ISOC may place the HANDOVER interval elsewhere within the station overlap period. When doing this, the HANDOVER Interval must remain within the Station Overlap period. If the overlap is shorter than the RAHANDOVER interval then ISOC must place the HANDOVER interval in the same position. In the case of a short TC outage of less than

Interval	Purpose	Duration	Start Time	Constraints on Placement	Constraint on Activities	Content	Remarks
							10mins between the two stations, the concept of a negative overlap period is valid and a fixed HANDOVER interval will be placed in the PSF. In this case the duration of the interval will be the duration of the outage plus 10mins either side of the outage. The advantage of this approach is that there is no need to insert LOS_CHK / AOS_CHK windows.
RMU_CAL	To provide an interval during stable pointing and free of other AOCS activities in order to perform the RMU Drift Calibration.	15 minutes	Variable (see Remarks)	May only be placed during INSTRUMENT and must by placed wholly within the INSTRUMENT window (thereby ensuring no overlap with other windows such as WHEEL_BIAS). The RMU_CAL interval must not overlap any other intervals scheduled within the INSTRUMENT window, such as HANDOVER.		Reset RMU FCE integration to start the RMU calibration	According to the pattern of slews placed in the POS (and any other constraints (see below) ISOC will be allowed to place these intervals at up to +/-3 hours from the time indicated in the PSF by the RSOPS(RMU_CAL) keyword. ISOC will try to minimize the size of the shifts by placing the interval as close as possible to time of the corresponding RSOPS(RMU_CAL) in the PSF. FD will place 4 RSOPS keywords for RMU_CAL evenly spaced in the orbit (i.e. every 18 hours) within the INSTRUMENT Window at: Perigee + 9 hours Perigee + 27 hours Perigee + 45 hours Perigee + 63 hours Although it is an interval, the time of the RMU Calibration is indicated in the PSF via the RSOPS keyword for historical reasons

Table 3. Intervals in the mission planning files

2.1.2.3 Creation of POS / EPOS from PSF

2.1.2.3.1 Overview

The following are the main activities scheduled in generating the POS at ISOC or the EPOS at MOC. In addition to the references given below to descriptions of the scheduling constraints for these activities, detailed constraints on the placement of individual EDs are provided in the description of each ED in Sections 2.1.2.3.6 and 2.1.2.3.7.

- **Slews and Reaction Wheel Biases:** Whenever ISOC need to slew the spacecraft either to point the telescope at a new target, or to move to the next point in a dithering or GPS observation, they will insert a PREQ in the POS. Along with the PREQ, information about the slew and the pointing identifier will also be inserted as parameters in the POS. For details about the scheduling and contents of the relevant EDs, see 2.1.2.3.7.2.9, 2.1.2.3.7.2.11 and 2.1.2.3.7.2.13. In addition, ISOC will insert Reaction Wheel Bias windows according to the RSOPS (WHEEL_BIAS) in the PSF as well as other planning rules, see the description of the WHEEL_BIAS window in section 2.1.2.2.2. Several constraints from the AOCS S/S and commanding must be considered in the scheduling of sequences of AOCS manoeuvres by ISOC. These are explained in detail in Section 2.1.2.3.2, which details the activities of the AOCS subsystem executed via the automatic Timeline and the related constraints.

  These PREQs and wheel biasing opportunities are processed in the EPOS generation, when the reaction wheel profile is planned and validated. The slew parameters are then calculated and the relevant AOCS EDs are then inserted in the APF.

- **RMU Calibrations:**: After planning the observations and scheduling the required PREQs, ISOC places intervals in which the RMU Calibrations can be performed during periods of stable pointing. For details of the constraints on the placement of RMU Calibrations, see the entry for RMU_CAL intervals in Section 2.1.2.2.3.
  During EPOS generation, Flight Dynamics insert the ED for the reset of the RMU integrator during these intervals.

- **Manipulation of the PST and Broadcast Packet Parameters:** ISOC assign the PST telemetry allocation amongst the instruments and set the Broadcast Packet Group 2 parameters during the INSTRUMENT window. The PST is controlled via a request inserted in the POS (PSTREQ). As regards the BCP G2 parameters, these EDs are inserted directly by ISOC, in line with certain timing constraints, see Section 2.1.2.3.6.1. MOC sets the Broadcast Packet Group 1 parameters after crossing the critical instrument altitude ascending via an ED inserted at the time of EPOS generation.
  During Timeline generation, the PSTREQ is processed and the appropriate ED is scheduled in the Timeline, see Section 2.1.2.3.3.

- **Antenna Swaps:** Calculation of required antenna swaps and the insertion of the relevant EDs is performed by MOC during EPOS generation. For details on the strategy for antenna swaps, see section 2.1.2.3.5.

- **Instrument Configuration:** ISOC configures the instruments as required for science observations during the INSTRUMENT (or DUMMY) window only by inserting the relevant mode EDs. This includes switching on the JEM-X High Voltage. In addition, CCCFs are inserted at regular intervals in case a recovery of the planned observation schedule is required. This is described in Section 2.1.2.3.4

- **Eclipse Configuration:** The EDs necessary for configuration of the instruments and platform during the eclipse season are inserted during EPOS generation at MOC. Relevant constraints are described in Section 2.1.2.3.7. Constraints on the timing of the AOCS eclipse EDs are detailed in Section 2.1.2.3.2.

- **Ground Station Handovers:** Apart from fixed handovers scheduled in the PSF, GSHOs are placed by ISOC in the POS within the overlap interval. The constraints which apply to the placement of HANDOVER intervals are described in the entry for HANDOVERs in Section 2.1.2.2.3.

- **Setting perigee passage attitude**: MOC FD inserts the recommended perigee passage attitude in the PSF, however ISOC are able to alter this to another safe perigee passage attitude if they prefer for the purpose of the science observations to be scheduled. The safety of the perigee passage attitude (like all attitudes throughout the revolution) are checked at POS and EPOS level against the S/C attitude constraints, see Integral User's Manual Section 4.5.1.

2.1.2.3.2 AOCS Sequence Timing Constraints in Automatic Timeline

This section describes the current implementation of the AOCS operations to be executed by the Automatic Timeline. It concentrates on the timing issues. In particular, it tries to detail the timing implemented inside the needed command sequences and the times needed in between sequences. These times are to be taken into account by ISOC when generating the POS.

The conclusions can be summarised as:
- From Open Loop Slew end to Open Loop Slew start, 622 seconds are needed.
- From Open Loop Slew end to Offset start, 679 seconds are needed.
- From Open Loop Slew end to RWB window star 420 seconds are needed.
- From Offset end to Open Loop Slew start, 682 seconds are needed.
- From Offset end to Offset start, 739 seconds are needed.
- From Offset end to RWB window star 480 seconds are needed.
- From RWB Window end to Open Loop Slew start, 202 seconds are needed.
- From RWB Window end to Offset start, 259 seconds are needed.
- From the beginning of the Science Window to Open Loop Slew start, at least 202 seconds are needed.
- From the beginning of the Science Window to Offset Start, at least 259 seconds are needed.
- The RWB window duration is 22 minutes (i.e. 1320 sec).

Note that the case of a RWB followed immediately by a scientific pointing, without any slew or offset in between, is currently not foreseen.

2.1.2.3.2.1 Timelines for Scheduled AOCS operations

2.1.2.3.2.1.1 General considerations

In the sequences detailed in the next sections, the following times have been adopted:
- 240 seconds needed by the Flight Dynamics System, from the start of a mapping, to the attitude reconstruction completion.
- 120 seconds to transfer updated AOCS command parameter from the FDS to the IMCS, and to process the file in the IMCS (time based on the IMCS SRD).
- The update of the timeline parameters will only be accepted when the affected command sequence is at least 60 seconds in the future. Taking this and the previous point into account, 420 seconds are needed from the start of a mapping before an AOCS command sequence, requiring an attitude reconstruction based on the mapping, can be scheduled.
- For commands that check the correct execution of the previous one as a precondition for uplink (interlock based on Command Execution Verification, designed as "C" in the ED tables), an interval of 25 seconds has been allocated. This does not assume worst-case delays. It just takes into account the reasonable delays. The onboard delay between the moment a parameter changes, and the relevant packet being downlinked, can amount to

15 seconds in the case of the RTU packets. The additional 10 seconds are there to cope with reasonable ground delays in the TC and TM transmission. In flight experience shows that this has worked well.

- For commands where some time interval with respect to the previous one has to be respected, an interval of 15 seconds has been allocated, plus an interlock on onboard acceptance has been set (designed as “O” in the ED tables). The interlock is needed, since the COP-1 protocol of the Packet Telecommand Standard does not respect the delta in between commands, in particular when there are re-transmissions. There is no way to ensure that commands that leave the control system at different times, are not actually released to the S/C at the same second (unless re-transmission is disabled at global level). By forcing interlock at the stage of onboard acceptance, the IMCS will not release the second command before it receives confirmation that the first one has been received and accepted on board. This ensures at least some interval between commands. In order to allow time for the confirmation, the 15 seconds interval has been set. This allows 10 seconds for ground delays in TC/TM transmission and 5 for onboard generation and downlink of the correspondent CLCW. For Redu, this margin is more than sufficient, but for Goldstone, the full margin has been found to be necessary.
- When the times for the OTF change are mentioned in the context of the AOCS operations, it should be taken into account that this is not when the instruments will see it, but just when the ACC sets it. The delay on the Broadcast Packet generation and distribution has to be taken into account.

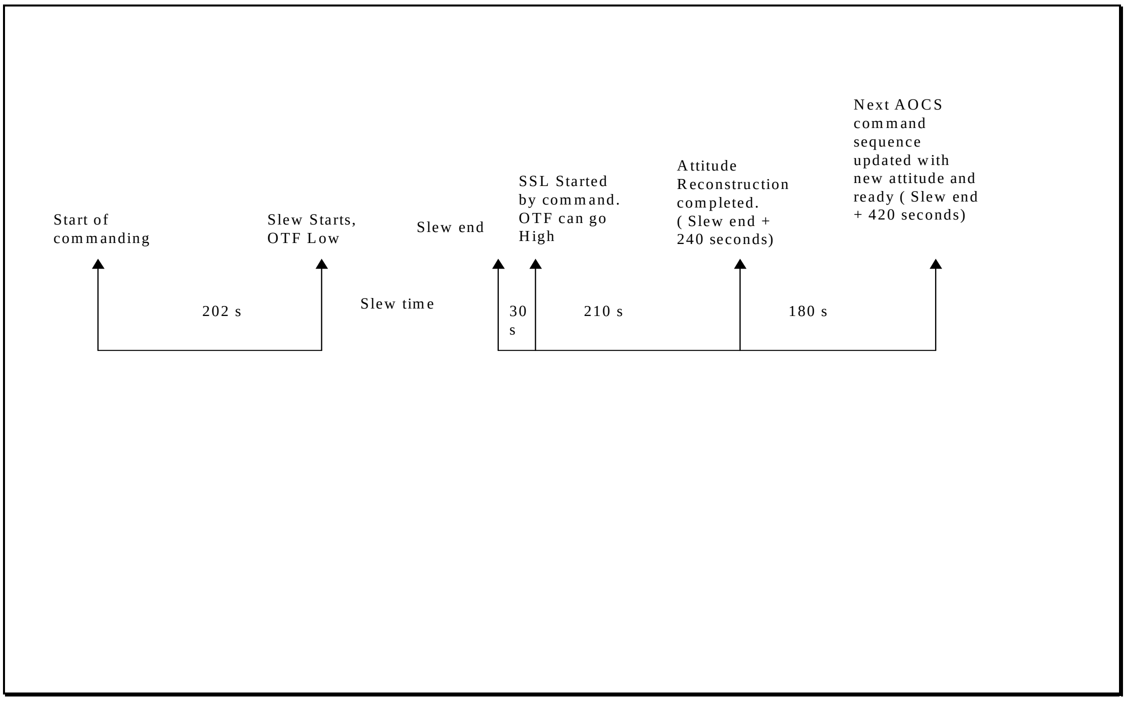
2.1.2.3.2.1.2 Open Loop Slew

In terms of command sequence, there are two types of slews:

- Slews > 7°. For these slews the Sun Steering Law can not be enabled autonomously at the end of the slew. It should be done by command, with a previous PTV to check the step in the demanded FSS set point.
- Slews < 7°. For these slews the SSL is enabled by the ACC at the end of the slew, without any previous check.

Note that these limits are defined for the actual commanded slew length, not the pre-planned one. The actual commanded length of a slew will depend on the error of the previous slew. Therefore the rule to be applied is that if the pre-planned length of a slew plus the worst case error of the previous one is more than 7°, then the SSL can not be re-enabled autonomously. To allow margin for error in the estimated slew length, the threshold of 6 degrees should be taken at planning level for the insertion of the ED AESSS_00, see Section 2.1.2.3.7.2.13.
The timeline needed to perform an Open Loop Slew is:

Slew > 6°



Note that there is no constraint on instrument commanding imposed by the AOCS operation.

For these slews larger than 7°, the Sun Steering Law cannot be resumed autonomously by the ACC (AOCS constraint). Due to this, the foreseen way to do it is to uplink the new SSL parameters before the slew start, and insert an Event Designator 5 seconds after the slew end to start the SSL. The command to actually start the SSL is uplinked 25 seconds after the start of this ED. The SSL is then effectively started 30 seconds after the end of the slew. This command will be assigned a Pre-Transmission Validation, that will prevent the uplink if the FSS α setpoint calculated from the SSL parameters is not within +- 10 arcminutes of the current FSS α reading (This PTV will also include other conditions, like proper RGA already selected onboard). Once the command to start the SSL has reached the ACC, the OTF can go high as far as the SSL is concerned. But the OTF might be still low after SSL is restarted following a "large" slew. There could be transients at slew end due to the rate error around the sun line which have not yet settled down only 30 s after slew end.
The ED to start the SSL, should be scheduled by FD.

Slew < 6°

In this case, the SSL will be restarted autonomously by the ACC at the end of the slew. The setting of the OTF, will happen a few seconds after the slew end. The timeline is identical to the previous case, with the only difference that the command to start the SSL is not sent.

The sequence of commands needed to start an Open Loop Slew is:

ED Name	Command	Command Description	Uplink $\Delta$with respect to previous command	Interlock stage*	Uplink time with respect to start of ED
AEOSL_00	A8119	MANOEUVRE TIME		C	
AEOSL_00	A3086	SUN STEERING INI	00.00.25	O	00.00.25
AEOSL_00	A3084	RP SUN STEER INI	00.00.15	C	00.00.40

AEOSL_00	A3087	AUTH SUN STEER	00.00.25	O	00.01.05
AEOSL_00	A3085	RC SUN STEER INI	00.00.15		00.01.20
AEOSL_00	A2544	SET STAR BRGH TH	00.00.01	O	00.01.21
AEOSL_00	A2554	RP STAR BRGH TH	00.00.15	C	00.01.36
AEOSL_00	A2549	AUTHORISE STR TC	00.00.25	O	00.02.01
AEOSL_00	A2564	RC STAR BRGH TH	00.00.15		00.02.16
AEOSL_00	A3121	SLEW MANOEUVRE	00.00.01	O	00.02.17
AEOSL_00	A3131	RP SLEW MAN	00.00.15	C	00.02.32
AEOSL_00	A7192	START MAN TIMER	00.00.25	C	00.02.57
AEOSL_00	A3129	START SLEW MAN	00.00.25	O	00.03.22
AEOSL_00	A3132	RC SLEW MAN	00.00.15		00.03.37

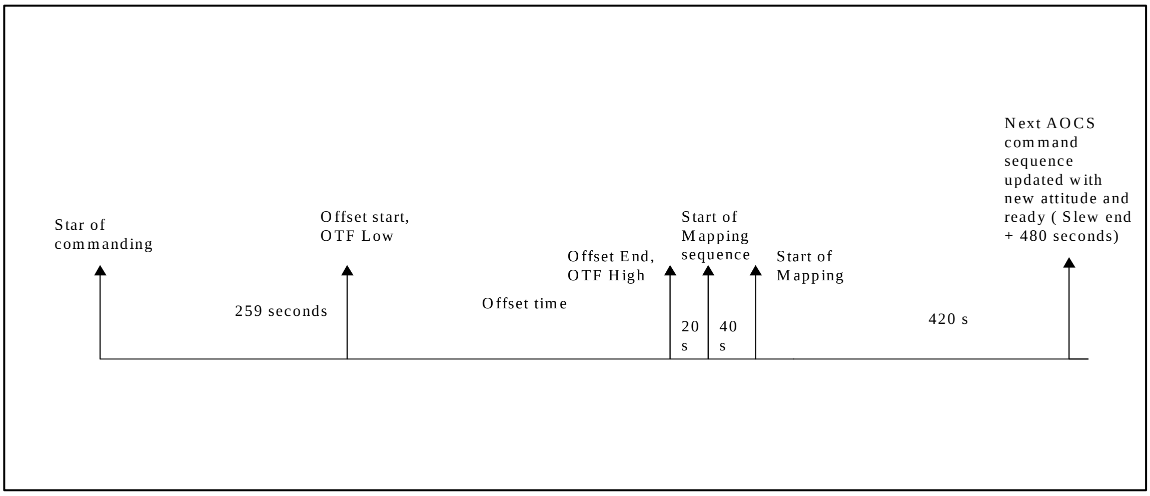
* C -> Next command uplink is interlocked to the correct execution of this one.
O -> Next command uplink is interlocked to the onboard acceptance of this one (only in AD commanding mode).

The ED to start the SSL is detailed in the following table:

ED Name	Command	Command Description	Uplink ∆with respect to previous command	Interlock stage*	Uplink time with respect to start of ED
AESSS_00	A3085	RC SUN STEER INI		O	
AESSS_00	A3089	START SUN STEER	00.00.25	C	00.00.25

2.1.2.3.2.1.3 Offset (Closed Loop Slew)

The timeline needed to perform an Offset is:



Also in this case, there is no constraint on instrument commanding imposed by the AOCS operation.

The SSL is restarted autonomously on board. In this case, the setting of the OTF will happen a few seconds after the offset end. After the end of the offset, a STR mapping is commanded using an additional ED (AESAM_00). This mapping is used for attitude reconstruction, in order to update the next AOCS sequence, and to produce the Snapshot/Attitude History files.

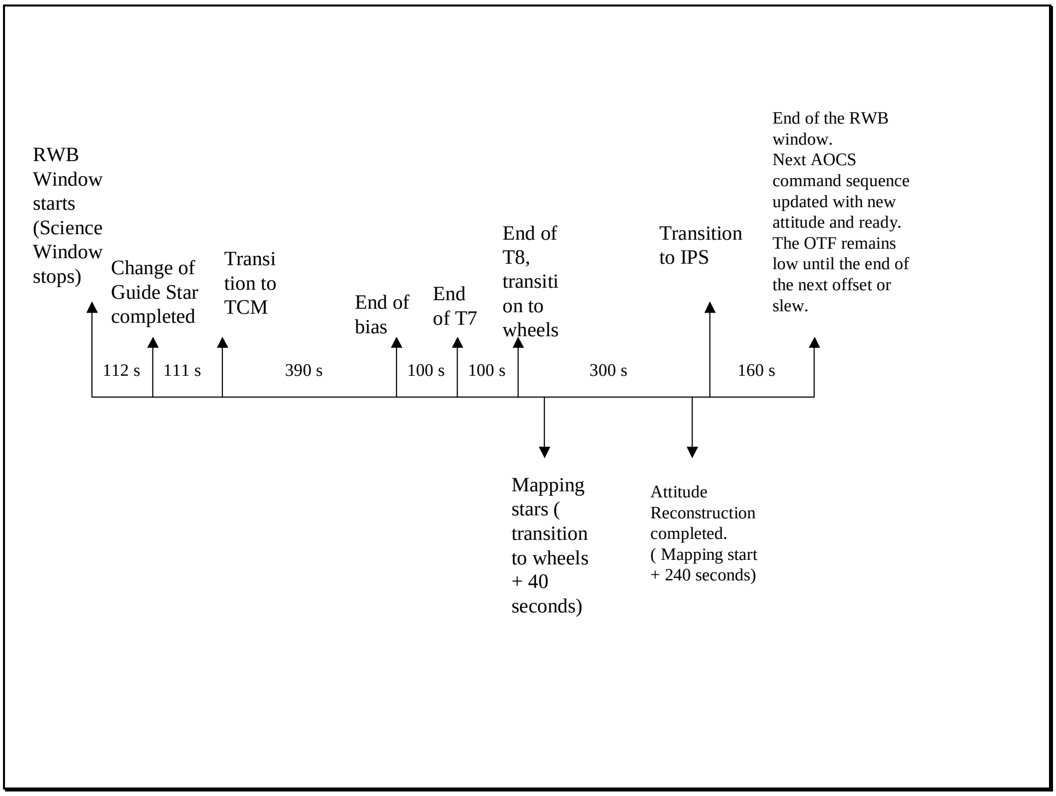
The sequence of commands needed to start an Offset Slew is:

ED Name	Command	Command Description	Uplink ∆with respect to previous command	Interlock stage*	Uplink time with respect to start of ED
AECSL_00	A2541	STR SRCH/TRCK		O	
AECSL_00	A2551	RP SRCH/TRK	00.00.15	C	00.00.15
AECSL_00	A2549	AUTHORISE STR TC	00.00.25	O	00.00.40
AECSL_00	A2561	RC SRCH/TRK	00.00.15		00.00.55
AECSL_00	A3181	LD SLT GDE STAR	00.00.01	O	00.00.56
AECSL_00	A3191	RP GUIDE STAR	00.00.15	C	00.01.11
AECSL_00	A3189	START GUIDE STAR	00.00.25	O	00.01.36
AECSL_00	A3192	RC GUIDE STAR	00.00.15		00.01.51
AECSL_00	A3086	SUN STEERING INI	00.00.01	O	00.01.52
AECSL_00	A3084	RP SUN STEER INI	00.00.15	C	00.02.07
AECSL_00	A3087	AUTH SUN STEER	00.00.25	O	00.02.32
AECSL_00	A3085	RC SUN STEER INI	00.00.15		00.02.47
AECSL_00	A8119	MANOEUVRE TIME	00.00.01	C	00.02.48
AECSL_00	A3161	SMALL OFFSET	00.00.25	O	00.03.13
AECSL_00	A3171	RP SMALL OFFSET	00.00.15	C	00.03.28
AECSL_00	A7213	RESET TIM ACCUM	00.00.25		00.03.53
AECSL_00	A7192	START MAN TIMER	00.00.01	C	00.03.54
AECSL_00	A3169	STRT SMALL OFFST	00.00.25	O	00.04.19
AECSL_00	A3172	RC SMALL OFFSET	00.00.15		00.04.34
AESAM_00	A2542	STR MAPPING		O	
AESAM_00	A2552	RP MAPPING	00.00.15	C	00.00.15
AESAM_00	A2549	AUTHORISE STR TC	00.00.25	O	00.00.40
AESAM_00	A2562	RC MAPPING	00.00.15		00.00.55

* C -> Next command uplink is interlocked to the correct execution of this one.
O -> Next command uplink is interlocked to the onboard acceptance of this one (only in AD commanding mode).

2.1.2.3.2.1.4 Reaction Wheel Bias

The timeline needed to perform a Reaction Wheel Bias is:



The sequence of operations is:

- Change of guide star. This is needed to ensure the guide is at least at the minimum distance with respect to the STR FoV edge. This operation needs as a precondition accurate attitude knowledge.
- Loading of the RWB parameters and ACC mode change from IPS to TCM.
- Bias proper, where the wheels are driven to the commanded value, while attitude control is on thrusters. The worst case duration is assumed as 390 seconds. This is based on a bias from 38 Nms to –38 Nms, plus 10 seconds margin.
- Period of normal thruster control, once the required wheel speeds have been reached (T7). This period lasts 100 seconds.
- Period of thruster control with tranquilisation, to decrease the rates before the transition to wheel controlled mode (T8). This period lasts 100 seconds.
- 5 minutes of wait in wheel controlled mode before the transition to IPS can be performed. During this time a STR mapping is commanded and the attitude reconstruction started.
- Transition to IPS, and some additional wait time needed to update the next AOCS commands in the timeline with the parameters resulting from the attitude reconstruction.

Note that if the amount of momentum change commanded is less, then the bias proper duration will be shorter, and the transition to T7 and T8, and TCM-B, will be advanced by the ACC accordingly. The time the mapping is commanded, and the transition to IPS have nevertheless to be done at fixed times, when using the pre-planned timeline.

Taking into account the duration of the steps above, the total duration assigned to the RWB Window is 22 minutes (rounding up the 21’13’’).

The Reaction Wheel Bias is executed in a fully dedicated window. Instrument commanding is not allowed. The OTF does not go low until the transition to TCM is performed. This transition occurs at RWB Window start + 223 seconds. After the completion of the bias, the OTF does not go back to high, due to the SSL not being enabled. At the moment it is assumed that there will always be an offset or an open loop slew after the bias. The setting of the adequate SSL parameters would then be part of the slew.

Based on this RWB timeline, the sequence of commands to perform the operation is:

ED Name	Command	Command Description	Uplink ∆with respect to previous command	Interlock stage*	Uplink time with respect to start of ED
AECGS_00	A2541	STR SRCH/TRCK		O	
AECGS_00	A2551	RP SRCH/TRK	00.00.15	C	00.00.15
AECGS_00	A2549	AUTHORISE STR TC	00.00.25	O	00.00.40
AECGS_00	A2561	RC SRCH/TRK	00.00.15		00.00.55
AECGS_00	A3181	LD SLT GDE STAR	00.00.01	O	00.00.56
AECGS_00	A3191	RP GUIDE STAR	00.00.15	C	00.01.11
AECGS_00	A3189	START GUIDE STAR	00.00.25	O	00.01.36
AECGS_00	A3192	RC GUIDE STAR	00.00.15		00.01.51
AERWB_00	A7213	RESET TIM ACCUM	00.00.01		
AERWB_00	A3101	THRUSTER MAN	00.00.01	O	00.00.01
AERWB_00	A3111	RP THRUST MAN	00.00.15	C	00.00.16
AERWB_00	A3109	AUTH THRUST MAN	00.00.25	O	00.00.41
AERWB_00	A3112	RC THRUST MAN	00.00.15		00.00.56
AERWB_00	P3051	LCL FCV A ON	00.00.01	C	00.00.57
AERWB_00	A7050	ACC A RELAY 5 OF	00.00.25		00.01.22
AERWB_00	A7010	ACC A RELAY 1 OF	00.00.01		00.01.23
AERWB_00	A7021	ACC A RELAY 2 ON	00.00.01		00.01.24
AERWB_00	A7031	ACC A RELAY 3 ON	00.00.01		00.01.25
AERWB_00	A7040	ACC A RELAY 4 OF	00.00.01		00.01.26
AERWB_00	A7051	ACC A RELAY 5 ON**	00.00.25		00.01.51
AERWB_00	A2542	STR MAPPING	00.09.50	O	00.11.41
AERWB_00	A2552	RP MAPPING	00.00.15	C	00.11.56
AERWB_00	A2549	AUTHORISE STR TC	00.00.25		00.12.21
AERWB_00	P3050	LCL FCV A OFF	00.00.01	O	00.12.22
AERWB_00	A2562	RC MAPPING	00.00.14		00.12.36
AERWB_00	A7050	ACC A RELAY 5 OF	00.03.36		00.16.12
AERWB_00	A7011	ACC A RELAY 1 ON	00.00.01		00.16.13
AERWB_00	A7020	ACC A RELAY 2 OF	00.00.01		00.16.14
AERWB_00	A7031	ACC A RELAY 3 ON	00.00.01		00.16.15
AERWB_00	A7040	ACC A RELAY 4 OF	00.00.01		00.16.16
AERWB_00	A7051	ACC A RELAY 5 ON**	00.00.25		00.16.41
AERWB_00	A7213	RESET TIM ACCUM	00.00.01		00.16.42

* C -> Next command uplink is interlocked to the correct execution of this one.
O -> Next command uplink is interlocked to the onboard acceptance of this one (only in AD commanding mode).
** The command to close relay number 5 should have a PTV based on the other 4 being properly set, plus other checks. This is why 25 seconds are needed.

2.1.2.3.2.2 Time constraints for sequences of AOCS operations

2.1.2.3.2.2.1 Open Loop Slew followed by Open Loop Slew

Taking into account the Open Loop Slew timeline in section 2.1.2.3.2.1.2, the Event Designator to command an Open Loop slew, can only be scheduled 420 seconds after the end of the previous Open Loop Slew. From the start of the ED, to the moment the slew starts, another 202 seconds are needed. No additional waiting time is needed due to the AOCS constraints (the AOCS constraint is to have at least 240 seconds between OL and OL, and it is already satisfied due to the other waiting times). Therefore:

Time needed from the end of an Open Loop Slew, to the start of the next (PREQ time) -> 622 seconds.

2.1.2.3.2.2.2 Open Loop Slew followed by Offset

Taking into account the Open Loop Slew timeline in section 2.1.2.3.2.1.2, and the one for the Offset in section 2.1.2.3.2.1.3, the Event Designator to command an Offset can only be scheduled 420 seconds after the end of the previous Open Loop Slew. From the start of the ED, to the moment the slew starts, another 259 seconds are needed. No additional waiting time is needed due to the AOCS constraints (the AOCS constraint is to have at least 60 seconds between OL and Offset, and it is already satisfied due to the other waiting times). Therefore:

Time needed from the end of an Open Loop Slew, to the start of an Offset (PREQ time) -> 679 seconds.

2.1.2.3.2.2.3 Open Loop Slew followed by a RWB

The parameters for the change of guide star at the beginning of the RWB operation need to take into account the current attitude. This means that when the RWB follows an Open Loop Slew, the time needed for the attitude reconstruction, IPF generation and IPF transfer to the timeline must be respected. This implies that the RWB Window start has to be at least 420 seconds after the end of the Open Loop Slew.

Time needed from the end of an Open Loop Slew, to the start of a RWB Window -> 420 seconds.

2.1.2.3.2.2.4 Offset followed by Open Loop Slew

Taking into account the Open Loop Slew timeline in section 2.1.2.3.2.1.2, and the one for the Offset in section 2.1.2.3.2.1.3, the Event Designator to command an Open Loop Slew, can only be scheduled 480 seconds after the end of the previous Offset, to allow time for the commanding and execution of the STR mapping and attitude reconstruction. From the start of the ED, to the moment the slew starts, 202 seconds are needed. No additional waiting time is needed due to the AOCS constraints (the AOCS constraint is to have at least 120 seconds between Offset and OL, and it is already satisfied due to the uplink time). Therefore:

Time needed from the end of an Offset, to the start of an Open Loop Slew (PREQ time) -> 682 seconds.

2.1.2.3.2.2.5 Offset followed by Offset

Taking into account the Offset timeline in section 2.1.2.3.2.1.3, the Event Designator to command an Offset, can only be scheduled 480 seconds after the end of the previous Offset, to allow time for the commanding and execution of the STR mapping and attitude reconstruction. From the start of the ED, to the moment the Offset starts, 259 seconds are needed. There is no AOCS constraint. Therefore:

Time needed from the end of an Offset, to the start of another Offset (PREQ time) -> 739 seconds.

2.1.2.3.2.2.6 Reaction Wheel Bias followed by an Open Loop Slew

Taking into account the RWB timeline in section 2.1.2.3.2.1.4, and the Open Loop Slew timeline in section 2.1.2.3.2.1.2, the Event Designator to command an Open Loop Slew, can be scheduled immediately after the end of the RWB window. From the start of the ED, to the moment the slew starts, 202 seconds are needed. No additional waiting time is needed due to the AOCS constraints (the AOCS constraint is to have at least 60 seconds between the transition to IPS and the OL, and it is already satisfied due to ground needs). Therefore:

Time needed from the end of a RWB window, to the start of an Open Loop Slew (PREQ time) -> 202 seconds

2.1.2.3.2.2.7 Reaction Wheel Bias followed by an Offset

Taking into account the RWB timeline in section 2.1.2.3.2.1.4, and the Offset timeline in section 2.1.2.3.2.1.3, the Event Designator to command an Offset, can be scheduled immediately after the end of the RWB window. From the start of the ED, to the moment the Offset starts, 259 seconds are needed. There is no AOCS constraint. Therefore:

Time needed from the end of a RWB window, to the start of an Offset (PREQ time) -> 259 seconds.

2.1.2.3.2.2.8 Time from the opening of a Window to the start of an Open Loop Slew

Taking into account the Open Loop Slew timeline in section 2.1.2.3.2.1.2, and considering only windows in which slewing is allowed:

An Open Loop Slew PREQ should not be scheduled less than 202 seconds after the opening of the Window in which the PREQ is placed.

2.1.2.3.2.2.9 Time from the opening of a Window to the start of an Offset

Taking into account the Offset timeline in section 2.1.2.3.2.1.3, and considering only windows in which slewing is allowed:

An Offset PREQ should not be scheduled less than 259 seconds after the opening of the Window in which the PREQ is placed.

2.1.2.3.2.2.10 Load and Start of AOCS eclipse Timers

The following EDs are used to Load and Start the Eclipse Timers.

NAME	DESC
AEAEL_00	ACC ECLIPSE TIMER LOAD
AEAES_00	ACC ECLIPSE TIMER START

NAME	DESC
AEFCE_00	FCE ECLIPSE TIMER LOAD
AEFCS_00	START FCE ECLIPSE TIMER
AEFDE_00	FDE ECLIPSE TIMER LOAD
AEFDS_00	START FDE ECLIPSE TIMER

There are some constraints associated with these EDs as a result of the need to uplink the AEFCS_00 and AEFDS_00 EDs as close together as possible. This is due to the fact that the granularity of the Eclipse timers is 176s. In order to have the timer transition to eclipse at the desired time with an accuracy better than this granularity, the uplink times of the 2 EDs to start the FDE and FCE eclipse timers (AEFCS_00 and AEFDS_00) should be such that the eclipse start time (in FDE and FCE of the next eclipse) coincides as close as possible with the real eclipse start time. To do this ESOC FD calculate the uplink times in the following way:

- The FDE eclipse timer start (uplink time of AEFDS_00) is placed as late in the NEXT_ECLIPSE window (i.e. within the last 176s) such that the eclipse start time will coincide the real start time of the next eclipse.
- The FCE eclipse Timer start (uplink time of AEFCS_00) is placed 1 second before this.
- The load of the FDE eclipse timers (AEFDE_00) takes place 1m 30s before this.
- The load of the FCE eclipse timers (AEFCE_00) takes place 1m 30s before this.
- The ACC eclipse Timer start (uplink time of AEAES_00) is placed 1 minute before this.
- The load of the ACC eclipse timers (AEAEL_00) takes place 1m before this.

2.1.2.3.3 Manipulation of the Polling Sequence Table

Whenever ISOC need to reassign the Telemetry allocation amongst the instruments, they will insert a PSTREQ in the POS, with 5 parameters defining the number of variable telemetry slots to be assigned to each instrument: IBIS; SPI; JEM-X1; JEM-X2 and OMC.

The ED to change the PST is not inserted by ISOC. Rather, when the EPOS and ICP are processed by MOC to create the Timeline on IMCS, the ED to change the PST (DEPST254) is inserted in the timeline and its formal parameters, which assign the PST windows, set according to the PSTREQ parameters in the POS.

The PSTREQ is placed by ISOC during a slew 15 seconds after the PREQ time. In addition, a PSTREQ should be inserted close to the start of the INSTRUMENT window to reassign science windows after MOC engineering activities.

Whenever the PST telemetry allocation is changed the Broadcast Packet telemetry allocation must also be changed. The ED to do this is the BCP Group 2 load ED (DEBPG200), which also sets the other BCP Group 2 parameters such as the Pointing ID. Therefore, this ED and associated formal parameters is also placed in the POS and ICP by ISOC. It is placed 58 seconds after the SLEW_START time.

Following the increase of the TM bit rate, there are a total of 249 windows in the PST assigned to telemetry from the DPEs, of which 99 are fixed and 150 are variable. The number of fixed slots for each instrument is based on:

- constraints on the minimum number of slots required for instrument HK TM,
- other instrument operations constraints and
- to enable the PST allocation to be performed by one ED which satisfies constraints such as required separation of PST slots to the same DPE. (Note that this constraint became more critical following the increase of the TM bit rate.)

For further information on the applicable constraints and the design of the PST ED, see INT-SYST-COM-TN-1001-TOS-OF.

Due to such constraints, the maximum number of programmable slots may be different for each instrument, and no instrument can be allocated the full number of variable slots.

The number of fixed slots for each instrument is given below, along with the maximum number of variable slots which can be allocated to that instrument, and thus the total maximum number of slots for each instrument:

Instrument	**Fixed**	**Maximum Programmable**	**Total Maximum**
SPI	8	127	135
IBIS	90	90	180
JEM-X1	0	127	127
JEM-X2	0	127	127
OMC	1	127	128

The PSTREQ can only be used to allocate or redistribute the variable science windows amongst the instruments. The PSTREQ specifies the allocation of programmable slots to each instrument in the following order:

- IBIS
- SPI
- JEM-X1
- JEM-X2
- OMC

The definition of the field names is as follows:

- **PST slot:** PST slot number

- **Val:** Value given to that slot. This is the actual numeric value representing the assignment made to that slot, as follows:

No Transaction=160 (Window type N/T)
Telecommand Send=128 (Window type TC)
Load/Dump=96 (Window type L/D)
RTU Table Execution window= 64 to 87 (Window type TM_RTU)
TM acquire from ACC=42 (Window type TM_ACC)
TM acquire from SPI DPE1=48 (Window type TM_SPI1)
TM acquire from IBIS DPE1=52 (Window type TM_IBIS1)
TM acquire from JEM-X1 DPE=56 (Window type TM_JEMX1)
TM acquire from JEM-X2 DPE=58 (Window type TM_JEMX2)
TM acquire from OMC DPE =60 (Window type TM_OMC)
TM acquire from SPI DPE2 (redundant)= 50 (Window type TM_SPI2)*
TM acquire from IBIS DPE2 (redundant)= 54 (Window type TM_IBIS2)*

**no PST slot is allocated to the redundant SPI or IBIS DPEs in this example*

- **Window type:** Description of the assignment made to that slot (as above)

- **Fixed/Prog:** Possible values for this field are:

F=Fixed
P=programmable to any value
P-NI = programmable to any value except IBIS DPE1

- **Indx**: The index of the formal parameter of the ED DEPST254. This index is used to programme the PST via the following mechanism:
    1) In the ODB the Formal parameters associated with an ED have an index defining the formal parameters ordinate position in the database table (CSP.CSP_FPNUM). This index is independent of the ordering of formal parameters within the *commands* placed in the sequence.
    2) Each formal parameter of the DEPST254 refers to a particular slot in the PST, thus each PST slot is associated to a particular formal parameter index of DEPST254.
    3) Values are given to the formal parameters of DEPST254 in order of their index. I.e. Formal parameter with index 1 is given its value first (regardless of the formal parameters location within the command / ED), followed by formal parameter with index 2 and so on. Therefore, the *PST slot* associated to formal parameter with index 1 is allocated first, and so on.
    4) The first instrument specified in the PSTREQ has its instrument 'value' assigned to the same number of formal parameters as the number of variable packets that the PSTREQ specifies should be allocated to that instrument. For instance if a PSTREQ has parameters 44, 90, 3, 3, 1; formal parameters with the index 1 to 44 would be assigned the value 'IBIS', those with index 45 to 134 would be assigned the value 'SPI and so on.
    5) In order to avoid bunching of windows allocated to IBIS, the windows which lie between two fixed IBIS windows have been associated to formal parameters with a high index, such that they will be allocated last and therefore can never be allocated to IBIS. These are referred to as P-NI in the Fixed/Prog column.
    6) The formal parameter indices associated to other PST slots is also based on constraints such as the distribution of PST slots allocated to the same instrument. Details of this are contained in INT-SYST-COM-TN-1001-TOS-OF.

Note that this mapping of formal parameter to PST location is undeviating, according the rules given above.

A configuration file is present on the IMCS:

```
/home/imcsops/MPS/etc/MPS.config
```

which includes parameters required by the MPS in the construction of the PST ED from the PSTREQ, i.e.:

- The numeric value representing the instruments (see description of Val field above)
- The name of the PST ED to be used. This depends on the SPI and IBIS DPE in use as follows:
    - SPI1 & IBIS1: DEPST254
    - SPI2 & IBIS1: DEPST208
    - SPI1 & IBIS2: DEPST209
    - SPI2 & IBIS2: DEPST210
- The maximum number of variable TM slots which can be allocated by the DEPST ED (e.g. 146).

More information on the PST ED is given in Section 2.1.2.3.8.2.

2.1.2.3.4 CCCFs

When scheduling an observation, it is normally necessary to split the observation into several 'exposures' as a result of operations such as RWBs or ground stations handovers, which may interrupt the acquisition of science data.

In such cases, Conditional Configuration Control Flags (CCCFs) are inserted in the Timeline at the start of every exposure of an observation, except for the first[1], in order to reconfigure the instruments into the correct mode for the continuation of the observation if necessary. These CCCFs are placed during the first slew of these exposures. The EDs in the CCCF are only executed if the desired instrument configuration is not already achieved.

In addition to inserting CCCFs at the start of every exposure from the 2nd onwards for a given observation, CCCFs are also inserted at regular intervals during long exposures. This is in order to facilitate rejoining of the Timeline, in cases where a deviation from the automatic timeline has occurred, such that the amount of science data lost due to a deviation is minimised. The frequency of insertion of these CCCFs is configurable within the OSS.

The same EDs are used in a CCCF as for normal instrument configuration, the distinction being made by the prefix `CCCF_` being added to the `ED` keyword in the POS, e.g.:

```
CCCF_ED    GESTAN02     /* ED record for mode Standard
```

CCCFs are delimited by MOUTPs with the following parameters:

- CCCF_START
- CCCF_END

The time between the last CCCF_ED within a CCCF and the CCCF_END MOUTP should be at least 5 mins in order to allow sufficient time for the last CCCF_ED to be executed (at the CCCF_END MOUTP, CCCF commanding is disabled).

2.1.2.3.5 Antenna Swaps.

Depending upon the sequence of slews defined by ISOC and the supporting ground station, Antenna swaps may be necessary during the operational orbit. It is possible to do this either by switching the antenna RFDN or the transponder RFDN. The EDs used to move the RFDN will be periodically changed, in order to respect a constraint as defined in the User Manual (ref: INT-MA-AI-0001, Section 5.5.3).

The original baseline algorithm for doing this was as follows:

- For Revolution numbers 1 to 100 the SWA RFDN (EDs REANTP02 and REANTX02) will be used. Five minutes before the end of the LOS_CHK window at the end of revolution 100, the SWA will be parked in the parallel position using ED REANTP02. If this is not the correct RFDN configuration for the next revolution, ground will have to load Time-tagged TCs to select the correct RFDN SWT configuration for the next revolution, these commands must be uplinked before the last SWA switching with an execution time some time after.
- For Revolution numbers 101 to 200 the SWT RFDN (EDs RETNTP02 and RETNTX02) will be used. Five minutes before the end of the LOS_CHK window at the end of revolution 200, the SWT will be parked in the parallel position using ED RETNTP02. If this is not the correct RFDN configuration for the next revolution, ground will have to load Time-tagged TCs to select the correct RFDN SWA configuration for the next revolution, these commands must be uplinked before the last SWT switching with an execution time some time after.

---

[1] Instrument configuration EDs are *necessary* at the start of the *first* exposure in the observation in order to put the instruments in the correct configuration.

However, following the switch to the higher TM downlink bit rate, and the resulting necessity to command in VC(0) (see INT-SYST-COM-TN-1001-TOS-OF), it was necessary to change to using the SWT RFDN (EDs RETNTP02 and RETNTX02) at that time. These were used for ~1 year, after the configuration was changed to use the SWA RFDN (EDs REANTP02 and REANTX02). Before using EDs with VC-7 TCs it was necessary to adjust the CLCW ratio in VC-0 TM in favour of VC-7 CLCWs, by switching between low and high bit rate until a suitable ratio is obtained. There are a few constraints associated with this operation:

- This cannot be done during the Instrument window (the high packet rate would cause TM buffer overflows at low bit rate).
- This operation should not be done under Goldstone coverage as the switching low<->high bit rate there is much slower than at REDU, at REDU 2 TMPs are used, one configured for low and one for high bit rate.
- 40 minutes should be reserved for this operation, normally this is the SAT_ENG window (in this case ISGRI CTX table load must be executed during the WHEEL_BIAS window) and the subsequent dummy window.

These EDs should be used for about 1 year, after which the configuration should be switched back again (in coordination with a further adjustment of the CLCW ratio) and so on.

The following information is placed in the EPOS:

1. Four minutes before the ED uplink time, a warning MOUT is issued, e.g. in the case of the ED REANTX02:
   `MOUT "Imminent Antenna Switch to minus Z Antenna”`
2. One minute after the ED uplink time another MOUT is issued, e.g.:
   `MOUT "Swap to 2"`

The ED is executed two minutes after the 2nd MOUT.

2.1.2.3.6 EDs Inserted in the POS by ISOC

Note that Section **Error! Reference source not found.** contains a database report of all EDs, along with their formal parameters and telecommands. For all EDs inserted in the POS by ISOC, any formal parameters of the ED must be specified in the ICP.

2.1.2.3.6.1 Summary of Timing Constraints Relevant to ISOC

Table 4 lists those configurable (CCS) parameters, used by the OSS in the scheduling of activities, *which are derived from constraints imposed by operational needs*. Other parameters, such as the frequency of insertion of CCCFs, which are either science driven or non-mandatory, are therefore not listed.

Each of these values are described and explained in detail elsewhere in this volume, however the constraints are rephrased here in order to provide an easily-referenced source for comparison.

In the case of parameters 1-4, it should be noted that timing constraints for slews are given in the FOP in terms of the required interval between slews and other types activities, e.g. a CSL followed by an RWB. This interval will vary depending on the manoeuvre which follows/precedes the slew. However, within the OSS, these constraints are currently defined in terms of a characteristic, fixed time for commanding before and after each type of slew. Therefore, the AOCS timing constraints are interpreted here in order to give a value for a fixed commanding time before and after each type of slew. Therefore the values for parameters 1-4 may not be optimal in that these times are not strictly required in all cases, e.g. between a CSL and a handover, less than 480 seconds are required.

For more details, refer to the section quoted in the Source column for each parameter.

No.	Parameter	Value	Source
1	Commanding time before CSL	259 sec	FOP 2.1.2.3.2
2	Commanding time after CSL	480 sec	FOP 2.1.2.3.2
3	Commanding time before OSL	202 sec[2]	FOP 2.1.2.3.2
4	Commanding time after OSL	420 sec	FOP 2.1.2.3.2
5	RWB duration	1320 sec	FOP 2.1.2.3.2
6	ED DEBPG200 to set PID=0 before PREQ	29 sec	FOP 2.1.2.3.6.3.1
7	ED DEBPG200 to set PID to real after PREQ	58 sec	FOP 2.1.2.3.6.3.1
8	Timing of PSTREQ after PREQ (slew start)	15 sec	FOP 2.1.2.3.3
9	ED DEBPG200 to set HO flag = 1 before start	29 sec	FOP 2.1.2.3.6.3.1
10	ED DEBPG200 to set HO flag = 0 after end	10 sec	FOP 2.1.2.3.6.3.1
11	Duration from last CCCF_ED to CCCF_END	300 sec	FOP 2.1.2.3.4
12	Slew angle requiring RWB beforehand	45 deg	FOP 2.1.2.2.2 (WHEEL_BIAS)
13	No. of GPS pointings after which RWB must be inserted	10	FOP 2.1.2.2.2 (WHEEL_BIAS)

Table 4. Applicable Timing Constraints in OSS

In addition to the parameters listed in Table 4, a parameter is defined in the OSS for the default slew accuracy for Delta-V manoeuvres and Perigee. This should be such that these slews are scheduled as Closed Loop Slews.

The scheduling of sequences of EDs within the POS is also constrained by the duration of individual EDs, as EDs to the same subsystem must not overlap and EDs must execute

[2] ISOC currently use a value of 259sec for this parameter.

entirely within the window(s)[3] or interval(s) in which they are allowed. These are summarised in the next Section, 2.1.2.3.6.2.

2.1.2.3.6.2 Duration of EDs inserted in the POS

Table 5 contains the Uplink Duration of those EDs which are scheduled in the POS. These uplink durations are based on the time between the uplink of the first and last commands in the sequence. These durations are taken into account in calculating the required separation in time between two EDs to the same subsystem.

ED	DESCRIPTION	DURATION
DEBPFM00	BCPKT MASK OTF	00:00:10
DEBPFU00	BCPKT UNMASK OTF	00:00:10
DEBPG200	LOAD BCPKT G2	00:00:10
EECONF02	CONF	00:00:00
EEPPM-02	PHOTON	00:00:25
EEPSDC02	PSD-CAL	00:00:25
GEHSDL01	IBIS READ LAST HIST	00:00:26
GEHSDS01	IBIS DISCARD ALL HIST	00:00:26
GEPLRY02	IBIS POLARIMETRY MODE	00:01:00
GEPPM-02	IBIS PHOTON BY PHOTON MO	00:00:56
GESTAN02	IBIS STANDARD MODE	00:01:08
GESTBY02	IBIS STAND-BY MODE	00:00:00
KEACT_03	JEMX1 HV ON & SCI CONF	00:33:45
KEDATA01	ISOC JEMX1 Data Take	00:00:25
KEDATA02	ISOC JEMX1 Data Take & set SW Trigger	00:00:45
KEDIAG01	ISOC JEMX1 Diagnostic	00:00:20
KESETU01	ISOC JEMX1 Set-Up Mode	00:00:00
KEHVAC01	JEMX1 HV ON IN 1 STEP &	00:14:45
LEACT_03	JEMX2 HV ON & SCI CONF	00:33:45
LEDATA01	ISOC JEMX2 Data Take	00:00:25
LEDATA02	ISOC JEMX2 Data Take & set SW Trigger	00:00:45
LEDIAG01	ISOC JEMX2 Diagnostic	00:00:20
LESETU01	ISOC JEMX2 Set-Up Mode	00:00:00
LEHVAC01	JEMX2 HV ON IN 1 STEP &	00:14:45
MEDCCA01	ISOC OMC DC CAL	00:00:25
MEFFCA01	ISOC OMC FF CAL	00:00:25
MEFFMO01	ISOC OMC FF CAL mode	00:00:00
MEFFON01	ISOC OMC FF CAL start	00:00:00
MEFFPA01	ISOC OMC FF CAL parameter set	00:00:00
MEFFST01	ISOC OMC FF CAL par set & start	00:00:05
MEIM-A01	ISOC OMC IM_A Command	00:00:05
MEIMB101	ISOC OMC IM_B1 Command	00:00:00
MEIMB201	ISOC OMC IM_B2 Command	00:00:00
MEIMB301	ISOC OMC IM_B3 Command	00:00:00
MEIMB401	ISOC OMC IM_B4 Command	00:00:00
MEIMON01	ISOC OMC IM_ON Command	00:00:00
MESTBY01	ISOC OMC Stand-by Comman	00:00:00

Table 5. ED Uplink Duration of EDs inserted by ISOC

[3] If windows/intervals are adjacent and an ED is allowed in both, the ED may cross the boundary of these windows/intervals. In such cases, at Timeline generation a warning is issued.

2.1.2.3.6.3 OBDH Event Designators

2.1.2.3.6.3.1 ED: DEBPG200

Formal Parameters: Yes

Description: Load of Broadcast Packet Group 2 data

Constraints: Due to possible TC propagation and BCPKT distribution time uncertainties, the last command of this ED must be uplinked at latest 19 seconds before the ED must come into effect. This is mandatory for HANDOVER, SLEW_START and SLEW_STOP events.

Uplink Time: 29 seconds before HANDOVER window opens
10 seconds after the HANDOVER window closes
29 seconds before SLEW_START event
58 seconds after SLEW_START event (note that if a PSTREQ was also placed after the SLEW_START, this BCP will update Pointing ID and TM allocation).

Execution Time: n/a

Remarks: See FCP_DHS_1302

2.1.2.3.6.3.2 ED: DEBPFM00

Formal Parameters: No

Description: Mask OTF Flag in BCPKT

Constraints: None

Uplink Time: When scheduled by ISOC, normally as part of a CCCF

Execution Time: n/a

Remarks: Used by ISOC to artificially set the OTF low in the BCPKT (for instrument reconfiguration).
See FCP_DHS_1307

2.1.2.3.6.3.3 ED: DEBPFU00

Formal Parameters: No

Description: Unmask OTF Flag in BCPKT

Constraints: None

Uplink Time: When scheduled by ISOC, normally as part of a CCCF

Execution Time: n/a

Remarks: Used by ISOC to unmask the OTF in the BCPKT

See FCP_DHS_1307

2.1.2.3.6.4 SPI Event Designators

2.1.2.3.6.4.1 ED: EECONF02

Formal Parameters: No

Description: Select SPI configuration mode

Constraints: Do not schedule this ED if SPI is already in CONF mode.

Uplink Time: When Scheduled by ISOC in the Instrument window

Execution Time: n/a

Remarks: See FCP_EECONF02

2.1.2.3.6.4.2 ED: EEPPM-02

Formal Parameters: No

Description: Command SPI to Photon by Photon Mode

Constraints: SPI should be in any science mode

Uplink Time: When Scheduled by ISOC in the Instrument window

Execution Time: n/a

Remarks:. The scheduling of this ED by ISOC is no longer required, as SPI performs the transition to Photon by Photon mode autonomously. This ED is maintained here for reference, as it is still possible for ISOC to schedule this if necessary.
See FCP_EEPPM02

2.1.2.3.6.4.3 ED: EEPSDC02

Formal Parameters: No

Description: Select SPI calibration Mode

Constraints: See FCP_EEPSDC02

Uplink Time: When Scheduled by ISOC in the Instrument window

Execution Time: n/a

Remarks: See FCP_EEPSDC02

2.1.2.3.6.5 IBIS Event designators

2.1.2.3.6.5.1 ED: GEHSDL01

Formal Parameters: No

Description: IBIS Transition to Standby and Download Last Histogram

Constraints:

Uplink Time: When Scheduled by ISOC, in the Instrument window

Execution Time: n/a

Remarks: This would normally be used when passing from STANDARD mode (GESTAN02) to PPM mode (GEPPM-02) in order to download the last HISTOGRAM accumulated on-board before passing the transition to Photon by Photon (may possibly be merged with GEPPM-02 in the future).
See FCP: GEHSDL01

2.1.2.3.6.5.2 ED: GEHSDS01

Formal Parameters: No

Description: IBIS Transition to Standby and Discard All Remaining Histograms in DPE

Constraints:

Uplink Time: When Scheduled by ISOC, in the Instrument window

Execution Time: n/a

Remarks: This would be scheduled whenever the flush of the HISTOGRAM buffer is requested
See FCP: GEHSDS01

2.1.2.3.6.5.3 ED: GEPLRY02

Formal Parameters: Yes

Description: Activate IBIS Polarimetry Mode

Constraints:

Uplink Time: When Scheduled by ISOC, in the Instrument window

Execution Time: n/a

Remarks: The use of this requires a modification of the onboard binning table for HEPI in order to produce meaningful scientific data.
See FCP: GEPLRY02

2.1.2.3.6.5.4 ED: GEPPM-02

Formal Parameters: Yes

Description: Activate IBIS Photon By Photon Mode

Constraints: IBIS must have a TM allocation of ≥ 160 packets (HK and SCI)

Uplink Time: When Scheduled by ISOC during a slew, in the Instrument window

Execution Time: n/a

Remarks: This ED is normally executed during a slew.
See FCP: GEPPM-02

2.1.2.3.6.5.5 ED: GESTAN02

Formal Parameters: Yes

Description: Activate IBIS Standard Mode

Constraints: TM allocation > 80 packets (HK and SCI)

Uplink Time: When Scheduled by ISOC, in the Instrument window

Execution Time: n/a

Remarks: This ED is normally executed during a slew.
See FCP: GESTAN02

2.1.2.3.6.5.6 ED: GESTBY02

Formal Parameters: No

Description: Select IBIS Standby Mode

Constraints: IBIS must not be already in Standby Mode

Uplink Time: It will be placed where required by ISOC in the Instrument window to stop IBIS scientific acquisition.

Execution Time: n/a

Remarks: See FCP: GESTBY02

2.1.2.3.6.6 JEM-X1 Event Designators

2.1.2.3.6.6.1 ED: KEDATA01

Formal Parameters: Yes

Description: Select JEM-X1 Data Taking Mode *(This ED is currently not used but is maintained here for reference)*

Constraints: High Voltage ON, All Anodes Enabled, Low level discriminator, grey filter parameters, Nr. of events for restricted imaging format set.
The formal parameters K0022F and K0023F shall always satisfy the following rule:
0 ≤ K0022F < K0023F ≤ 31

Uplink Time: Scheduled by ISOC within Instrument window, normally during slews

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
See FCP: KEDATA01

2.1.2.3.6.6.2 ED: KEDATA02

Formal Parameters: Yes

Description: Select JEM-X1 Data Taking Mode and set SW Trigger Limit

Constraints: High Voltage ON, All Anodes Enabled, Low level discriminator, grey filter parameters, Nr. of events for restricted imaging format set.
The formal parameters K0022F and K0023F shall always satisfy the following rule:
0 K0022F < K0023F 31

Uplink Time: Scheduled by ISOC within Instrument window, normally during slews

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
See FCP: KEDATA02

2.1.2.3.6.6.3 ED: KEDIAG01

Formal Parameters: Yes

Description: Select JEM-X1 Diagnostic data dump mode

Constraints: HV on, All anodes enabled, Low level discriminator set

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: The time to downlink the events depends on the TM allocation (see JEM-X UM Section 3.7.7.10)
See FCP: KEDIAG01

2.1.2.3.6.6.4 ED: KESETU01

Formal Parameters: No

Description: Select JEM-X1 Set-Up Mode

Constraints: None

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: At execution of this ED JEM-X1 will enter the OSS Default Mode.
See FCP: KESETU01

2.1.2.3.6.6.5 ED: KEACT_03

Formal Parameters: Yes

Description: JEM-X1 HV Activation and Configuration for Science Operations
(This ED is currently not used but is maintained here for reference)

Constraints: JEM-X1 in Setup mode; HV off; Shutdown levels = Normal; Radiation levels in range for HV switch-on.

Uplink Time: Scheduled by ISOC within Instrument window, after radiation belt exit and anode calibration and before the start of JEM-X1 science operations

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
Following successful execution of this ED, JEM-X1 will be in Data Taking mode with the commanded observation parameters.
See FCP: KEACT_03

2.1.2.3.6.6.6 ED: KEHVAC01

Formal Parameters: Yes

Description: JEM-X1 HV Activation in 1 step and Configuration for Science Operations

Constraints: JEM-X1 in Setup mode; HV off; Shutdown levels = Normal; Radiation levels in range for HV switch-on.

Uplink Time: Scheduled by ISOC within Instrument window, after radiation belt exit and anode calibration and before the start of JEM-X1 science operations

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
Following successful execution of this ED, JEM-X1 will be in Data Taking mode with the commanded observation parameters.
See FCP: KEHVAC01

2.1.2.3.6.7 JEM-X2 Event Designators

2.1.2.3.6.7.1 ED: LEDATA01

Formal Parameters: Yes

Description: Select JEM-X2 Data Taking Mode. *(This ED is currently not used but is maintained here for reference)*

Constraints: High Voltage ON, All Anodes Enabled, Low level discriminator, grey filter parameters, Nr. of events for restricted imaging format set.
The formal parameters L0022F and L0023F shall always satisfy the following rule:
0 ≤ L0022F < L0023F ≤ 31

Uplink Time: Scheduled by ISOC within Instrument window, normally during slews.

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
See FCP: LEDATA01

2.1.2.3.6.7.2 ED: LEDATA02

Formal Parameters: Yes

Description: Select JEM-X2 Data Taking Mode and set SW Trigger Limit

Constraints: High Voltage ON, All Anodes Enabled, Low level discriminator, grey filter parameters, Nr. of events for restricted imaging format set.
The formal parameters L0022F and L0023F shall always satisfy the following rule:
0 L0022F < L0023F 31

Uplink Time: Scheduled by ISOC within Instrument window, normally during slews

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
See FCP: LEDATA02

2.1.2.3.6.7.3 ED: LEDIAG01

Formal Parameters: Yes

Description: Select JEM-X2 Diagnostic data dump mode

Constraints: HV on, All anodes enabled, Low level discriminator set

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: The time to downlink the events depends on the TM allocation (see JEM-X UM Section 3.7.7.10)
See FCP: LEDIAG01

2.1.2.3.6.7.4 ED: LESETU01

Formal Parameters: No

Description: Select JEM-X2 Set-Up Mode

Constraints: None

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: At execution of this ED JEM-X1 will enter the OSS Default Mode.
See FCP: LESETU01

2.1.2.3.6.7.5 ED: LEACT_03

Formal Parameters: Yes

Description: JEM-X2 HV Activation and Configuration for Science Operations.
(This ED is currently not used but is maintained here for reference)

Constraints: JEM-X2 in Setup mode; HV off; Shutdown levels = Normal; Radiation levels in range for HV switch-on.

Uplink Time: Scheduled by ISOC within Instrument window, after radiation belt exit and anode calibration and before the start of JEM-X2 science operations

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
Following successful execution of this ED, JEM-X2 will be in Data Taking mode with the commanded observation parameters.
See FCP: LEACT_03

2.1.2.3.6.7.6 ED: LEHVAC01

Formal Parameters: Yes

Description: JEM-X2 HV Activation in 1 step and Configuration for Science Operations

Constraints: JEM-X2 in Setup mode; HV off; Shutdown levels = Normal; Radiation levels in range for HV switch-on.

Uplink Time: Scheduled by ISOC within Instrument window, after radiation belt exit and anode calibration and before the start of JEM-X2 science operations

Execution Time: n/a

Remarks: Setting of Formal Parameters values must follow the rules defined in the JEM-X Users Manual, section 3.7.5.2.3.4 and 4.1.8.2.
Following successful execution of this ED, JEM-X2 will be in Data Taking mode with the commanded observation parameters.
See FCP: LEHVAC01

2.1.2.3.6.8 OMC Event Designators

2.1.2.3.6.8.1 ED: MEDCCA01

Formal Parameters: Yes

Description: Select OMC Dark Current Calibration Mode and load Calibration parameters

Constraints: OMC in Standby Mode

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: To exit the Calibration Mode this ED must be followed by ED MESTBY01.
See FCP: MEDCCA01

2.1.2.3.6.8.2 ED: MEFFCA01

Formal Parameters: Yes

Description: Select OMC Flat-field Calibration Mode and load Calibration parameters

Constraints: OMC in Standby Mode

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: To exit the Calibration Mode this ED must be followed by ED MESTBY01.
See FCP: MEFFCA01

2.1.2.3.6.8.3 ED: MEFFMO01

Formal Parameters: Yes

Description: Select OMC Flat-field Calibration Mode.

Constraints: OMC in Standby Mode

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: To exit the Calibration Mode this ED must be followed by ED MESTBY01.
See FCP: MEFFCA01

2.1.2.3.6.8.4 ED: MEFFON01

Formal Parameters: Yes

Description: OMC Flat-field Calibration start.

Constraints: OMC in Flat Field Calibration Mode, with parameters loaded.

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: To exit the Calibration Mode this ED must be followed by ED MESTBY01.
See FCP: MEFFCA01

2.1.2.3.6.8.5 ED: MEFFPA01

Formal Parameters: Yes

Description: Load OMC Flat-field Calibration parameters.

Constraints: OMC in Flat Field Calibration Mode.

Uplink Time: Scheduled by ISOC within Instrument window

Execution Time: n/a

Remarks: To exit the Calibration Mode this ED must be followed by ED MESTBY01.
See FCP: MEFFCA01

2.1.2.3.6.8.6 ED: MEIM-A01

Formal Parameters: Yes

Description: Uplink OMC Imaging parameters A

Constraints: OMC must be in Standby Mode
OTF must be low and Pointing number = 0.

Uplink Time: Scheduled by ISOC within Instrument window, normally during slews.

Execution Time: n/a

Remarks: This ED must be followed by ED MEIMB101 and as required MEIMB201, MEIMB301, and MEIMB401.
See FCP: MEIM-A01

2.1.2.3.6.8.7 ED: MEIMB101

Formal Parameters: Yes

Description: Uplink OMC Imaging parameters B1

Constraints: OMC must be in Standby Mode.
OTF must be low and Pointing number = 0.

Uplink Time: 10 seconds after uplink time of the previous ED (MEIM-A01)

Execution Time: n/a

Remarks: This ED may be followed as required by MEIMB201, MEIMB301, and MEIMB401.
See FCP: MEIMB101

2.1.2.3.6.8.8 ED: MEIMB201

Formal Parameters: Yes

Description: Uplink OMC Imaging parameters B2

Constraints: OMC must be in Standby Mode.
OTF must be low and Pointing number = 0.

Uplink Time: If required it will be uplinked 5 seconds after uplink time of the previous ED (MEIMB101).

Execution Time: n/a

Remarks: This ED is not mandatory, it will be scheduled by ISOC when required.

This ED may be followed as required by MEIMB301, and MEIMB401.
See FCP: MEIMB201

2.1.2.3.6.8.9 ED: MEIMB301

Formal Parameters: Yes

Description: Uplink OMC Imaging parameters B3

Constraints: OMC must be in Standby Mode.
OTF must be low and Pointing number = 0.

Uplink Time: If required it will be uplinked 5 seconds after uplink time of the previous ED (MEIMB201).

Execution Time: n/a

Remarks: This ED is not mandatory, it will be scheduled by ISOC when required.

This ED may be followed as required by MEIMB401.
See FCP: MEIMB301

2.1.2.3.6.8.10 ED: MEIMB401

Formal Parameters: Yes

Description: Uplink OMC Imaging parameters B4

Constraints: OMC must be in Standby Mode.
OTF must be low and Pointing number = 0.

Uplink Time: If required it will be uplinked 5 seconds after uplink time of the previous ED (MEIMB301).

Execution Time: n/a

Remarks: This ED is not mandatory, it will be scheduled by ISOC when required. After execution of this ED the OTF and Pointing ID can be set again for Science operations.
See FCP: MEIMB401

2.1.2.3.6.8.11 ED: MEIMON01

Formal Parameters: Yes

Description: Select OMC Science Mode

Constraints: OMC must be in Standby Mode

Uplink Time: If required it will be scheduled by ISOC, 5s after the last imaging parameter uplink ED.

Execution Time: n/a

Remarks: This ED is used to force OMC Science Mode. It can be sent before or after EDs MEIM-A01 and MEIMB101 to MEIMB401
See FCP: MEIMON01

2.1.2.3.6.8.12 ED: MESTBY01

Formal Parameters: No

Description: Select OMC Stand-by Mode

Constraints: OMC not in Stand-by Mode

Uplink Time: If required it will be scheduled by ISOC

Execution Time: n/a

Remarks: This ED will be nominally scheduled by ISOC after EDs MEDCCA01, MEFFCA01 and MEIMON01.
See FCP: MESTBY01

2.1.2.3.7 EDS inserted in the EPOS by ESOC FD

Note that Section 2.1.2.3.6.2 contains a summary of the duration of all EDs and Section **Error! Reference source not found.** contains a database report of all EDs, along with their formal parameters and telecommands. For all EDs containing formal parameters, these formal parameters must be specified in the APF whenever this ED is inserted by FD in the EPOS.

2.1.2.3.7.1 Duration of EDs inserted in the EPOS

Table 6 summarises the Uplink Duration of those EDs inserted by Flight Dynamics during EPOS generation, based on the time between the uplink of the first and last commands in the sequence.

ED	DESCRIPTION	DURATION
AEAEL_00	ACC ECLIPSE TIMER LOAD	00:00:15
AEAES_00	ACC ECLIPSE TIMER START	00:00:15
AECGS_00	CHANGE GUIDE STAR	00:01:51
AECSL_00	OFFSET SLEW	00:04:34
AEFCE_00	FCE ECLIPSE TIMER LOAD	00:00:50
AEFCS_00	START FCE ECLIPSE TIMER	00:00:00
AEFDE_00	FDE ECLIPSE TIMER LOAD	00:00:50
AEFDS_00	START FDE ECLIPSE TIMER	00:00:00
AEINT_00	RESET FCE INT	00:00:00
AEIOF_00	TT ACC WORD C	00:00:06
AEOSL_00	OPEN LOOP SLEW	00:03:37
AEPOF_00	PRECL BLIND PP	00:01:20
AEPON_00	NOMINAL PP	00:01:20
AERWB_00	RWB ACC-A RCS-A	00:16:42
AESAM_00	STR MAPPING	00:00:55
AESSL_00	LOAD SSL COEFFICIENTS	00:01:20
AESSS_00	START SSL	00:00:25
DEBPG100	LD BCPKT G1	00:00:10
DEBWHI01	PST-16PD OR-BW9	00:00:25
DEBWLO00	CDMU OR TMSP = 1	00:00:00
DESCLD00	DISABLE SECL	00:00:00
DESCLE00	SECL ENABLE TT	00:00:00
DESCTD00	DISABLE SECL TT	00:00:00
DETREP00	REP SUM TBUF	00:00:00
EEHTF_02	TTC-AFRZON-AFOFF	00:00:03
EENTRY03	RBinSetInOper	00:03:38
EEORTM01	SPIALLTMREP	00:03:12
EESPCH01	TTC-RAD-HTR-ON	00:00:00
EEXIT-03	RBoutSetInOper	00:03:32
EECLEX02	SPI POST ECL ACT	00:05:38
GEBENT02	IBIS Belt Entry(PDM ON)	00:00:34
GEBEXT01	IBIS reconfiguration aft	00:00:32
GECLEX02	IBIS POST-ECLIPSE RECONF	00:09:07
GEDHON01	IBIS additional detector	00:00:00
GEISCL03	ISGRI CALIBRATION	00:24:45
GEPHOF01	PICsiT CsI Redundant Det	00:00:00
GEVESP01	IBIS-VETO patch 31+32	00:05:42
JEDMP100	DUMP BUFFERS + TIMES	00:01:20

KEACAL01	JEMX1 ANODE ECAL PERIGEE	00:09:40
KECLEX01	JEMX1 POST ECLIPSE ACTIV	00:00:01
KECLXT01	JEMX1 POST ECLIPSE ACTIV (Time-tagged)	00:00:02
KESAFE01	ISOC/MOC JEMX1 SAFE Mode	00:00:00
KESAFE02	ISOC/MOC JEMX1 SAFE Mode & set SW Trigger Limit	00:01:05
LEACAL01	JEMX2 ANODE ECAL PERIGEE	00:09:40
LECLEX01	JEMX2 POST ECLIPSE ACTIV	00:00:01
LECLXT01	JEMX2 POST ECLIPSE ACTIV (Time-tagged)	00:00:02
LESAFE01	ISOC/MOC JEMX2 SAFE Mode	00:00:00
LESAFE02	ISOC/MOC JEMX2 SAFE Mode & set SW Trigger Limit	00:01:05
MEBEXT01	OMC RESET ROE	00:00:00
MECLEX01	OMC POST ECLIPSE ACTIVAT	00:00:01
REANTP02	ED: SWA POS= TT RT	00:01:00
REANTX02	ED: SWA POSX TT RT	00:01:00
RETNTP02	ED: SWT POS= TT RT	00:01:00
RETNTX02	ED: SWT POSX TT RT	00:01:00
RET1OF00	ED: Transponder 1 Off	00:01:00
RET1ON00	ED: Transponder 1 On	00:01:00
RET2OF00	ED: Transponder 2 Off	00:01:00
RET2ON00	ED: Transponder 2 On	00:01:00
TEECL100	TCS IN ECL TT	00:01:06
TEECL200	TCS IN ECL TT R	00:01:06
TENPE_00	TCS PLM N POSTECL	00:01:55
UEGROF01	IREM GROUND LINK OFF	00:00:00
UEGRON01	IREM GROUND LINK ON	00:00:00

Table 6. Uplink Duration of EDs inserted by FD

2.1.2.3.7.2 AOCS Event Designators

2.1.2.3.7.2.1 ED: AEAEL_00

Formal Parameters: Yes

Description: Load ACC Eclipse timers

Constraints: This ED must be executed in sunlight.
For the nominal orbit, the values for the next eclipse have to be loaded at least 36 hours in advance.
The ACC eclipse timers must be loaded only after the currently loaded eclipse timers have expired.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time: n/a

Remarks: The eclipse Timers loaded are derived as described in INT-TN-MMB-0093.
See FCP_AOC_1005

2.1.2.3.7.2.2 ED: AEAES_00

Formal Parameters: No

Description: Start ACC eclipse Timers

Constraints: The ACC eclipse timers must be started only when the currently loaded eclipse timers are in sunlight phase.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time: n/a

Remarks See FCP_AOC_1005

2.1.2.3.7.2.3 ED: AEFCE_00

Formal Parameters: Yes

Description: Load FCE Eclipse timers

Constraints: This ED must be executed in sunlight.
For the nominal orbit, the values for the next eclipse have to be loaded at least 36 hours in advance.
The FCE eclipse timers must be loaded only after the currently loaded eclipse timers have expired.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time: n/a

Remarks: The eclipse Timers loaded are derived as described in INT-TN-MMB-0093.
See FCP_AOC_1260

2.1.2.3.7.2.4 ED: AEFCS_00

Formal Parameters: No

Description: Start FCE eclipse timer

Constraints: The FCE eclipse timers must be started only after the currently executing eclipse timers have expired.
FCE and FDE Timers must be started at a time as close to one another as possible.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time: n/a

Remarks See FCP_AOC_1260

2.1.2.3.7.2.5 ED: AEFDE_00

Formal Parameters: Yes

Description: Load FDE Eclipse timers

Constraints: This ED must be executed in sunlight.
For the nominal orbit, the values for the next eclipse have to be loaded at least 36 hours in advance.
The FDE eclipse timers must be loaded only after the currently loaded eclipse timers have expired.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time: n/a

Remarks: The eclipse timers loaded are derived as described in INT-TN-MMB-0093. See FCP_AOC_1215

2.1.2.3.7.2.6 ED: AEFDS_00

Formal Parameters: No

Description: Start FDE eclipse timer

Constraints: The FDE eclipse timers must be started only after the currently executing eclipse timers have expired.
FCE and FDE Timers must be started at a time as close to one another as possible.

Uplink Time: See 2.1.2.3.2.2.10

Execution Time:

Remarks See FCP_AOC_1215

2.1.2.3.7.2.7 ED: AECGS_00

Formal Parameters: Yes

Description: Change of Guide Star to select an adequate Guide Star for RWB or perigee passage.

Constraints: Integral must be in stable pointing and outside eclipse.

Uplink Time: - LOS_CHK open + 10min 8 sec (to prepare for 1st RWB of subsequent Revolution.)
- At every WHEEL_BIAS window open, except for the first in a Revolution.

Execution Time: n/a

Remarks: See FCP_AOC_0529

2.1.2.3.7.2.8 ED: AERWB_00

Formal Parameters: Yes

Description: Execution of Reaction Wheel Bias manoeuvre

Constraints: No slews allowed

Uplink Time: 112sec after WHEEL_BIAS_OPEN

Execution Time: n/a

Remarks: See FCP_AOC_0510

2.1.2.3.7.2.9 ED: AECSL_00

Formal Parameters: Yes

Description: Execution of Closed Loop Slews

Constraints: See 2.1.2.3.2. In particular, in the case of a corrective CSL, this ED must not be scheduled earlier than 420 seconds after SLEW_END of previous Open Loop Slew.

Uplink Time: 259 seconds before SLEW_START (time of PREQ placed in the POS by ISOC)

Execution Time: n/a

Remarks: See FCP_AOC_0520

2.1.2.3.7.2.10 ED: AEINT_00

Formal Parameters: No

Description: Reset of RMU Integrators in FCE. Start of RMU Drift Calibration

Constraints: Integral must be in stable pointing and outside eclipse

Uplink Time: To be scheduled by FD at RMU_START + 300sec.

Execution Time: n/a

Remarks: The RMU calibration is to be executed every 18 hours +/- 3 hours.
See FCP_AOC_0550

2.1.2.3.7.2.11 ED: AEOSL_00

Formal Parameters: Yes

Description: Execute Open Loop Slew

Constraints: See 2.1.2.3.2

Uplink Time: 202 seconds before SLEW_START (PREQ) time. Scheduled by FD, according to ISOC placing of PREQs.

Execution Time: n/a

Remarks: See FCP_AOC_0518

2.1.2.3.7.2.12 ED: AESSL_00

Formal Parameters: Yes

Description: Update Sun Steering Law parameters during long pointings

Constraints: The ACC must be in IPS mode, with stable pointing

Uplink Time: 3 hours after the start of any pointing, and every 3 hours thereafter as long as the pointing lasts.

Execution Time:

Remarks: If the pointing has a duration of less than 3 hours this ED will not be scheduled.
See FCP_AOC_0806

2.1.2.3.7.2.13 ED: AESSS_00

Formal Parameters: No

Description: Re-enable Sun Steering Law

Constraints: To be executed only after an open loop slew of greater than 6 Degrees

Uplink Time: 5 Seconds after the SLEW_END time of an Open Loop Slew greater than 6 Degrees.

Execution Time: n/a

Remarks: See FCP_AOC_0806

2.1.2.3.7.2.14 ED: AEPON_00

Formal Parameters: No

Description: Enable Ping-pong Filter and restore the nominal value for the Minimum Gyro-on-time

Constraints: See uplink time

Uplink Time: 2 minutes before the slew EDs (AEOSL_00 and AECSL_00), *during the eclipse season only*, in all cases where ED AEPOF_00 would not be sent.

Execution Time: n/a

Remarks See FCP_AOC_0520 / 0518

2.1.2.3.7.2.15 ED: AEPOF_00

Formal Parameters: Yes

Description: Disable Ping-pong Filter and load a value of 8 hours for the Minimum Gyro-on-time.

Constraints: See uplink time

Uplink Time: To be scheduled by FD 2 minutes before the slew EDs (AEOSL_00 and AECSL_00), *during the eclipse season only*, and *only where the next slew is such that a STR blinding would occur at the target attitude*, sometime between SLEW_END time and eclipse entry time.

Execution Time: n/a

Remarks See FCP_AOC_0520 / 0518

2.1.2.3.7.2.16 ED: AESAM_00

Formal Parameters: Yes

Description: Perform a STR Mapping keeping the current guide star in slot nr. 1

Constraints:

Uplink Time: To be uplinked 20 seconds after the Closed-Loop Slew end time calculated by FD.

Execution Time: n/a

Remarks See FCP_AOC_0531

2.1.2.3.7.2.17 ED: AEIOF_00

Formal Parameters: No

Description: Re-enable IMU Autonomous Switch-off after eclipse

Constraints: S/C in sunlight, ACC in IPS, stable pointing

Uplink Time: NEXT_ECLIPSE_CLOSE - 12mins (equivalent to NEXT_ECLIPSE_OPEN + 3mins)

Execution Time: Next eclipse (penumbra) end + 700secs

Remarks See FCP_AOC_0526

2.1.2.3.7.3 OBDH Event Designators

2.1.2.3.7.3.1 ED: DEBPG100

Formal Parameters: Yes

Description: Load Broadcast Packet Group 1 data

Constraints: To be executed after passing critical altitude post Perigee and outside eclipse.

Uplink Time: POST_BELT_CONF_CLOSE minus 4 minutes

Execution Time: n/a

Remarks: The eclipse entry time to be loaded is 3 minutes before the start of penumbra. The other Orbital events times should be their actual time. In orbits where no eclipse is present, the values to be loaded for Formal parameters ECL_ENTR and ECL_EXIT are:
ECL_ENTR = Uplink time – 2 days, 1 hour; ECL_EXIT = Uplink time – 2 days.
See FCP_DHS_1301

2.1.2.3.7.3.2 ED: DESCLD00

Formal Parameters: No

Description: Disable SECL software before instrument activation Post Eclipse

Constraints: Must be released before activation of instruments begins

Uplink Time: POST_ECLIPSE_CLOSE minus 20mins (equivalent to 10mins after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: This ED is necessary as, following instrument switch-on, many nominal PLM heaters must remain OFF until the peripherals' temperature has stabilised above the heaters thermostatic switch-on temperature. This must occur before the instrument activations.
See FCP_DHS_1365

2.1.2.3.7.3.3 ED: DESCTD00

Formal Parameters: No

Description: Disable SECL software before eclipse entry via Time-tagged command

Constraints:

Uplink Time: 12 minutes and 40 seconds after NEXT_ECLIPSE window opens

Execution Time: 50 seconds before eclipse (Penumbra) entry of the subsequent eclipse

Remarks: See FCP_TCS_1010

2.1.2.3.7.3.4 ED: DESCLE00

Formal Parameters: No

Description: Enable SECL at eclipse exit via Time-tagged command

Constraints: None

Uplink Time: 12 minutes and 30 seconds after NEXT_ECLIPSE window opens

Execution Time: 30 seconds after exit from Penumbra at the end of the subsequent eclipse

Remarks See FCP_TCS_1010

2.1.2.3.7.3.5 ED: DETREP00

Formal Parameters: No

Description: Summary Report of Time-tag Buffer

Constraints: Avoid uplink when a report is already on-going

Uplink Time: 14 minutes 50 seconds after NEXT_ECLIPSE window opens

Execution Time: n/a

Remarks: This report is commanded at the end of the NEXT_ECLIPSE window when all time-tagged TCs for the subsequent eclipse passage have already been loaded.
See FCP_TCS_1010

2.1.2.3.7.3.6 ED: DEBWHI01

Formal Parameters: No

Description: Assign TM Bandwidth for patch and Dump activities. This ED loads a PST with 16 P&D windows, and also allows up to 8 OR Packets / TM Cycle.

Constraints: None

Uplink Time: AOS_CHK_CLOSE minus 5 minutes (equivalent to 20 minutes after AOS_CHK window opens)

Execution Time: n/a

Remarks: This ED is needed by MOC for their Engineering activities in the SATENG window. Before the INSTRUMENT window opens the Bandwidth will be set low again, see 2.1.2.3.7.3.7.
See FCP_DHS_1414

2.1.2.3.7.3.7 ED: DEBWLO00

Formal Parameters: No

Description: Remove TM Bandwidth for patch and Dump activities. This ED restores the default limit on the number of OR Packets / TM Cycle of 1.
Note that at the beginning of the INSTRUMENT window ISOC insert a PSTREQ to prepare for the first observations.

Constraints: None

Uplink Time: POST_BELT_CONF_CLOSE minus 1 minute

Execution Time: n/a

Remarks: This ED is needed by MOC for their Engineering activities in the SATENG window.
See FCP_DHS_1255

2.1.2.3.7.4 SPI Event Designators

2.1.2.3.7.4.1 ED: EECLEX02

Formal Parameters: No

Description: SPI Post Eclipse Re-activation

Constraints: Must be executed after Broadcast Packet eclipse exit and after PDU ECL sequences have been executed.

Uplink Time: POST_ECLIPSE_CLOSE minus 18 minutes (equivalent to 12 minutes after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: See FCP_EECLEX02

2.1.2.3.7.4.2 ED: EESPCH01

Formal Parameters: No

Description: Switch SPI Radiator Compensation Heater N on post eclipse via time-tagged TC.

Constraints: Must be executed after eclipse (Penumbra) exit

Uplink Time: 14 minutes 30 seconds after the NEXT_ECLIPSE window opens

Execution Time: 1 minute 30 seconds after the next eclipse (Penumbra) exit time

Remarks: See FCP: EESPCH01

2.1.2.3.7.4.3 ED: EEHTF_02

Formal Parameters: No

Description: Disable SPI AFEE TM/TC I/F, AFEE analogue lines pre Eclipse

Constraints:

Uplink Time: 11 minutes after the NEXT_ECLIPSE window opens

Execution Time: 1 minute 10 seconds before next eclipse (Penumbra) entry

Remarks: See FCP_EEHTF_02

2.1.2.3.7.4.4 **ED: EEORTM01** *(This ED is currently not used but is maintained here for reference.)*

Formal Parameters: No

Description: SPI OR Telemetry Reporting

Constraints: None

Uplink Time: **1)** 180 seconds after Broadcast Packet Radiation Belt Exit time and
2) 30 seconds after Broadcast Packet Radiation Belt Entry time and
3) AOS_CHK _CLOSE minus 8 minutes (equivalent to 17 minutes after AOS_CHK_OPEN)
This ED is not uplinked if there is no ground station coverage or the S/C is in eclipse at the times above.

Execution Time: n/a

Remarks: See FCP_EEORTM01

2.1.2.3.7.4.5 ED: EEPPM-02

Formal Parameters: No

Description: Command SPI to Photon by Photon Mode

Constraints: SPI should be in any science mode

Uplink Time: POST_BELT_CONF_CLOSE minus 5 minutes

Execution Time: n/a

Remarks:. This is scheduled at the beginning of the revolution in order to force the SPI mode transition PHOTON>CONF>PHOTON in order to make full use of the allocated bandwidth (see anomaly report INT_SC-21).
See FCP_EEPPM02

2.1.2.3.7.4.6 EENTRY03

Formal Parameters: No

Description: SPI Belts Entry Setting keeping Operations

Constraints: Before eclipse; outside radiation belts; SPI in any science mode (i.e. PHOTON, DIAG, TM EMGY, CAL)

Uplink Time: Whenever a NEXT_ECLIPSE window is present in the PSF, this ED is scheduled in the EPOS at Broadcast Packet Radiation Belt Entry minus 300secs.

Execution Time: n/a

Remarks: Note the scheduling algorithm assumes the eclipse starts after radiation belts entry. Where this is not the case, this ED must be advanced to 8 minutes before the eclipse start time. I.e. This ED must be uplinked 8mins before the earliest of (eclipse start or Broadcast Packet belt entry).
See FCP_EENTRY03

2.1.2.3.7.4.7 EEXIT-03

Formal Parameters: No

Description: SPI Belts Exit Setting keeping Oper

Constraints: After eclipse; Outside radiation belts; SPI in any mode higher than configuration mode

Uplink Time: Whenever a POST_ECLIPSE window is present in the PSF, this ED is scheduled in the EPOS at Broadcast Packet Radiation Belt Exit plus 300secs.

Execution Time: n/a

Remarks: Note the scheduling algorithm assumes the eclipse ends before radiation belts exit. Where this is not the case, this ED must be delayed to 5 minutes after the eclipse end time. I.e. This ED must be uplinked 5mins after the latest of (eclipse end or Broadcast Packet belt exit).
See FCP_ EEXIT-03

2.1.2.3.7.5 IBIS Event Designators

2.1.2.3.7.5.1 ED: GEBENT02

Formal Parameters: No

Description: IBIS in Safe Configuration at Belts Entry

Constraints:

Uplink Time: POST_BELT_CONF_CLOSE minus 10 minutes

Execution Time: Broadcast Packet Radiation Belt entry time + 5 minutes

Remarks: This may possibly be integrated in the future with the TC G0824 to download the last HISTOGRAM on board.
See FCP: GEBENT02

2.1.2.3.7.5.2 ED: GECLEX02

Formal Parameters: No

Description: Reconfigure IBIS after eclipse exit

Constraints: Must be started only after eclipse exit

Uplink Time: POST_ECLIPSE_CLOSE minus 19 minutes 20 seconds (equivalent to 10 minutes 40 second after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: This activity reconfigures IBIS into a safe status after eclipse (but within Radiation Belts) with all peripherals ON (power side) and:
PICSIT nominal;
ISGRI MDUs in stand-by;
VETO in stand-by;
IASW in stand-by.
See FCP: GECLEX02

2.1.2.3.7.5.3 ED: GEISCL03

Formal Parameters: No

Description: Perform the IBIS/ISGRI calibration and prepare for the start of scientific observations.

Constraints: This ED shall be executed only after completion of procedure FCP_IBIS1_0401 / FCP_IBIS2_0401 (Upload ISGRI Context Tables) and, when possible, 25 minutes before emerging from the Radiation Belts region. The execution of this ED is strongly dependent on the MDUs temperatures and must **not** be executed if the MDUs Temp1 values are > 19degC.

Uplink Time: When the IBIS_CAL window opens

Execution Time: n/a

Remarks: The ISGRI calibration cannot be commanded if the ISGRI context tables have not been up-linked. This ED contains also some reconfiguration to prepare IBIS for the next observation period.
See FCP: GEISCL03

2.1.2.3.7.5.4 ED: GEPHOF01

Formal Parameters: No

Description: IBIS PICsIT Redundant Detector Heater OFF

Constraints:

Uplink Time: 11min 30 sec after NEXT_ECLIPSE_OPEN

Execution Time: 1min before next eclipse (penumbra) entry

Remarks: **This ED is currently not used but is documented here for reference**.
See FCP: GEPHOF01

2.1.2.3.7.5.5 ED: GEDHON01

Formal Parameters: No

Description: IBIS additional Detector Unit Heater switch-on at eclipse exit via time-tagged TC.

Constraints: This ED must execute before the start of the ED GECLEX02

Uplink Time: NEXT_ECLIPSE_OPEN +13 minutes 30 seconds

Execution Time: Eclipse (Penumbra) exit + 45 seconds

Remarks: The switch-off TC is contained in ED GECLEX02
See FCP: GEDHON01

2.1.2.3.7.5.6 ED: GEBEXT01

Formal Parameters: No

Description: IBIS VETO transition to nominal mode after belts exit (HV On)

Constraints: This ED must execute only after Radiation Belts exit

Uplink Time: POST_BELT_CONF_CLOSE minus 3 minutes

Execution Time: n/a

Remarks: See FCP: GEBEXT01

2.1.2.3.7.5.7 ED: GEVESP01

Formal Parameters: No

Description: IBIS-VETO patch 31+32

Constraints: Must be started only after eclipse exit

Uplink Time: POST_ECLIPSE_CLOSE minus 6 minutes (equivalent to 24 minutes after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: See FCP: GEVESP01

2.1.2.3.7.6 System Event Designators

2.1.2.3.7.6.1 ED: JEDMP100

Formal Parameters: No

Description: Report of On-board SVM buffers (OEMs, OBM, Time-tags)

Constraints: None

Uplink Time: 1) 10 minutes before AOS_CHK_CLOSE and
2) when the LOS_CHK window opens

Execution Time: n/a

Remarks: This sequence of commands will be followed by manual commands to reset the OEM buffer and OBM reports when the report is successfully completed.
See FCPs: FCP_SYS_1100 and FCP_SYS_1101

2.1.2.3.7.7 JEM-X1 Event Designators

2.1.2.3.7.7.1 ED: KEACAL01

Formal Parameters: No

Description: JEMX-1 Anode Electronic Calibration at perigee exit

Constraints: To be executed before BCPKT Radiation Belts exit time, and after JEM-X switch on post eclipse (ED: KECLEX01/KECLXT01)

Uplink Time: 16 minutes before the IBIS_CAL window closes

Execution Time: n/a

Remarks: This ED can be uplinked in parallel to other activities (IBIS Calibration).

See FCP: KEACAL01

2.1.2.3.7.7.2 ED: KECLEX01

Formal Parameters: No

Description: Activate JEM-X1 in POST_ECLIPSE window

Constraints: Eclipse exit time in Broadcast Packet must have elapsed, and PDU ecl(e/s) sequence execution must be complete.

Uplink Time: POST_ECLIPSE_CLOSE minus 13 minutes (equivalent to 17 minutes after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: See FCP: KECLEX01

2.1.2.3.7.7.3 ED: KECLXT01

Formal Parameters: No

Description: Activate JEM-X1 in POST_ECLIPSE window

Constraints: Eclipse exit time in Broadcast Packet must have elapsed, and PDU ecl(e/s) sequence execution must be complete.

Uplink Time: NEXT_ECLIPSE Open plus 1 minute.

Execution Time: NEXT_ECLIPSE End (Penumbra end) plus 5 minutes

Remarks: See FCP: KECLXT01

2.1.2.3.7.7.4 ED: KESAFE01

Formal Parameters: No

Description: Put JEM-X1 in SAFE mode. *(This ED is currently not used but is maintained here for reference.)*

Constraints:

Uplink Time: Time corresponding to 63000km descending minus 5 seconds

Execution Time: n/a

Remarks: See FCP: KESAFE01

2.1.2.3.7.7.5 ED: KESAFE02

Formal Parameters: No

Description: Put JEM-X1 in SAFE mode and set SW Trigger Limit to default

Constraints:

Uplink Time: Time corresponding to 63000km descending minus 5 seconds

Execution Time: n/a

Remarks: See FCP: KESAFE02

2.1.2.3.7.8 JEM-X2 Event Designators

2.1.2.3.7.8.1 ED: LEACAL01

Formal Parameters: No

Description: JEMX-2 Anode Electronic Calibration at perigee exit

Constraints: To be executed before Radiation Belts exit, and after JEM-X switch on post eclipse (ED: LECLEX01/LECLXT01).

Uplink Time: 15 minutes before the IBIS_CAL window closes

Execution Time: n/a

Remarks: This ED can be uplinked in parallel to other activities (IBIS Calibration).

See FCP: LEACAL01

2.1.2.3.7.8.2 ED: LECLEX01

Formal Parameters: No

Description: Activate JEM-X2 in POST_ECLIPSE window

Constraints: Eclipse exit time in Broadcast Packet must have elapsed, and PDU ecl(e/s) sequence execution must be complete.

Uplink Time: POST_ECLIPSE_CLOSE minus 12 minutes 50 seconds (equivalent to 17 minutes 10 seconds after the POST_ECLIPSE window opens)

Execution Time: n/a

Remarks: See FCP: LECLEX01

2.1.2.3.7.8.3 ED: LECLXT01

Formal Parameters: No

Description: Activate JEM-X2 in POST_ECLIPSE window

Constraints: Eclipse exit time in Broadcast Packet must have elapsed, and PDU ecl(e/s) sequence execution must be complete.

Uplink Time: NEXT_ECLIPSE Open plus 1 minute and 10 seconds

Execution Time: NEXT_ECLIPSE End (Penumbra end) plus 5 minutes and 10 seconds

Remarks: See FCP: LECLXT01

2.1.2.3.7.8.4 ED: LESAFE01

Formal Parameters: No

Description: Put JEM-X2 in SAFE mode. *(This ED is currently not used but is maintained here for reference.)*

Constraints:

Uplink Time: Time corresponding to 63000km descending

Execution Time: n/a

Remarks: See FCP: LESAFE01

2.1.2.3.7.8.5 ED: LESAFE02

Formal Parameters: No

Description: Put JEM-X2 in SAFE mode and set SW Trigger Limit to default

Constraints:

Uplink Time: Time corresponding to 63000km descending minus 5 seconds

Execution Time: n/a

Remarks: See FCP: LESAFE02

2.1.2.3.7.9 OMC Event Designators

2.1.2.3.7.9.1 ED: MECLEX01

Formal Parameters: No

Description: Activate OMC in POST_ECLIPSE window, and reset of OMC ROE at Radiation Belts exit (when Safe to Standby mode transition occurs)

Constraints: Eclipse exit time in Broadcast Packet must have elapsed, and PDU ecl(e/s) sequence execution must be complete.

Uplink Time: 11 minutes before the POST_ECLIPSE window closes

Execution Time: n/a

Remarks See FCP: MECLEX01

2.1.2.3.7.9.2 ED: MEBEXT01

Formal Parameters: No

Description: Reset ROE

Constraints: None

Uplink Time: POST_BELT_CONF_CLOSE minus 4 minutes 41 seconds

Execution Time: n/a

Remarks See FCP: MEBEXT01

2.1.2.3.7.10 RFS Event Designators

2.1.2.3.7.10.1 ED: REANTP02

Formal Parameters: No

Description: Select RFDN Antenna Switch Direct (Parallel) Configuration, this implies *Transponder 1 connected to LGA1, which is located on the +Z side of the satellite*.

Constraints: The Transmitter switch (SWT) must also be in parallel position. Transmitter 1 must be in use.

Uplink Time: One minute before an MOUT **`"Swap to 1"`** keyword in the EPOS

Execution Time: Two minutes after an MOUT **`"Swap to 1"`** keyword in the EPOS

Remarks: To slow down degradation of the RF path through the RFDN network there is an agreement to change the RFDN switch in use periodically. At this time this ED will be replaced by ED RETNTP02, which commands the Transponder switch, it must also be ensured that when the changeover of EDs takes place that the SWA switch

is ‘parked’ in the Parallel position, for further details see section 2.1.2.3.5.
The purpose of these EDs is to select the correct Antenna for the upcoming coverage period and to move the RFDN in case it ’sticks’.
See FCP_RFS_1100

2.1.2.3.7.10.2 ED: REANTX02

Formal Parameters: No

Description: Select RFDN Antenna Switch Crossed (X) Configuration, this implies *Transponder 1 connected to LGA2 which is located on the -Z side of the satellite.*

Constraints: The Transmitter switch (SWT) must also be in parallel position. Transmitter 1 must be in use.

Uplink Time: One minute before an MOUT **`"Swap to 2"`** keyword in the EPOS

Execution Time: Two minutes after an MOUT **`"Swap to 2"`** keyword in the EPOS

Remarks: To slow down degradation of the RF path through the RFDN network there is an agreement to change the RFDN switch in use periodically. At this time this ED will be replaced by ED RETNTX02, which commands the Transponder switch, it must also be ensured that when the changeover of EDs takes place that the SWA switch is ‘parked’ in the Parallel position, for further details see section 2.1.2.3.5.
The purpose of these EDs is to select the correct Antenna for the upcoming coverage period and to move the RFDN in case it ’sticks’.
See FCP_RFS_1101

2.1.2.3.7.10.3 ED: RETNTP02

Formal Parameters: No

Description: Select RFDN Transponder Switch Direct (Parallel) Configuration, this implies *Transponder 1 connected to LGA1 which is located on the +Z side of the satellite.*

Constraints: The Antenna switch (SWA) must also be in parallel position. Transmitter 1 must be in use.

Uplink Time: One minute before an MOUT **`"Swap to 1"`** keyword in the EPOS

Execution Time: Two minutes after an MOUT **`"Swap to 1"`** keyword in the EPOS

Remarks: To slow down degradation of the RF path through the RFDN network there is an agreement to change the RFDN switch in use periodically. At this time this ED will be replaced by ED REANTP02, which commands the Antenna switch, it must also be ensured that when the changeover of EDs takes place that the SWT switch is ‘parked’ in the Parallel position, for further details see section 2.1.2.3.5.
The purpose of these EDs is to select the correct Antenna for the upcoming coverage period and to move the RFDN in case it ’sticks’.
See FCP_RFS_1110

2.1.2.3.7.10.4 ED: RETNTX02

Formal Parameters: No

Description: Select RFDN Transponder Switch Crossed (X) Configuration, this implies *Transponder 1 connected to LGA2 which is located on the -Z side of the satellite.*

Constraints: The Antenna switch (SWA) must be in parallel position.
Transmitter 1 must be in use.

Uplink Time: One minute before an MOUT **`"Swap to 2"`** keyword in the EPOS

Execution Time: Two minutes after an MOUT **`"Swap to 2"`** keyword in the EPOS

Remarks: To slow down degradation of the RF path through the RFDN network there is an agreement to change the RFDN switch in use periodically. At this time this ED will be replaced by ED REANTX02, which commands the Antenna switch, it must also be ensured that when the changeover of EDs takes place that the SWT switch is 'parked' in the Parallel position, for further details see section 2.1.2.3.5.
The purpose of these EDs is to select the correct Antenna for the upcoming coverage period and to move the RFDN in case it 'sticks'. See FCP_RFS_1111

2.1.2.3.7.10.5 ED: RET1OF00

Formal Parameters: No

Description: Transponder 1 switch off.

Constraints: None.

Uplink Time: Three minutes after "AOS_CHK_OPEN" keyword in the EPOS

Execution Time: At 5100km altitude descending

Remarks: To comply with legal requirements to switch off transmissions below 4800km when out of ground contact. Active from rev. 960 onwards.

2.1.2.3.7.10.6 ED: RET1ON00

Formal Parameters: No

Description: Transponder 1 switch on.

Constraints: None.

Uplink Time: Three minutes 30 seconds after "AOS_CHK_OPEN" keyword in the EPOS

Execution Time: At 5100km altitude ascending

Remarks: To switch transmitter on prior to AOS. Active from rev. 960 onwards.

2.1.2.3.7.10.7 ED: RET2OF00

Formal Parameters: No

Description: Transponder 2 switch off.

Constraints: None.

Uplink Time: Three minutes after “AOS_CHK_OPEN" keyword in the EPOS

Execution Time: At 5100km altitude descending

Remarks: To comply with legal requirements to switch off transmissions below 4800km when out of ground contact. Active from rev. 960 onwards.

2.1.2.3.7.10.8 ED: RET2ON00

Formal Parameters: No

Description: Transponder 2 switch on.

Constraints: None.

Uplink Time: Three minutes 30 seconds after “AOS_CHK_OPEN" keyword in the EPOS

Execution Time: At 5100km altitude ascending

Remarks: To switch transmitter on prior to AOS. Active from rev. 960 onwards.

2.1.2.3.7.11 TCS Event Designators

2.1.2.3.7.11.1 ED: TEECL100

Formal Parameters: No

Description: Spurious ECL(e/s) protection time-tagged TCs

Constraints: This sequence should execute only during Umbra. The latest permitted execution time should be 5 minutes before Umbra exit at eclipse end.

Uplink Time: 0 minutes after opening of the NEXT_ECLIPSE window, and every 4 minutes thereafter depending on the number of instances necessary.

Execution Time: 5 minutes after eclipse (umbra) entry, and every 30 minutes thereafter during eclipse (umbra), but see also constraints above.

Remarks: These commands should only execute during Umbra, an execution during Penumbra at eclipse exit as (or after) the ecl(e/s) transition could lead to an incorrect satellite thermal status.
If the eclipse has no Umbra, this ED will not be uplinked.
See FCP_TCS_1010

2.1.2.3.7.11.2 ED: TEECL200

Formal Parameters: No

Description: Spurious ECL(e/s) protection time-tagged TCs via Redundant PDU Interface

Constraints: This sequence should execute only during Umbra. The latest permitted execution time should be 5 minutes before Umbra exit at eclipse end.

Uplink Time: 2 minutes after opening of the NEXT_ECLIPSE window, and every 4 minutes thereafter depending on the number of instances necessary.

Execution Time: 7 minutes after eclipse (umbra) entry, and every 30 minutes thereafter during eclipse (umbra), but see also constraints above.

Remarks: These commands should only execute during Umbra, an execution during Penumbra at eclipse exit as (or after) the ecl(e/s) transition could lead to an incorrect satellite thermal status.
If the eclipse has no Umbra, this ED will not be uplinked.
See FCP_TCS_1010

2.1.2.3.7.11.3 ED: TENPE_00

Formal Parameters: No

Description: Enable Nominal PLM Heaters post eclipse

Constraints: The relevant PLM units must have reached their nominal operating temperature.
Bearing in mind that the duration of uplink of the sequence is 115 seconds, this ED should not be scheduled in or within 2 minutes of the following windows: AOS_CHK, LOS_CHK, ECLIPSE, POST_ECLIPSE, NEXT_ECLIPSE, HANDOVER, PRE_ECLIPSE.
In case of double eclipse with less than 20 hours between one another this ED must be delayed until 20 hours after the second eclipse finishes, again subject to the constraints above.

Uplink Time: 20 hours after eclipse exit, If no ground station coverage is available at this time uplink must be delayed, in both cases however the above constraints must be observed.

Execution Time: n/a

Remarks: See FCP_TCS_1020

2.1.2.3.7.12 IREM Event Designators

2.1.2.3.7.12.1 ED: UEGROF01

Formal Parameters: No

Description: IREM Ground Link Off

Constraints: None

Uplink Time: 2 minutes after LOS_CHK_OPEN

Execution Time: n/a

Remarks: See FCP: UEGROF01

2.1.2.3.7.12.2 ED: UEGRON01

Formal Parameters: No

Description: IREM Ground Link On

Constraints: None

Uplink Time: 1 minute before AOS_CHK_CLOSE

Execution Time: n/a

Remarks: See FCP: UEGRON01

2.1.2.3.8 Other Event Designators

2.1.2.3.8.1 Duration of Other Event Designators

Table 7 gives the uplink duration of those EDs which are neither inserted at POS nor EPOS level.

ED	DESCRIPTION	UPLINK DURATION (hh:mm:ss)
AERMU_00	RMU DRIFT UPDATE	00:00:50
DEPST254	ED: PST 2JX HR	00:00:20

Table 7. Duration of other EDs

2.1.2.3.8.2 ED: DEPST254

This ED is inserted at the time of Timeline generation by the MOC. It is currently, the only ED which falls under this category. See also Section 2.1.2.3.3. The formal parameters are calculated automatically based on the parameters in the PSTREQ.

Formal Parameters: Yes

Description: Load and Start Timeline PST-2 for use with High Bit Rate RS

Constraints: None

Uplink Time: Whenever a PSTREQ is inserted in the EPOS. This will normally be 15 seconds after a slew start time and at the start of an INSTRUMENT window.

Execution Time: n/a

Remarks: The name used for this ED depends on the configuration of the SPI and IBIS instruments in use as follows:

- SPI1 & IBIS1: DEPST254
- SPI2 & IBIS1: DEPST208
- SPI1 & IBIS2: DEPST209
- SPI2 & IBIS2: DEPST210

2.1.2.3.8.3 ED: AERMU_00

This ED is to be uplinked manually as a TPF following the RMU calibration. It is the only ED which is planned to be uplinked manually on a regular basis. See Section 2.1.2.5.1.5.

Formal Parameters: Yes

Description: RMU Drift Update

Constraints: Integral must be in stable pointing and outside eclipse

Uplink Time: In the RMU_CAL interval, following receipt of a TPF after the successful completion of the reset of RMU Integrators in FCE and the RMU Drift Calibration.

Execution Time: n/a

Remarks: The RMU calibration is to be executed every 18 hours +/- 3 hours. See FCP_AOC_0550

2.1.2.4 OMC Command Request

Due to downlink data rate limitations, it is not possible to downlink all the OMC Field Of View data. Therefore, through any pointing cycle, predefined specific sub-windows of the OMC FOV are downlinked. If a Gamma Ray Burst occurs it might be that it is in the FOV of other instruments but not in the current OMC sub-window.

The occurrence of any GRB will be detected in near real-time by the Integral Burst Alert System (IBAS) at ISDC. This task permanently monitors the telemetry from SPI, IBIS and JEM-X. This data is analysed such that if significant excesses with respect to a running average is detected, a GRB alert is triggered. When such a candidate event is detected, a process of image analysis and cross-checking among instruments verifies the GRB.

If the event is genuine, the satellite attitude data is used to determine the exact position of the GRB source in IBIS coordinates, which are then translated into OMC coordinates. If the GRB is within the OMC FOV, OMC sub-window coordinates are defined such that the GRB source is in the centre of the sub-window and there is the maximum window size around the centre.

These data are converted into OMC telecommand parameters to set the required sub-window and the parameters are sent to MOC as a TC request via the INTEGRAL File Transfer System (IFTS). The parameters sent in the TC request are the X and Y coordinates of the OMC pixel chosen as the centre pixel for the new sub-window.

ISDC will be notified automatically of the reception of this TC request by MOC. The "External CMD" task, which is permanently running on the IMCS without any user intervention, receives the TC request from ISDC. This module is an additional command source within the IMCS and interfaces with the Multiplexer exactly in the same manner as other CMD sources (Manual-Stack and Auto-Stack). The module receives the telecommand parameters and encodes the respective OMC TC, which is then forwarded to the Multiplexer. The Multiplexer then forwards the command to the releaser.

This OMC telecommand will pass through the same verification cycle as any other command does. There is no Pre-Transmission Validation in place for this command that would check for certain settings onboard the S/C before uplink. The Instrument mode is also not checked before uplink of this command, so it can be rejected onboard if OMC is not in the correct mode or overwritten by other commands. Which means at the end of each pointing mode the OMC will return to its nominal viewing mode as defined in the observation plan. The operator has no intervention in this process and can only verify the uplink of this command through the command history. The verification status can be monitored by the TC History display task.

Under nominal circumstances, the delay between monitoring of the GRB event and execution of the command on-board is in the order of 1 minute.

2.1.2.5 Manual Operations

2.1.2.5.1 Regular Manual Operations

2.1.2.5.1.1 IBIS/ISGRI Context tables LOADING

In order to perform the IBIS/ISGRI calibration it is requested by IBIS PI to upload new ISGRI context tables, based on processing of pixel statuses (HK3 data) from the previous revolutions operations. This operation is mandatory and IBIS PI does not foresee to activate the unit without executing the IBIS/ISGRI calibration. The Context tables will be supplied to ESOC from ISDC in the form of 8 TPFs generated by the ISGRI table handling system. The file naming convention is:

GMCEnCTX_rrrr_yyyymmddhhmmss_vv.TPF

where:
n = (0,7) number of MCE
rrrr = revolution number
yyyymmddhhmmss= ERT of the first packet of the dump
vv = version number

The context table loading must be executed during the SATENG window.
See:
FCP_IBIS1_0401 ISGRI CTX Upload via TPF
FCP_IBIS2_0401 ISGRI CTX Upload via TPF

2.1.2.5.1.2 Regular dump of the IBIS on-board Configuration tables

It is required to maintain on ground updated images of the on-board context tables in order to keep track of the instrument peripherals configuration. This activity requires a save in the DPE and a dump on ground of these tables. Hereafter follows the list of the on-board CTX tables interested by the activity:

HEPI
LUT1
LUT2
VETO
PICsIT
ISGRI

This activity will be performed after every substantial modification of the on-board configuration (approx. once per month). It will be executed after crossing the critical instrument altitude descending (except during eclipse season because the Context saving is performed by the eclipse on-board automatism).

See: FCP_IBIS1_0261 IBIS Context Saving
FCP_IBIS1_9860 Load and Dump LUT1
FCP_IBIS1_9870 Load and Dump LUT2
FCP_IBIS1_9880 Load and Dump HEPI
FCP_IBIS1_9890 Load and Dump VETO
FCP_IBIS1_9900 Load and Dump PICSIT

2.1.2.5.1.3 Reset OEM Buffers

The AOCS and OBDH OEM buffers will be reset manually at the start of every Revolution during the AOS_CHK window (or shortly afterwards) and during the LOS_CHK window, *only following successful report* of the 2 buffers.
See FCP_SYS_1100.

2.1.2.5.1.4 Reset OBM Buffers

Following reporting of the MIN/MAX and Limit Status check tables during the AOS_CHK and LOS_CHK windows the On-board monitoring task should be reset.
See FCP_DHS_1235.
The time field of the OBM MIN/MAX and Limit Status check tables reports has a wraparound time of 18.6 hours, to prevent ambiguities in the time field, these tables should be reported and rest with a frequency greater that 18.6 hours.
For this reason the following new MOUT has been added to the EPOS at PSF level:

R_OBM MOUT: REPORT AND RESET OBM

This MOUT will be generated 12 hours after LOS_CHK close and every 12 hours thereafter during coverage. This MOUT prompts the SPACON to report and reset the OBM Tables.
See FCP_DHS_1235.

2.1.2.5.1.5 Update RMU Drifts

The RMU drift must be calculated and updated at least every 24 hours. This requirement applies for the complete mission. The required data collection time is 5 minutes. In the Operational Orbit, the RMU calibration is baselined every 18 hours with a flexibility of +- 3 hours (i.e. every revolution at Perigee+9h, P+27h, P+45h and P+63h). The calibration itself is performed automatically, see Section 2.1.2.3.1 and Section 2.1.2.3.7.2.10, however the update of the FCE RMU drift correction after the calibration is manual.

The uplink of the new drift correction is done by uplinking the TPF (AERMU_00, Section 2.1.2.3.8.3), which is received automatically following the calibration. This TPF should be uplinked during a period where there is a gap of about 5mins in AOCS commands.
See: FCP_AOC_0550

2.1.2.5.1.6 IMU Health-Check

The purpose is to perform a manual health check of the IMU that is going to be used by the ACC for the next eclipse passage. In order to do this, 3 hours before the eclipse, or 3 hours before the previous LOS if there are not 3 hours of ground station coverage immediately before the eclipse, the default IMU is switched on and checked by ground. After the check the IMU is left on until the eclipse end. This operation requires to disable the IMU autonomous switch off by the ACC.
This operations is only performed in eclipse season and is triggered by an MOUT.
See: FCP_AOC_0523

2.1.2.5.1.7 Check execution of TT ED AEIOF

Since before the eclipse the ACC autonomous IMU switch off function is disabled, it has to be re-enabled once the eclipse is finished. This is done by Time-Tagged command in the ED AEIOF_00. Once there is ground station coverage after eclipse, it should be verified that this TT command has been executed, and if not the re-enable of the IMU autonomous switch off should be done manually.
See: FCP_AOC_0526

2.1.2.5.1.8 Reset of SAS Operating Points

This should be executed at least every 24 hours of steady pointing.
See FCP_AOC_0540 AOCS Daily Maintenance.

2.1.2.5.1.9 Battery End of Charge Timer

According to the eclipse duration and Satellite power consumption during eclipse, the MRU End of Charge timer setting may have to be adjusted.
Following every eclipse the batteries DOD, recharge time and Satellite power consumption should be checked and the End of Charge timer adjusted accordingly.

FCP_EPS_1260 Battery EOC Timer - Change Time

2.1.2.5.1.10 DPE LOBT wraparound

Wraparound of the DPE LOBT is predicted to occur at the following times:

09/11/2003 10:20:37
21/05/2004 14:40:52
01/12/2004 19:01:07
13/06/2005 23:21:22
25/12/2005 03:41:37
07/07/2006 08:01:52
17/01/2007 12:22:07
30/07/2007 16:42:22
09/02/2008 21:02:37
22/08/2008 01:22:52

If the above times would be during an INSTRUMENT window, a 40 minute SATENG window is inserted in the PSF, centred on the time of the wraparound, in order to allow the instruments to be manually configured into their standby modes before the wraparound, and prepared for reconfiguration back to science mode after the wraparound.

2.1.2.5.2 Irregular Manual Operations

2.1.2.5.2.1 Preparation for Eclipse Season

2.1.2.5.2.1.1 Batteries Reconditioning

Before the eclipse season starts a reconditioning should be performed on both batteries.
The reconditioning must be performed sequentially.
The battery reconditioning should start one month before the eclipse season.
The relevant FCPs are:

FCP_EPS_1280 Battery 1 Reconditioning
FCP_EPS_1281 Battery 2 Reconditioning

2.1.2.5.2.1.2 Charge Rate Selection

Before the eclipse season starts, but after battery reconditioning is terminated. Battery Full Charge rate C/13 must be selected.

FCP_EPS_1271 Select Full Charge Rate (C/13), BCR1
FCP_EPS_1272 Select Full Charge Rate (C/13), BCR2

At the end of the eclipse season Battery Full Charge rate C/26 must be selected
FCP_EPS_1273 Select Full Charge Rate (C/13), BCR1
FCP_EPS_1274 Select Full Charge Rate (C/13), BCR2

2.1.2.5.2.1.3 OBDH On-board Monitoring Tables

Different on-board monitoring tables have to be loaded depending upon the season.

Before the first eclipse of the season load the OBM tables for eclipse season:
FCP_EPS_1232 Load OBM Entries for Eclipse Season
After the last eclipse of the season load the OBM tables for 'non-eclipse' season:
FCP_EPS_1231 Load OBM Entries for Non-eclipse Season.

2.1.2.5.2.1.4 MRU end of Charge Timer Status

Before the eclipse season starts, but after battery reconditioning is terminated the MRU EOC timer Automatic mode must be selected.
FCP_EPS_1261 Battery EOC Timer - Automatic Mode

At the end of the eclipse season the MRU EOC timer Enable mode must be selected.
FCP_EPS_1262 Battery EOC Timer - Enable EOC

2.1.2.5.2.1.5 IMU Calibration Before the Eclipse Season

Every 6 months, before the eclipse season, the drift for IMU-1 and its backup IMU-2 should be calibrated, and their health (TM flags+ noise) assessed. The proposed sequence is:

1) IMU-1
- Power on IMU-1.
- Select IMU-1 on the ACC for both Roll and Yaw, and on the FDE for X and Z.
- Wait 30 minutes for thermal stabilization.
- Collect the IMU data during a period of at least 20 minutes.
- During this time calculate also the IMU noise on the digital channels.
- Power off IMU-1
- Update the ACC drift correction.

2) IMU-2
- At least 2 hours after IMU-1 power off (could be much later), power on IMU-2.
- Select IMU-2 on the ACC for both Roll and Yaw, and on the FDE for X and Z.
- Wait 30 minutes for thermal stabilization.
- Collect the IMU data during a period of at least 20 minutes.
- During this time calculate also the IMU noise on the digital channels.
- Power off IMU-2
- Update the ACC drift correction.

This operation can be performed during several orbits prior to the eclipse season starting, whenever it can be executed without interfering with nominal operations. It is proposed to implement these calibrations manually in parallel with the running automatic timeline. Since all the channels that are calibrated here, are calibrated as well as part of the yearly complete calibration, it is proposed to alternate them, and perform this calibration only for the Winter Eclipse Season, starting with the one shortly after the LEOP. The proposed period is (First_Eclipse_Winter_Season Start – 8 days, First_Eclipse_Winter_Season Start – 4 days), in order to allow finding a suitable time slot during working hours.

See FCP_AOC_1630 Complete IMU calibration Pre Eclipse Season

2.1.2.5.2.1.6 AOCS reconfiguration prior the eclipse season

At least 36 hours prior to the first eclipse in the Eclipse Season the AOCS needs to be configured. This normally implies only the loading of the eclipse season AMD thresholds. This activity is covered in the procedure FCP_AOC_0524 ECLIPSE PREPARATION.

2.1.2.5.2.1.7 AOCS Reconfiguration after the eclipse season

After the last eclipse in the season, the AOCS needs to be reconfigured back to the Sunlight Season settings. This involves freezing the FDCE eclipse timers in the sunlight state, stopping the ACC Eclipse task, and loading the non-eclipse season AMD thresholds. These activities are covered by procedure FCP_AOC_0522 AOCS RECONFIGURATION AFTER THE ECLIPSE SEASON

2.1.2.5.2.2 Double Eclipse Strategy

The strategy to be applied depends on the duration of the two eclipses, their separation and position within the orbit and therefore will be determined on a case by case basis according to the constraints and information contained in the Integral User Manual Section 4.4.5.

2.1.2.5.2.3 Additional AOCS Calibrations

2.1.2.5.2.3.1 Yearly Complete IMU calibration

Once a year the complete set of IMU's needs to be powered on, and their health (TM flags+ noise) assessed. In addition the opportunity is used to perform a 20m drift calibration.
The proposed sequence is:

1)
IMU 1 and 3 are powered on.
IMU selection set to:

FDE: IMU- 1 X, IMU- 3 Y and Z
ACC: IMU- 1 ROLL, IMU- 1 YAW

Wait 30 minutes for thermal stabilization.
Collect drift data for 20m. Estimate the IMU noise on the ACC selected channels.

2)
IMU selection changed to:

FDE: IMU- 1 X and Z, IMU- 3 Y
ACC: IMU- 1 ROLL, IMU- 3 YAW

And the following new channels are calibrated (20m of data collection):

IMU 1 analog Z
IMU 3 digital Z (noise check performed)

3)
IMU 1 and 3 are powered off, and a waiting time of at least 2 hours (could be much more) is introduced for thermal stability reasons.

4)

IMU 2 and 4 are powered on, and the following IMU selection is commanded:

FDE: IMU- 2 X and Z, IMU- 4 Y
ACC: IMU- 2 ROLL, IMU- 2 YAW

After a waiting time of 30 minutes, the selected channels are calibrated (20m of data collection), i.e.:

IMU 2 digital channels X and Z (noise evaluated as well), analog channel X and Z.
IMU 4 analog channel Y

5)
The IMU selection is changed to:

FDE: IMU- 4 X and Y, IMU- 2 Z
ACC: IMU- 4 ROLL, IMU- 2 YAW

And the following new channels are calibrated (20m of data collection):

IMU 4 digital channel X (noise evaluated as well) and analog channel X

6)
The IMU 2 and 4 are powered off, and the ACC IMU drift updated for all channels.

It is proposed to implement these calibrations manually in parallel with the running automatic timeline, and in the period (First_Eclipse_of_Summer_Season Start – 8 days, First_Eclipse_of_Summer_Season Start – 4 days), in order to allow finding a suitable time slot during working hours. Note that the steps relevant to IMU 1 and 3 on one side and the steps relevant to IMU 2 and 4 on the other could be executed on different days.

2.1.2.5.2.3.2 Redundant RMU Health Check

This check is intended to check the health status of the redundant RMU. It is to be performed every 6 months. The check consists in powering on the unit, and estimating the drift by using the RTU rates.
It is proposed to perform this check together with the pre-eclipse season IMU calibrations, for both eclipse seasons.

2.1.2.5.2.3.3 Periodic Thruster Torque Calibration

The purpose is to calibrate the thrusters in short pulse mode. This is required in order to provide representative torque estimates which are used to calculate the FDE thresholds for RTIM, PTIM and YTIM, the ACC reciprocal torques and the AMD on times. The calibration requires a series of short duration thruster firings while the attitude control is on wheels. The total duration is 300 minutes.

This calibration is to be performed:

- After each Delta-V.
- After each RW set reconfiguration.
- At least every 6 months.

Unless a Delta-V or RW reconfiguration occurs, it is proposed to execute the calibration at Transition_to_Operational_Orbit + 6 months, and every 6 months after that. In order to perform this calibration, a dedicated slot of 6 hours has to be allocated in the timeline. This slot should be allocated in the PSF as an Engineering Window, so that science can not be planned in that period. It is recommended to schedule it during normal working hours, in order to have full support of the FCT and FD.

2.1.2.5.2.3.4 Periodic FSS/STR Misalignment Calibration

This calibration is to be performed:

- After a FSS or a STR reconfiguration
- At least every 6 months

Two different approaches exist:

- The one executed by FD for XMM, and proposed for Integral (Ref: XMM-MOC-TN-0122-OAD, “Star Tracker/Fine Sun Sensor Misalignment Calibration for XMM and INTEGRAL“).
- The one proposed by Astrium in appendix 8 of INT-PR-MMB-0005 “INTEGRAL AOCS Operating Procedures for the FM AOCS Subsystem”

The two methods are different in terms of the operations to be performed. The method used for XMM uses 4 pointings at the corners of the allowed FSS FoV to calibrate 6 transfer function coefficients, namely *(A 9,A 10 ,A 11*) and *(B 9 ,B 10 ,B 11*). The Astrium-proposed method calibrates the same coefficients, using data from only 3 corners of the allowed FoV. In each of these corners, 3 different attitudes, 0.8° apart, are taken. The purpose is to average out the error contribution from the transfer function coefficients that are not calibrated. These coefficients are sinusoidal with a period of ≈ 1.6°.

The proposed method is to perform the “union” of the two approaches, by performing a 4 corner x 3 points calibration. This allows choosing the approach to be used at data processing level.

The resulting operation is[4]:

Activity	Time (minutes)
RWB	25
Open Loop slew to boresight Sun + att. Recons.	35
Open Loop slew to α +4° β +39° + att. Recons.	35
STR S/T and data collection	30
Offset slew 0.8° on α	5
STR S/T and data collection	30
Offset slew 0.8° on β	5
STR S/T and data collection	30
Offset slew to α -4° β +39°	15
STR S/T and data collection	30
Offset slew 0.8° on α	5
STR S/T and data collection	30
Offset slew 0.8° on β	5
STR S/T and data collection	30
Open Loop slew to α -4° β -39° + att. Recons.	35
STR S/T and data collection	30
Offset slew 0.8° on α	5
STR S/T and data collection	30
Offset slew 0.8° on β	5
STR S/T and data collection	30
Offset slew to α +4° β -39°	15

4 It should be noted that the procedure could be adapted at a later stage if the results of currently ongoing studies, to improve the FSS calibration by trying to calibrate the remaining terms of the transfer function, lead to a method with more accurate calibration results.

Activity	Time (minutes)
STR S/T and data collection	30
Offset slew 0.8° on α	5
STR S/T and data collection	30
Offset slew 0.8° on β	5
STR S/T and data collection	30
Open Loop slew to boresight Sun + att. Recons.	35

The operation takes 595 minutes. To allow margin it is suggested to allocate 12 hours.

It is proposed to schedule this calibration (unless a FSS or STR occurs before), after each eclipse season. Since the first eclipse season is quite close to the previous calibration performed at the transition to the operational orbit, it is proposed to schedule the first calibration after the end of the first Summer Eclipse Season, in the time range of (Last_Eclipse_End + 1 day, Last_Eclipse_End + 4 days), in order to allow a slot during normal working hours. This slot should be allocated in the PSF as an engineering window, such that science activities are not planned in this period.

2.1.2.5.2.3.5 Periodic Inertia/RW Calibration

The purpose of this calibration is to get the values of the following 15 coefficients:
- The 6 different coefficients of the symmetric S/C inertia matrix (rigid body)
- The 3 non-zero coefficients of the diagonal RW inertia matrix
- The 6 RW alignment angles

This calibration should be done:
- After each Delta-V
- After each RW set reconfiguration
- At least once a year

The calibration is performed by collecting data during 3 closed-loop slews: a pure pitch, pure yaw and pure roll, plus some waiting time in between. The result is confirmed by performing a pure yaw open loop slew.[5]

The sequence of activities is as follows:

Activity	Time (minutes)
RWB	25
Open Loop slew to boresight Sun + att. Recons.	35
Close loop slew to move guide at STR –Y extreme	10
30 minutes wait	30
Close Loop slew to move guide to STR +Y extreme	10
Close loop slew to move guide at STR –Z extreme	10
30 minutes wait	30
Close Loop slew to move guide to STR +Z extreme	10
Close Loop slew to move guide to (0,0) and roll to +4 degrees	10
30 minutes wait	30

[5]For more detail on this calibration see: INT-MOC-FD-TN-1006-TOS-GFO, “Additional Studies for Spacecraft Inertia and Reaction Wheel Calibration”.

Activity	Time (minutes)
Close Loop slew to roll to –4 degrees	15
Close Loop slew to return to zero roll	10
Process of the data and uplink of new S/C Inertia Matrix, RW DCM and RW inertia	120
20° pure Yaw slew to assess the quality of the updated values	20

The total time needed is 365 minutes. To allow margin, a slot of 8 hours is suggested.

It is proposed to schedule this calibration after each Summer Eclipse season, in the time range of (Last_Eclipse_Summer_Season End + 4 days, Last_Eclipse_Summer_Season End + 8 days). This in order to allow a slot during normal working hours and not in the same time frame as the FSS/STR calibration. This slot should be allocated in the PSF as an engineering window such that science activities are not planned in this period.

2.1.2.5.2.4 Delta-V Manoeuvres

Delta-V manoeuvres will be planned as required by the orbit evolution. At the moment there is no manoeuvre foreseen.

2.1.2.5.2.5 Instrument Calibrations

2.1.2.5.2.5.1 SPI Annealing

SPI annealing consists of bringing the detectors, placed in the cold box and normally kept at the temperature of 85 Kelvin, to a high temperature on order to re-generate the detector crystal from damage caused by high energy radiation during the normal operations.
For this purpose, the scientific mode is stopped, active cooling is interrupted and two special annealing heaters (prime and redundant) are switched on. The detector’s temperature increases progressively, up to a first plateau of 37 +-4°C lasting 2 hrs where the RTU cold plate temperature sensors are checked, and then to a final steady state temperature of 104 +-4°C for the required annealing period. Heat pipes heaters and antifreeze heaters are also reconfigured during the annealing procedure.
Following the annealing, SPI is cooled in two stages. The first is the Passive Cooling phase, which lasts about 3 days, and decreases the temperature to the operating temperature of the SPICO compressors (<35°C). When this temperature is reached, the Active Cooling is started and it then takes about 5-6 days to reach the 85K nominal operative temperature of the detectors. Once the 82K is achieved, the fine-tuning procedure of the SPICO compressors starts.
The SPI camera is switched on during the cool down phase, at around 117K: at this time the detector high voltages are turned on in steps of 500V (up to 4kV) and the nominal SPI flight configuration is applied. The time between 117K and 82K is used to check out the post annealing detectors health status.

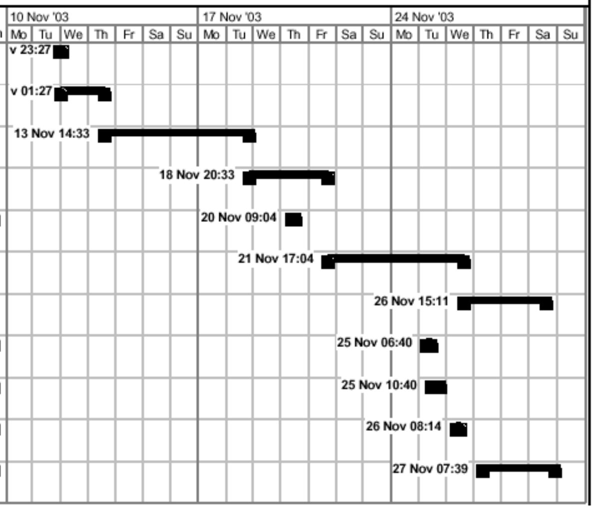
The annealing operation is foreseen about twice per year and ISOC has to allocate special windows to SPI. During these windows, no SPI EDs should be scheduled by ISOC and the PST allocation can be dropped as low as 5pkts/cycle unless differently required by the SPI PI. The PST allocation should be set back to nominal at the time the camera is switched on.

A typical sequence of operations and associated procedures involved in SPI Annealing is detailed in the following timeline. The example includes additional SPI activities, like the patch of a new IASW version or special tests, not strictly related to the Annealing but usually performed during the Annealing cycle in order not to affect the normal science observation periods.

Summary view of the example timeline:

3rd SPI Annealing - revs 132-136

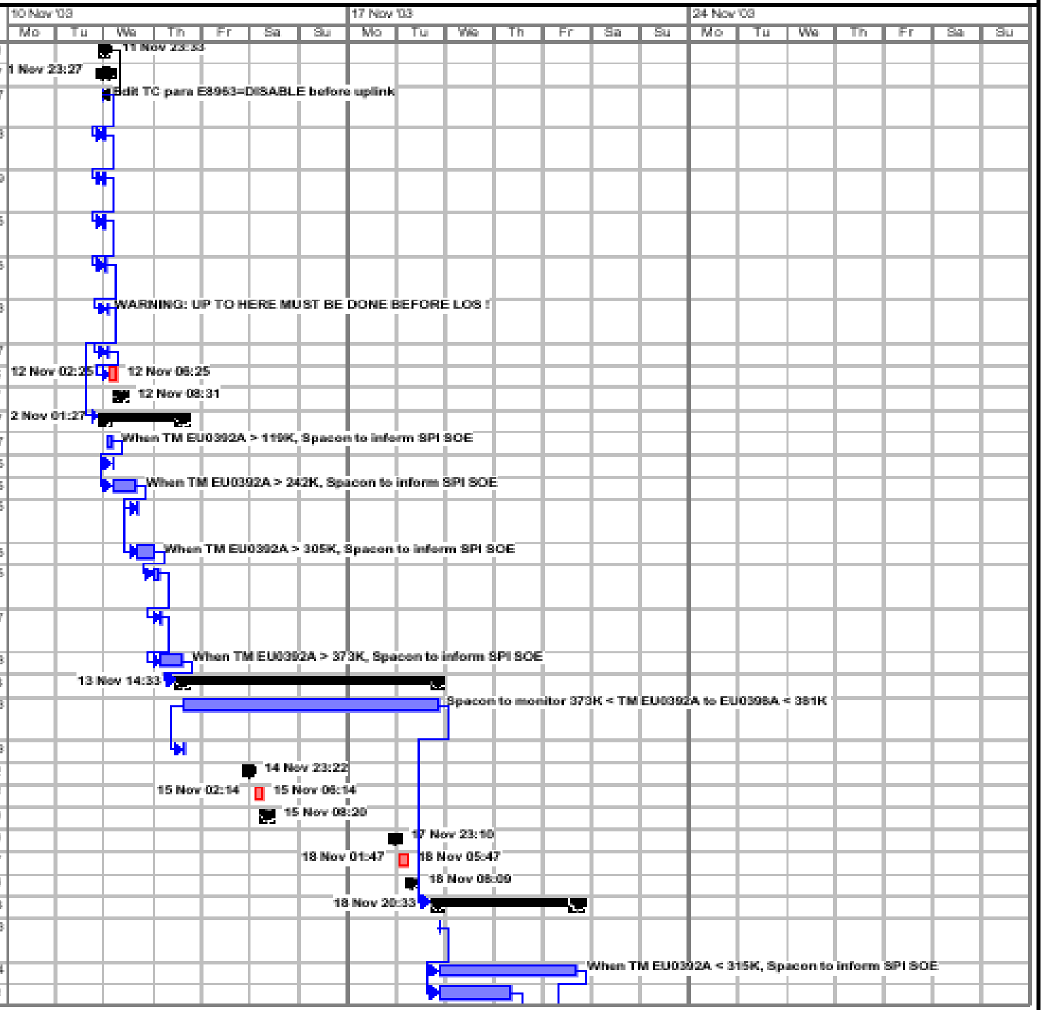
ID	Task Name	Duration	Start	Resource Nam
2	**Start SPI Annealing**	**2.9 hrs**	**11 Nov 23:27**	**PST[5 pkts]**
12	**Warm up to Annealing Temperature**	**37.1 hrs**	**12 Nov 01:27**	**PST[5 pkts]**
21	**Annealing at 104degC**	**126 hrs**	**13 Nov 14:33**	**PST[5 pkts]**
30	**Stop SPI Annealing - Passive Cooling**	**68.52 hrs**	**18 Nov 20:33**	**PST[5 pkts]**
34	**Uplink IASW 4.3.0**	**4.01 hrs**	**20 Nov 09:04**	**PST[98 pkts]**
56	**Start Active Cooling**	**118.12 hrs**	**21 Nov 17:04**	**PST[5 pkts]**
65	**Active Cooling Fine Tuning**	**72.3 hrs**	**26 Nov 15:11**	**PST[5 pkts]**
76	**ACS and Camera Switch on & Performance Tests**	**4 hrs**	**25 Nov 06:40**	**PST[98 pkts]**
85	**IASW 4.3.0 In-flight Validation**	**7.57 hrs**	**25 Nov 10:40**	**PST[98 pkts]**
111	**ACS FEE57 Fault Identification Tests**	**3.91 hrs**	**26 Nov 08:14**	**PST[98 pkts]**
128	**SPI POS Observations**	**62.8 hrs**	**27 Nov 07:39**	**PST[98 pkts]**



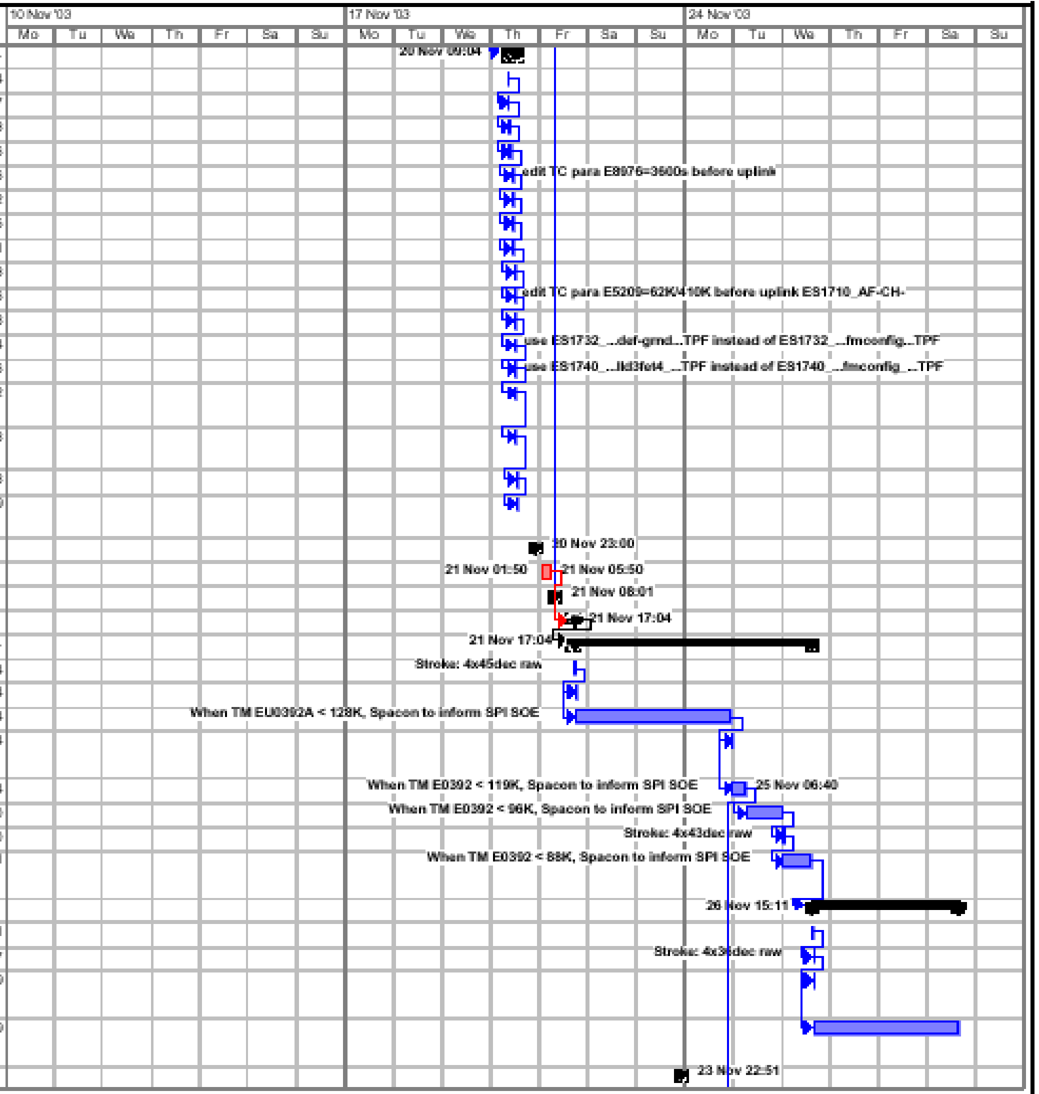
Detailed view of the example timeline:

3rd SPI Annealing - revs 132-136

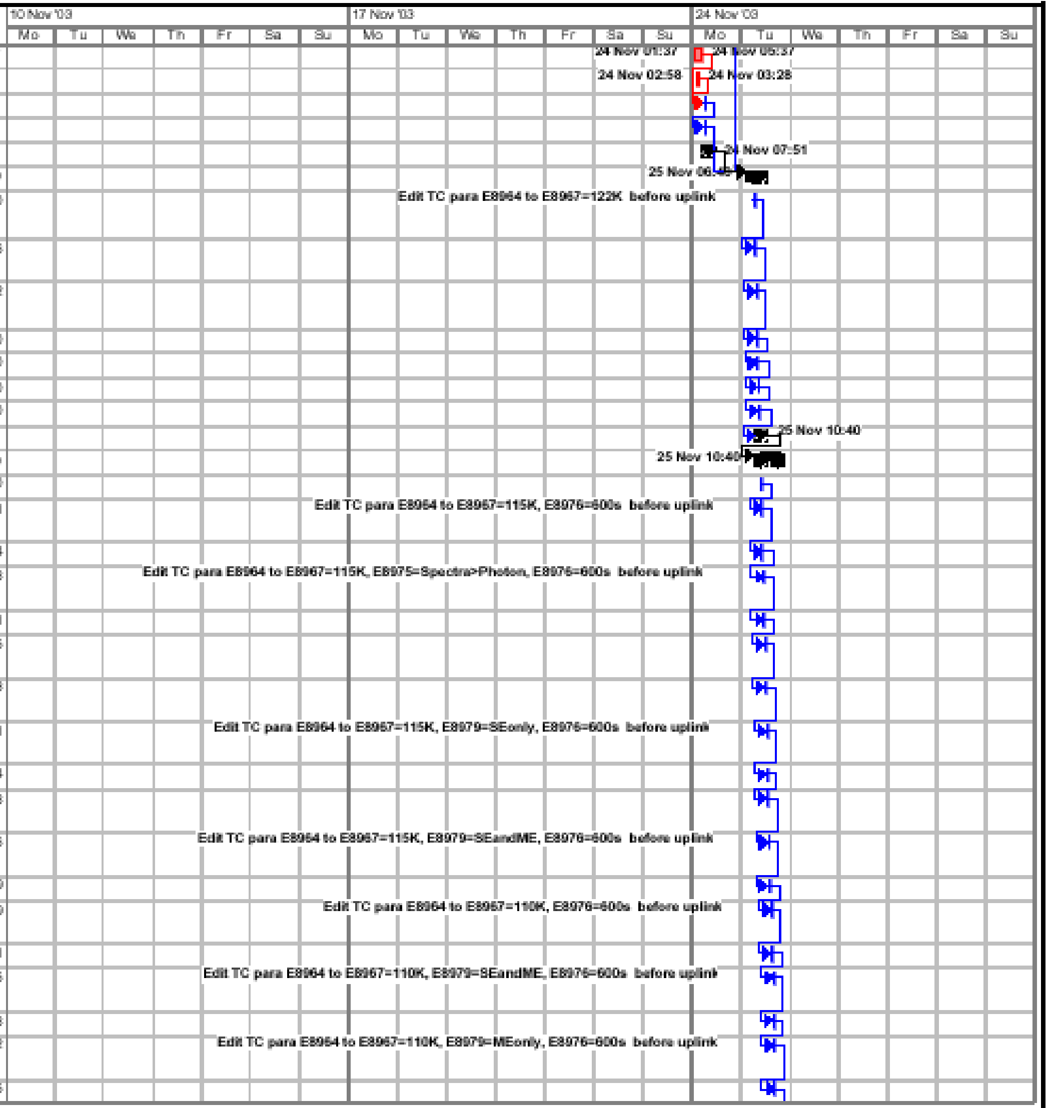
ID	Task Name	Duration	Start
1	***Rev131 Rad Belts ENTRY***	*0 hrs*	*11 Nov 23:33*
2	**Start SPI Annealing**	**2.9 hrs**	**11 Nov 23:27**
3	~5 min before belts entry : go to Conf, disable IASW reactions to cp temp & belts, switch off ACS HV: Execute ED EENTRY01	0.1 hrs	11 Nov 23:27
4	Set AFEE HV to 0(zero) V: Uplink ES1713_AF-HVSET_def-grnd_vvvv.TPF (subdir /def_grnd)	0.1 hrs	11 Nov 23:33
5	Switch AFEE HV off: Uplink ES1710_AF-CH-OO_def-grnd_vvvv.TPF (subdir /def_grnd)	0.1 hrs	11 Nov 23:39
6	Stop active cooling: Execute FCP_SPI1_0240 (it includes the increase of PSD threshold)	1 hr	11 Nov 23:45
7	Load commands of FCP_SPI1_0180 as TT TCs to stop SPI annealing on 18 Nov at 21:00 (for safety)	0.3 hrs	12 Nov 00:45
8	Start annealing procedure: Execute FCP_SPI1_0100 up to step 5.1 (i.e. up to Annealing htr A switch on)	0.4 hrs	12 Nov 01:03
9	Time margin to LOS	0.9 hrs	12 Nov 01:27
10	***LOS***	*4 hrs*	*12 Nov 02:25*
11	***Rev132 Rad Belts EXIT***	*0 hrs*	*12 Nov 06:31*
12	**Warm up to Annealing Temperature**	**37.1 hrs**	**12 Nov 01:27**
13	WAIT cold plate temp >/= 120K (-153degC) (step 5.2 FCP_SPI1_0100)	2.3 hrs	12 Nov 01:27
14	Switch on annealing htr B : Execute FCP_SPI1_0100 step 5.3 by TT TCs	0.1 hrs	12 Nov 03:45
15	WAIT cold plate temp >/= 243K (-30degC) (step 6 FCP_SPI1_0100)	12.5 hrs	12 Nov 03:45
16	Switch on heat pipes htrs / off antifreeze htrs: Execute FCP_SPI1_0100 from step 7.1 to 7.5	0.1 hrs	12 Nov 16:15
17	WAIT cold plate temp >/= 306K (33degC) (step 8 of FCP_SPI1_0100)	9 hrs	12 Nov 16:15
18	Calibrate RTU temp sensors at 37degC : Execute FCP_SPI1_0100 from step 9 to 10.3	2.2 hrs	13 Nov 01:15
19	Select annealing temperature (104degC) on AFEE: Execute FCP_SPI1_0100 from step 11.1 to 11.5	0.1 hrs	13 Nov 03:27
20	WAIT cold plate temp >/=373K (100degC) (step 12 of FCP_SPI1_0100)	11 hrs	13 Nov 03:33
21	**Annealing at 104degC**	**126 hrs**	**13 Nov 14:33**
22	WAIT the required time at 104degC for GeD annealing (step 13 of FCP_SPI1_0100) : min 100hrs	126 hrs	13 Nov 14:33
23	If necessary, adjust execution time of the safing TT TCs stopping annealing	0.3 hrs	13 Nov 14:33
24	***Rev132 Rad Belts ENTRY***	*0 hrs*	*14 Nov 23:22*
25	***LOS***	*4 hrs*	*15 Nov 02:14*
26	***Rev133 Rad Belts EXIT***	*0 hrs*	*15 Nov 06:20*
27	***Rev133 Rad Belts ENTRY***	*0 hrs*	*17 Nov 22:10*
28	***LOS***	*4 hrs*	*18 Nov 01:47*
29	***Rev134 Rad Belts EXIT***	*0 hrs*	*18 Nov 06:09*
30	**Stop SPI Annealing - Passive Cooling**	**68.52 hrs**	**18 Nov 20:33**
31	Stop annealing : Execute FCP_SPI1_0180 (annealing and heat pipes htrs switch off)	0.02 hrs	18 Nov 20:33
32	WAIT thermal braids temp </= 308K (35degC) (step 8 of FCP_SPI1_0180)	68.5 hrs	18 Nov 20:34
33	*On-purpose delay to control timing of IASW uplink*	*36.5 hrs*	*18 Nov 20:34*



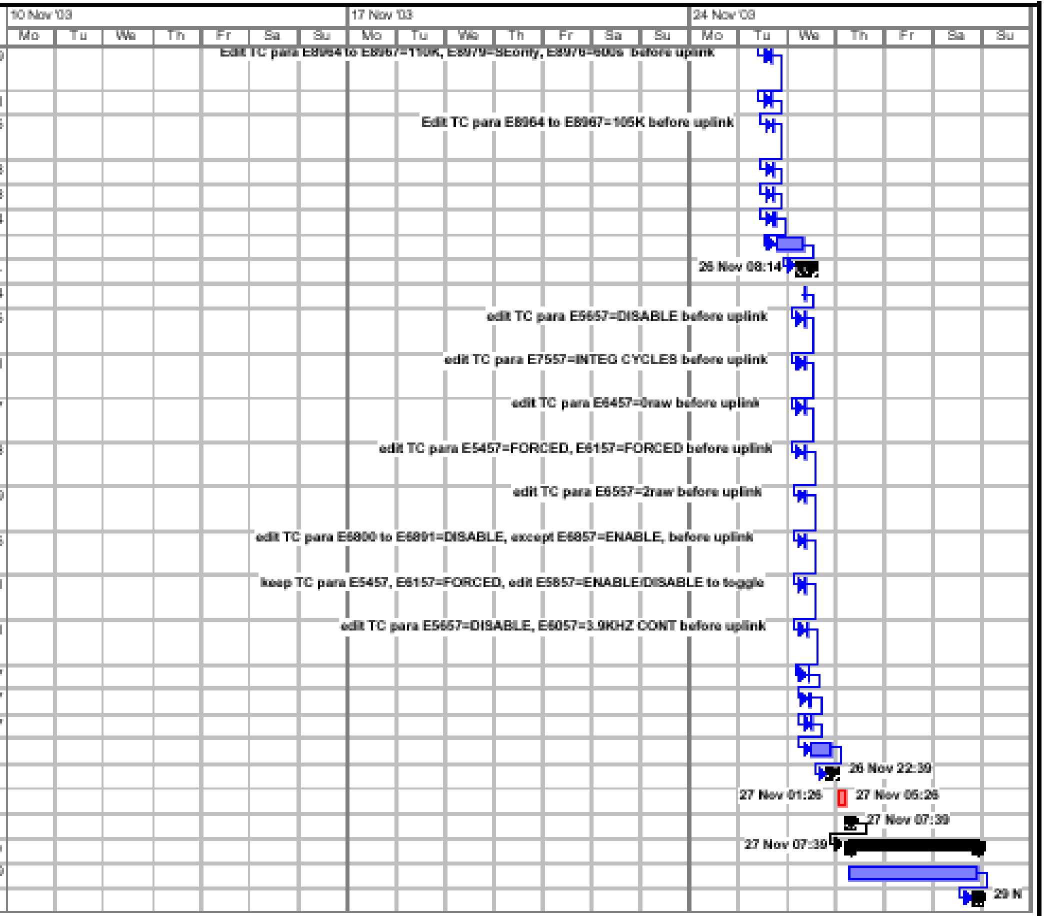
ID	Task Name	Duration	Start
34	**Uplink IASW 4.3.0**	**4.01 hrs**	**20 Nov 09:04**
35	Go to Stand-by: Execute FCP_SPI1_0120	0.05 hrs	20 Nov 09:04
36	Switch off Subassemblies: Execute FCP_SPI1_0061	0.1 hrs	20 Nov 09:07
37	Disable BCP to SPI1: Execute FCP_SPI1_0064	0.05 hrs	20 Nov 09:13
38	Uplink IASW 4.3.0 and restart DPE: Execute FCP_SPI1_9810	1.5 hrs	20 Nov 09:16
39	Start IASW: Execute FCP_SPI1_0041	0.1 hrs	20 Nov 10:46
40	Enable BCP to SPI1: Execute FCP_SPI1_0042	0.05 hrs	20 Nov 10:52
41	Switch on Subassemblies: Execute FCP_SPI1_0043	0.1 hrs	20 Nov 10:55
42	Refresh Subassembly telemetry: Execute FCP_SPI1_0045	0.2 hrs	20 Nov 11:01
43	Transition from St-by2 to Conf mode: Execute FCP_SPI1_0080	0.05 hrs	20 Nov 11:13
44	Load AFEE HV OFF config (keep 62K/410K): Execute FCP_SPI1_0172	0.2 hrs	20 Nov 11:16
45	Load DFEE fmconfig: Execute FCP_SPI1_0174	0.1 hrs	20 Nov 11:28
46	Load ACS fmconfig (keep HV off): Execute FCP_SPI1_0177	0.2 hrs	20 Nov 11:34
47	Load PSD fmconfig (keep high thresholds): Execute FCP_SPI1_0171	0.1 hrs	20 Nov 11:46
48	Set AFEE thresholds for hot GeD: Uplink ES1711_AF-LW-DT_svt-36pk_vvvv.TPF (subdir /test): if necessary, adjust	0.1 hrs	20 Nov 11:52
49	Transition to Oper mode to verify science data generation: Execute FCP_SPI1_0130	1 hr	20 Nov 11:58
50	Go to Conf: Execute FCP_SPI1_0160	0.01 hrs	20 Nov 12:58
51	Restore nominal AFEE thresholds: Uplink ES1711_AF-LW-DT_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	20 Nov 12:59
52	***Rev134 Rad Belts ENTRY***	*0 hrs*	*20 Nov 23:00*
53	***LOS***	*4 hrs*	*21 Nov 01:50*
54	***Rev135 Rad Belts EXIT***	*0 hrs*	*21 Nov 08:01*
55	*On-purpose delay to control timing of cryocooler start-up*	*0 hrs*	*21 Nov 17:04*
56	**Start Active Cooling**	**118.12 hrs**	**21 Nov 17:04**
57	Start active cooling: Execute FCP_SPI1_0075 up to step 4.9	1 hr	21 Nov 17:04
58	Load TT TCs to reduce the stroke to 4x36raw on 16 Nov at 15:00 (for safety)	0.2 hrs	21 Nov 18:04
59	WAIT cold plate temp </=127K (step 5 of FCP_SPI1_0075)	78 hrs	21 Nov 18:04
60	Select narrow range cryo temps and restore PSD nominal threshold: Execute FCP_SPI1_0075 from step 5 to 5.2.4	0.1 hrs	25 Nov 00:04
61	WAIT cold plate temp </=117K (to switch on camera)	6.6 hrs	25 Nov 00:04
62	WAIT cold plate temp </=95K (to decrease stroke by 2 lsb)	18.5 hrs	25 Nov 06:40
63	Reduce cryocooler strokes to 4x43raw: Execute FCP_SPI1_0075 step 6.1	0.02 hrs	26 Nov 01:10
64	WAIT cold plate temp <85.9K (step 6.2 of FCP_SPI1_0075; to start Fine Tuning ops)	14 hrs	26 Nov 01:11
65	**Active Cooling Fine Tuning**	**72.3 hrs**	**26 Nov 15:11**
66	Remove safing TT TCs reducing the stroke	0.1 hrs	26 Nov 15:11
67	Reduce compressor stroke: Execute FCP_SPI1_0075 step 6.3	0.2 hrs	26 Nov 15:17
68	Update IASW cold plate temp thresholds: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 15:29
69	Fine tune compressor stroke @85K : Execute FCP_SPI1_0075 from step 6.4 to the end	72 hrs	26 Nov 15:29
70	***Rev135 Rad Belts ENTRY***	*0 hrs*	*23 Nov 22:51*



ID	Task Name	Duration	Start
71	***LOS***	*4 hrs*	*24 Nov 01:37*
72	***Moon Eclipse***	*0.5 hrs*	*24 Nov 02:58*
73	*Switch off subassemblies : Execute sequence EC0061 (to be sure they are off)*	*0.1 hrs*	*24 Nov 05:48*
74	*Post Eclipse switch on : automatic execution of ED EECLEX02*	*0.2 hrs*	*24 Nov 05:54*
75	***Rev136 Rad Belts EXIT***	*0 hrs*	*24 Nov 07:51*
76	**ACS and Camera Switch on & Performance Tests**	**4 hrs**	**25 Nov 06:40**
77	Enable IASW reactions to cp temp & belts, enable autoreconf, set thresh at 122K: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	25 Nov 06:40
78	Switch on ACS HV: Uplink ES1732_AS-SERVS_fmconfig_vvvv.TPF and ED EEORTM01	0.1 hrs	25 Nov 06:46
79	Switch on Camera HV at steps of 500V: Execute FCP_SPI1_0179 in the following way:	0.3 hrs	25 Nov 06:52
80	@ 0.5kV, 1.0kV, 1.5kV stay in Conf mode	0.5 hrs	25 Nov 07:10
81	@ 2kV make acquisition in Oper mode	0.5 hrs	25 Nov 07:40
82	@ 2.5kV, 3kV, 3.5kV stay in Conf mode	0.5 hrs	25 Nov 08:10
83	@ 4kV make acquisition in Oper mode and stay in this mode	2 hrs	25 Nov 08:40
84	*Time reserved for further SPI tuning and performance tests*	*0 hrs*	*25 Nov 10:40*
85	**IASW 4.3.0 In-flight Validation**	**7.57 hrs**	**25 Nov 10:40**
86	Execute test procedure SPI-PR-0-16673-CNES as follows:	0.01 hrs	25 Nov 10:40
87	1-2: Go to Conf and set priority Photon>Spectra and accu time=10min, thresh at 105K: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir	0.05 hrs	25 Nov 10:41
88	3-4: Go to Oper for 25 min	0.4 hrs	25 Nov 10:44
89	5-7: Go to Conf and set priority Spectra>Photon: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 11:08
90	8-9: Go to Oper for 25 min	0.4 hrs	25 Nov 11:11
91	10-12: Go to Conf and load OBSMS file IIMG_P_SPI_0129_00002_T_V_430_001_5.INT: Execute FCP_SPI1_9815	0.3 hrs	25 Nov 11:35
92	13: Load OBSMS file IIMG_P_SPI_0129_00002_T_V_430_001_0.INT: Execute FCP_SPI1_9815	0.3 hrs	25 Nov 11:53
93	13: Select SE filtering only: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 12:11
94	14-15: Go to Oper for 25 min	0.4 hrs	25 Nov 12:14
95	16-17: Go to Conf and load OBSMS file IIMG_P_SPI_0129_00002_T_V_430_001_5.INT: Execute FCP_SPI1_9815	0.3 hrs	25 Nov 12:38
96	17: Select SE and ME filtering: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 12:56
97	18-19: Go to Oper for 2hrs	2 hrs	25 Nov 12:59
98	20-22: Go to Conf and select filtering Nothing: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.2 hrs	25 Nov 14:59
99	23-24: Go to Oper for 25 min	0.4 hrs	25 Nov 15:11
100	25-26: Go to Conf and select SE and ME filtering: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 15:35
101	27-28: Go to Oper for 25 min	0.4 hrs	25 Nov 15:38
102	29-30: Go to Conf and select ME filtering only: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 16:02
103	31-32: Go to Oper for 25 min	0.4 hrs	25 Nov 16:05



ID	Task Name	Duration	Start
104	33-35: Go to Conf and select SE filtering only: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.2 hrs	25 Nov 16:29
105	36-37: Go to Oper for 25 min	0.4 hrs	25 Nov 16:41
106	Go to Conf and restore nominal IASW config: Uplink ES1700_IASW-PAR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.05 hrs	25 Nov 17:05
107	Go to Oper	0.01 hrs	25 Nov 17:08
108	Disable generation OEM 243 on IASW 4.3.0: Execute FCP_SPI1_0331	0.1 hrs	25 Nov 17:08
109	Time reserved for further tests	1 hr	25 Nov 17:14
110	*Time reserved for further SPI tuning and performance tests*	*14 hrs*	*25 Nov 18:14*
111	**ACS FEE57 Fault Identification Tests**	**3.91 hrs**	**26 Nov 08:14**
112	Go to Conf	0.01 hrs	26 Nov 08:14
113	Disable FEE57 watchdog: Uplink ES1732_AS-SERVS_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:15
114	Select FEE57 ratemeter based on intergration cycles: Uplink ES1734_AS-RT-MT_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:21
115	Select FEE57 delay line 0: Uplink ES1735_AS-VTDLY_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:27
116	Set FEE57 in forced veto mode(both normal and extended): Uplink ES1733_AS-VTCNF_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:33
117	Reduce FEE57 event trigger threshold: Uplink ES1736_AS-EVTGR_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:39
118	Mask all FEEs except FEE57 on VCU overall veto: Uplink ES1730_AS-VTPLS_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 08:45
119	Toggle veto signal generation en/dis every 10s: Use ES1733_AS-VTCNF_fmconfig_vvvv.TPF (subdir /fmconfig)	1 hr	26 Nov 08:51
120	Enable FEE57 test generator: Uplink ES1732_AS-SERVS_fmconfig_vvvv.TPF (subdir /fmconfig)	0.1 hrs	26 Nov 09:51
121	Go to Diag mode, continue toggling veto signal generation en/dis	1 hr	26 Nov 09:57
122	Time reserved for further tests	1 hr	26 Nov 10:57
123	Go to Conf, restore ACS nominal config, go to Oper	0.2 hrs	26 Nov 11:57
124	*Time reserved for further SPI tuning and performance tests*	*10 hrs*	*26 Nov 12:09*
125	***Rev136 Rad Belts ENTRY***	*0 hrs*	*26 Nov 22:39*
126	***LOS***	*4 hrs*	*27 Nov 01:26*
127	***Rev137 Rad Belts EXIT***	*0 hrs*	*27 Nov 07:39*
128	**SPI POS Observations**	**62.8 hrs**	**27 Nov 07:39**
129	POS driven observations	62.8 hrs	27 Nov 07:39
130	***Rev137 Rad Belts ENTRY***	*0 hrs*	*29 Nov 22:30*



2.1.2.6 Planning Procedures

2.1.2.6.1 FCP_MPS_0001: Create and Authorise a Timeline

2.1.2.6.1.1 Introduction and Background Information.

This Procedure defines the generation and nominal execution of a timeline on IMCS.

Three Mission planning files are necessary to generate a Timeline, these are:

- Enhanced Preferred Operations Schedule (EPOS)
- Attitude Parameter File (APF)
- EPOS Summary File (ESM)

The three Mission Planning files used by IMCS to generate a Timeline are delivered from FD in one tar file. This file contains 3 files with the following naming convention:

rrrr_vv.EPO
rrrr_vv.APF
rrrr_vv.ESM
(where rrrr = revolution number, vv = version number).

The tar file has the following naming convention.

EPOS_IMCMPS_D_rrrr_vv_______12345.INT
(again rrrr = revolution number, vv = version number)

This file is placed on the 'ldsa' machine, account 'iftsops', directory /home/iftsops/IFTS/0/working, and then transferred to the IMCS MPS server M/C using a dedicated script.

On the IMCS the file is placed in the **/home/imcsops/MPS/import** directory on the MPS server machine.

The file is detected automatically by the MPS server almost immediately and imported.

2.1.2.6.1.2 Constraints.

- Currently sun128 is configured as the prime MPS Server Workstation, and sun127 as the backup MPS workstation.
- Only one version of a Timeline can exist in the MPS Client task for any revolution.
- The Timeline should be generated at latest 24 hours before the start of the revolution for which it is valid.
- This FCP is valid for nominal Timeline generation only, in the event of re-planning as a result of an RPOS, see FCP_MPS_0003, Section 2.1.2.6.3.

2.1.2.6.1.3 Procedure to Generate a Timeline.

This Section should be executed by the Mission Planning Engineer during normal working hours. It must be executed at least 24 hours before the start of the revolution.

1. When a new set of Mission Planning files are received on IMCS MPS server from FD, the following 3 messages are issued if the import is successful:
   Import task starting for rev rrrr ver vv'
   Import succeeded'
   Import task ending for rev rrrr ver vv with success'
   If any of the messages are missing or different, then a problem occurred during the import.

2. MPS Client Display
   Start an MPS Client task on the MPS Workstation.
   At this point the file becomes available to the MPS client task, which displays the following information for the Timeline:

REVOL.	VERSION	IMP DATE	IMP TIME
rrrr	vv	yyyymmdd	hhmmss

   In addition the following information about the processing of the mission Planning files whilst generating the Timeline is displayed:

EPOS VAL	APF VAL	CROSS VAL	TLGENR

   Initially all these fields have the value **'TO DO'**, following execution of each step in the Timeline generation process, this changes to either 'SUCCESS' (Green background), FAIL (Red background) depending on the success or failure of each particular step.

3. Timeline Generation
   To start the Timeline generation press the **AUTO** Button on the MPS Client task, the following sequence of messages should appear (if the generation is successful):
   'Auto Generate task starting for rev rrrr ver vv'
   'TL Generate task starting for rev rrrr ver vv'
   'Cross Validate task starting for rev rrrr ver vv'
   'EPOS Validate task starting for rev rrrr ver vv'
   'APF Validate task starting for rev rrrr ver vv'
   'EPOS Validate task ending for rev rrrr ver vv with success'
   'APF Validate task ending for rev rrrr ver vv with success'
   'Cross Validate task ending for rev rrrr ver vv with success'
   'TL Generate task ending for rev rrrr ver vv with success'
   'Auto Generate task ending for rev rrrr ver vv with success'

   The **EPOS VAL, APF VAL, CROSS VAL, TLGENR** columns should now be flagged '**SUCCESS**' (Green background).
   If any problem is encountered at any stage, the automatic Timeline Generation will stop, an error message will be issued and the stage at which the Timeline generation failed will be flagged '**FAIL**' (Red background), further details can be found in the appropriate timeline generation Log files.

4. Check Timeline Generation Log Files

Details of the validation process and any warnings regarding the Timeline files or generation process can be seen in the Timeline Generation log files. In particular if the Timeline generation failed at any stage details can be seen in the Log files.

To access the log files from the MPS Client task menu bar select:

<VIEW> - <REPORT> - <EPOS VALIDATION>
<VIEW> - <REPORT> - <APF VALIDATION>
<VIEW> - <REPORT> - <CROSS VALIDATION>
<VIEW> - <REPORT> - <TIMELINE GENERATION>

Even in the event of a successful import and Timeline generation process all the Log files should be checked for warning messages regarding problems, which were not serious enough to fail timeline generation. In particular:

- If a warning message is issued about an ED overlapping a TL window, verify that the ED is in fact allowed in both windows.
- If a warning message is issued about an antenna switch ED uplinked outside coverage (before AOS at the start of the revolution), issue a note to SPACON via the Cover Sheet to execute TT antenna switch procedure before LOS of previous revolution. If desired, request Flight Dynamics to delete the antenna switch ED from the EPOS/APF and send a new version from which to regenerate the Timeline.

5. Timeline Summary File

Following successful Timeline generation a Timeline Summary file should be generated.
To create a summary timeline version of the timeline press the TIMELINE SUMMARY button.
The **AUTH TLS** column should indicate **'SUCCESS**' (Green background).
The following messages should be issued by IMCS:

'TL Summ Authorise task starting for rev rrrr with ver vv'
'TL Summ Authorise task ending for rev rrrr with ver vv with success'

At this point the generated Timeline Summary File will be sent automatically to ISDC.

6. Authorise Timeline

Before a Timeline can be loaded onto the Autostack and be executed it has to be authorised. Once the user has checked all the log files and the timeline itself, the Timeline can be authorised for use.

Authorisation means that the authorised timeline is the unique timeline for use for that particular revolution.

Note that for any revolution only one Timeline can be authorised at any one time, however a Timeline (RPOS) can be authorised when another Timeline for the same revolution is running on the ASTACK.

To authorise the timeline press the **'TIMELINE'** button.
The **TL VER** column will indicate **'*'**
In the MPS Client task any other previously authorised Timeline for the same revolution will no longer be authorised (i.e. the **'*'** will disappear from the **TL VER** column).
The following messages will be issued by IMCS:

'TL Authorise task starting for rev rrrr with ver vv'
'TL Authorise task ending for rev rrrr with ver vv with success'

At this point the Timeline has been generated and is in the directory containing all authorised Timelines on the MPS Server:

/home/imcsops/MPS/authorise/

Note that if a previous version of a timeline has been authorised, it will be available for downloading from the server and loading onto the autostack even if it has since been superseded by a later, authorised version of the timeline for the same revolution.

7. Load and Check the Timeline

Load the Timeline by following the procedure FCP_MPS_0002 Section 2.1.2.6.2.2 Step 5.
Check that the Timeline loads without any errors or warnings and scroll through to verify in

particular that the entries near the start and end of the revolution are correct (in line with EPOS). Print the autostack to a file. This file-print should be distributed by email to the distribution list for Timeline notification along with the EPOS, APF and ESM.

8. Complete the TIMELINE and ROUTINE MANUAL OPERATIONS sections of the Operational Orbit Cover Sheet (Section 2.1.2.6.1.4), as well as ECLIPSE and SPECIAL OPERATIONS sections as appropriate. Forward the Operational Orbit Cover Sheet to the SPACON.

2.1.2.6.1.4 Operational Orbit Cover Sheet

Operational Orbit: Cover Sheet			
Date		**DOY**	
Revolution		**Eclipse Season (Y/N)**	
TIMELINE			
TL Filename		TL Version	
TL Checked MP (Y/N)		TL Checked SPACON (Y/N)	
TSF Received ISOC (Y/N)		TSF Received ISDC (Y/N)	
REPOS **(If filled check (i)RPOS Log attached (ii)printed EPOS/ESM replaced by REPOS/RESM)**			
TL Filename		TL Version	
TL Switch-over Time		TL Switch-over Executed (Y/N)	
IBIS CONTEXT TABLE			
Version		Backup	
FILE CONTENTS CHECKLIST (Y)			
FCP_MPS_0002		EPOS/ESM	
FCP_MPS_0003		REPOS/RESM	
SHIFT H/O PROC.		SPI TPFs & List	
INT MOC-OPS-NOP		WIMPY	
Default SIs		Pass Spec SIs	
ROUTINE MANUAL OPERATIONS		**Required (Y/N)**	**Procedure**
AOS_CHK Window (duration = 15mins)			
Establish and Verify TC Uplink			send TC D3831
Check S/C health/OOL & reset OEM buffers			FCP_SYS_1100
Report and reset OBM Buffers (triggered by MOUT)			FCP_DHS_1235/1220
SATENG Window (duration = 40mins)			
Upload IBIS ISGRI Context Tables			FCP_IBIS1_0401 / FCP_IBIS2_0401
Routine (througout timeline)			
Update RMU Drifts (triggered by TPF after RMU_CAL)			FCP_AOC_1905
Report and reset OBM Buffers (triggered by MOUT)			FCP_DHS_1235/1220
AOCS Daily Housekeeping (triggered by MOUT)			FCP_AOC_0540
Check OEM & OBM limit violation			
Periodic visual check of OMCH Task status			
LOS_CHK Window (duration = 15mins)			
Check S/C health/OOL & reset OEM buffers			FCP_SYS_1110
Report and reset OBM Buffers (triggered by MOUT)			FCP_DHS_1235/1220
Stop Uplink			
ECLIPSE MANUAL OPERATIONS		**Required (Y/N)**	**Procedure**
IMU Pre-Eclipse Health-Check (triggered by MOUT)			FCP_AOC_0523
Verify execution of TT ED AEIOF_00 (IMU autonomous switch-off enabled) at AOS			FCP_AOC_0526
SPECIAL OPERATIONS / NOTES		**TIME**	
Manual commanding		**See Operational Requests Folder**	
Antenna Swaps			

2.1.2.6.2 FCP_MPS_0002: Load and execute Timeline

2.1.2.6.2.1 Introduction and Background Information

This procedure describes the operations to be performed by the SPACON to prepare for, load and execute a timeline for one revolution on the IMCS autostack during routine operations.

Nominal operations are executed via a pre-planned timeline covering an entire revolution, which executes from the automatic stack. In addition to the timeline, the following files are relevant to routine operations:

- The EPOS (Enhanced Preferred Observation Sequence)
- The APF (Attitude Parameter File)
- The ESM (EPOS Summary File)

The EPOS and APF are the mission planning products which are used in the generation of the timeline. EPOS, APF, ESM and Timeline have a consistent file-naming convention and within one set of these files, they all have the same revolution and version number, e.g.:

rrrr_vv.EPO: EPOS for revolution rrrr, version vv

Once the Timeline has been generated and authorised, it is transferred automatically via IFTS to the **`imscops/CMD/STACKS/`** directory on the server, thus being available for download to individual clients, to load and execute.

2.1.2.6.2.2 Preliminary Activities

The following checks should be executed by the Spacecraft Controller who will be on Shift at the start of the revolution. They should be executed at least 24 hours before the start of the shift.

1. Receive the Operational Orbit Cover Sheet from the Mission Planner indicating the revolution number, Version number and Filename of the Timeline.

2. Receive an email from the Mission Planner indicating the Revolution and Version number of the EPOS, APF and Timeline and verify that this information is consistent with the Cover Sheet.

3. Print out the EPOS/ESM and the other documents listed in the File Contents Checklist of the Cover Sheet and include them in the SPACON Folder.

4. Ensure that any procedures needed for Special Operations as indicated on the Cover Sheet are included in the SPACON folder.

5. Check that the Timeline loads onto the ASTACK correctly

   Start an ASTACK task.

   Download the Timeline file from the MPS.server and load it onto the stack:

   From the ASTACK menu bar select:
   <FILE> - <LOAD STACK / SCHEDULE>
   Enter a filter of the form:
   /home/imcsops/CMD/STACKS/*rrrr_vv*.INT
   (where rrrr = revolution number, vv = version number)

   Then press the FILTER followed by the DOWNLOAD key.

   The authorised Timeline will be Downloaded from the /home/imcsops/MPS/authorise directory on the MPS.server to the /home/imcsops/CMD/STACKs directory on all client machines, from which it can be loaded onto the ASTACK.

The Timeline file has a name of the form:

TL__rrrr_vv_yyyymmddhhmmss.INT
where:
rrrr_vv = revolution and version number as above.
yyyymmddhhmmss - date and time of generation of the Timeline.

Select the correct file and press OK.

The Timeline will be loaded onto the stack. Check and record any error messages generated on the console. If desired, print the Stack or execute further checks (time-tags execution times etc.)

Once it has been checked that the Timeline loads successfully, it may be aborted, by pressing the '**ABORT**' button on the ASTACK.

6. Indicate on the Cover Sheet that the Timeline has been loaded and checked by the SPACON.

2.1.2.6.2.3 Autostack Operations

This Section should be executed by the Spacecraft Controller on Shift at the start of the Revolution. It must be executed at least 1 hour before AOS_TM at the start of the revolution.

1. To load the Timeline in order to begin execution:
   Wait until the executing Timeline is completed, i.e. the last command or MOUT has expired.
   Load the Timeline onto the ASTACK again:
   From the ASTACK menu bar select:
   <FILE> - <LOAD STACK / SCHEDULE>
   Enter a filter of the form:
   /home/imcsops/CMD/STACKS/*rrrr_vv*.INT
   (where rrrr = revolution number, vv = version number).

   Then press the FILTER key (the file will not need to be downloaded if the previous section was executed from the same workstation as is used to execute this section of the procedure.)

   The Timeline file has a name of the form:

   TL__rrrr_vv_yyyymmddhhmmss.INT
   where:
   rrrr_vv = revolution and version number as above.
   yyyymmddhhmmss - date and time of generation of the Timeline.

   Select the correct file and press OK.

   The Timeline will be loaded onto the stack.

4. Check that:
   a. **WAIT** mode is disabled
   b. **CCCFs** are disabled
   c. All other checks should be enabled

7. Start the execution of the Timeline.
   On the ASTACK press the **START** button.
   A pop-up will appear in which the user can enter the time at which Timeline execution should start, the default is the time of the next valid entry, in the nominal case this will be the first entry, note that the time of a valid entry must be entered in this box.

The Source box on the ASTACK display will then show **DISPATCHED** on a blue background. Verify that commands and/or MOUTs start to be dispatched at their expiry time.

8. Control of Executing Timeline.
   *The following actions are possible from the **ASTACK** task:*

   To interrupt the Timeline execution, press the **STOP** Button. The Source box on the ASTACK display will then show **STOPPED** on a red background.

   To stop the Timeline execution **and** clear the stack, press the **ABORT** Button. The Source box on the ASTACK display will then show **STOPPED** on a red background and the stack will empty.

   By pressing the **SCROLL MODE** button the user can toggle between **MANUAL** and **AUTOMATIC** scrolling.

   EXPANDED / BRIEF View Modes
   3 views of the running timeline are available.
   The Timeline must be stopped to change the view mode.
   Select from:
   - **EXPANDED BRIEF** (Displays MOUT, MOUTP, TCs)
   - **EXPANDED FULL** (Displays MOUT, MOUTP, TCs, TC parameters)
   - **SUMMARY BRIEF** (Displays only EDs)

2.1.2.6.3 FCP_MPS_0003: Replanning in case of RPOS

2.1.2.6.3.1 Introduction and Background Information

This procedure is executed in case a replanning needs to be performed on a revolution for which:
- the Timeline is already executing;
- the start of the revolution is within a few hours or
- the start of the revolution is on a non-working day.

An RPOS is only processed in case of a Target Of Opportunity (TOO) or in case of a Satellite anomaly. This mechanism shall not be used in order to tune the configuration of an instrument.

Upon receipt of an alert from ISDC, ISOC generates a Replanned Preferred Observation Sequence (RPOS), which is then delivered to MOC for processing and execution. Alternatively, the RPOS may be initiated by ISOC itself.

This procedure covers the processing of the RPOS by MOC and the generation and loading of the new timeline and is performed in 4 main stages:
- Receipt of RPOS by MOC and confirmation to ISOC;
- Generation of the REPOS from RPOS using FDS;
- Validation of the REPOS and generation of the new Timeline;
- Stopping execution of the current Timeline and loading and starting the new Timeline at the specified time.

2.1.2.6.3.2 Constraints

General Mission Planning Constraints:
- Currently sun129 is configured as the prime MPS Server Workstation, and sun127 as the backup MPS workstation.
- Only one authorized version of a Timeline can exist in the MPS Client task for any revolution.
- File format and naming conventions must comply with those specified in the relevant ICD.

RPOS Specific Constraints:
- The RPOS must be received by MOC at least 8 hours before start of execution of the new Timeline.
- The first event in the new Timeline after time of divergence of timelines must be a Reaction Wheel Biasing (to prepare for the updated slew pattern).
- Satellite/instrument configurations and attitudes must match in the POS and RPOS until the time of divergence. However, the wheel profile may not necessarily be the same up to the RWB before the first slew which is divergent in the RPOS.
- Ground station handovers must be the same throughout the POS and RPOS.
- Only one RPOS may be issued by ISOC for one revolution.

If any of these constraints are not met, the RPOS may be rejected.

2.1.2.6.3.3 Receipt of RPOS

Duration: 30min – 1hr
This Section should be executed by the SPACON on shift using the IMCS and voice/email interface. Progression through these steps should be noted in real-time in the RPOS Log (Section 2.1.2.6.3.7).

1. RPOS and associated ICP are received at MOC in the wrapper file:

   RPOS_SOCFDS_DREVOLUTIONnnnn_vvvvv.INT

where nnnn indicates the revolution number and vvvvv indicates the version number. SPACON receives and acknowledges message that new RPOS wrapper file has been received and records RPOS revolution and version number in section (A) of RPOS Log.

2. SPACON verifies the following and records this in section (B) of the RPOS Log:
   - nnnn is equal to the current revolution or the current revolution + 1

3. ISOC telephones SPACON on ESOC extension 62408 and provides at least the following information:
   a. Revolution number nnnn of the RPOS
   b. Version number vvvvv of the RPOS
   c. Time at which the RPOS diverges from the current (E)POS (the latest time to start commanding using the new Timeline)

   SPACON records this in section (C) of the RPOS Log.

4. SPACON verifies the following and records this in section (D) of the RPOS Log:
   a. Revolution and version number are the same as those received (in Step 2 above)
   b. First event in the new timeline after time of divergence of timelines is a Reaction Wheel Biasing

   SPACON confirms points above during the telephone call with ISOC.

5. ISOC sends email to INTEGRAL@esa.int confirming information provided in Step 3 above. SPACON notes this in section (D) of RPOS Log.

   All further steps are tracked in 'RPOS Actions Checklist' section of RPOS Log.

6. SPACON calls on-call support for replanning.

7. SPACON informs ISDC that RPOS has been received.

In case the RPOS is to be processed outside working hours, there is a delay of up to 2 hours before progression to the next stage due to the wait time for on-call support.

2.1.2.6.3.4 Generation of REPOS

Duration: 1hr – 1.5hr
This Section should be executed by FD on call support using the FDS.

Inform ISDC that REPOS has been generated successfully or report reason for any failure.

2.1.2.6.3.5 Generation of New Timeline

Duration: 30mins – 1hr
This Section should be executed by FCT on call support using the IMPS.
This procedure is the same as that for the nominal Timeline generation using an EPOS: see FCP_MPS_0001 (Section 2.1.2.6.1), with the additional check that in the REPOS, all RWB windows have a RWB..

Note: All steps of the procedure FCP_MPS_0001 should be executed, including the authorisation of the new Timeline. This will not adversely affect the current revolution, as the timeline is already loaded and executing on the stack.

Inform ISDC that Timeline has been generated successfully or report reason for any failure. In case of successful Timeline generation, confirm receipt of TSF by ISDC.

2.1.2.6.3.6 Autostack Operations

Duration: 1hr – 1.5hr
This Section should be executed by the Spacecraft Controller on Shift.

It must be executed at least 1 hour before the start of execution of the new Timeline.

1. SPACON receives notification that a new Timeline has been generated with name:

   TL__rrrr_vv_yyyymmddhhmmss.INT

   where rrrr_vv = revolution and version number and yyyymmddhhmmss is the date and time of generation of the Timeline. SPACON verifies that rrrr=nnnn and vv=vvvv above (recorded in RPOS Log).

   If the old Timeline for this revolution is already executing, proceed with steps 2 – 11, otherwise proceed with steps 12 – 18.

2. Load the Timeline onto the ASTACK of a different workstation (logged in as SPAC_nnn) from the one currently commanding:
   a. From the ASTACK menu bar select:
      <FILE> - <LOAD STACK / SCHEDULE>
   b. Enter a filter of the form:
      /home/imcsops/CMD/STACKS/*rrrr_vv*.INT
      (where rrrr = revolution number, vv = version number)
      Then press the FILTER followed by the DOWNLOAD key.
   c. Select the correct file and press OK

   The Timeline will be loaded onto the stack.

3. Check that:
   - **WAIT** mode is disabled
   - **CCCFs** are disabled
   - All other checks are enabled

4. Print the REPOS and replanned ESM and include in SPACON file.

5. Identify a window of duration 5mins before time of divergence of Timelines when no commands will be issued on either stack. This window should be far enough in the future that at least one TPF from the FDS will have been received by the new ASTACK instance, on which the new Timeline is loaded, before the start of this window. This is to ensure that the parameters for the first slew in the new Timeline are updated before the new Timeline is executed.

6. Update the Operational Orbit Cover Sheet with the REPOS Filename, Version, the Timeline Switch-over Time and the REPOS/RESM checked in the File Contents Checklist.

7. At the start of the window identified for Timeline Switch-over, interrupt execution of current Timeline by pressing **STOP** button.

8. Start the execution of the new Timeline:
   a. On the ASTACK, press the **START** Button.
   b. A pop-up will appear in which the user can enter the time at which Timeline execution should start. (The default is the time of the next valid entry. In the nominal case this will be the first entry, note that the time of a valid entry must be entered in this box.) Enter the time at which Timeline execution should start.
   c. Verify that the source box on the ASTACK display shows **DISPATCHED** on a blue background and that commands and/or MOUTs start to be dispatched at their expiry time.

9. If the swap was immediately before the CGS prior to the divergence, manually update the CGS.

10. Once correct execution of the new Timeline has been verified, clear the previously executing Timeline by pressing the **ABORT** button. Verify that the ASTACK has cleared.

11. Inform ISDC that the new Timeline is executing.

12. Update the Operational Orbit Cover Sheet indicating that the Timeline Switchover has been executed.

13. Ask FD to patch and update the wheel profile plot.

The following steps 13-19 are only performed if execution of the old Timeline for this revolution was not started.

14. Load the Timeline onto the ASTACK of a different workstation (logged in as SPAC_nnn) from the one currently commanding:
    a. From the ASTACK menu bar select:
       <FILE> - <LOAD STACK / SCHEDULE>
    b. Enter a filter of the form:
       /home/imcsops/CMD/STACKS/*rrrr_vv*.INT
       (where rrrr = revolution number, vv = version number)
       Then press the FILTER followed by the DOWNLOAD key.
    c. Select the correct file and press OK

    The Timeline will be loaded onto the stack.

15. Check that:
    - **WAIT** mode is disabled
    - **CCCFs** are disabled
    - All other checks are enabled

16. Print the REPOS and replanned ESM and include in SPACON file.

17. Update the Operational Orbit Cover Sheet with the REPOS Filename, Version, the Timeline Switch-over Time and the REPOS/RESM checked in the File Contents Checklist.

18. Once the last command from the current revolution has been executed, start the execution of the new Timeline:
    a. On the ASTACK, press the **START** Button.
    b. A pop-up will appear in which the user can enter the time at which Timeline execution should start. (The default is the time of the next valid entry. In the nominal case this will be the first entry, note that the time of a valid entry must be entered in this box.) Enter the time at which Timeline execution should start.
    c. Verify that the source box on the ASTACK display shows **DISPATCHED** on a blue background and that commands and/or MOUTs start to be dispatched at their expiry time.

19. Inform ISDC that the new Timeline is executing.

20. Update the Operational Orbit Cover Sheet indicating that the Timeline Switchover has been executed.

2.1.2.6.3.7 RPOS Log

Operational Orbit: RPOS Log			
Date		**DOY**	
Revolution			
CURRENT TIMELINE			
TL Filename		TL Version	
RPOS Receipt and Verification			
(A) RPOS Receipt			
Time of RPOS Receipt		RPOS Filename	
RPOS Revolution		RPOS Version	
(B) RPOS Verification (Y/N)			
RPOS Revolution = Current Revolution or Current Revolution +1			
(C) RPOS Data from ISOC (via telephone call)			
Time of Call from ISOC		RPOS Filename	
RPOS Revolution		RPOS Version	
Time of Divergence of Timelines			
(D) RPOS Verification with ISOC (Y/N)			
Filename, Rev, Ver in (A) = Filename, Rev, Ver in (C)			
RWB immediately after Time of Divergence of TL			
Email from ISOC stating Filename, Rev, Ver, Divergence Time as in (C)			
RPOS Actions Checklist			
Action		**Actionnee**	**Executed (Time)**
Call on-call support for replanning		SPACON	
Inform ISDC that RPOS received & rev/version verified		SPACON	
Arrival of on-call support		SOE(MP) / FD	
Generation of REPOS		SOE(MP) / FD	
Inform ISDC that REPOS generated		SOE(MP) / FD	
Generation of new Timeline		SOE(MP)	
Load and Check new Timeline		SOE(MP)	
Confirm receipt of new TSF by ISDC		SOE(MP)	
Receive notification of new Timeline		SPACON	
Load and Check new Timeline		SPACON	
Print REPOS and RESM		SPACON	
Timeline Switch-over window identified		SPACON/SOE	
Update Operational Orbit Cover Sheet		SPACON/SOE	
Execute Timeline Switch-over		SPACON	
Inform ISDC that new Timeline executing		SPACON	
Update Operational Orbit Cover Sheet		SPACON/SOE	
SPECIAL NOTES			
APPROVAL	**Signature**		**Date**
SOM			

EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
FLIGHT OPERATIONS PLAN

Volume 2
Mission Support Procedures

Book 2
On-Board S/W Maintenance

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CHANGE RECORD SHEET

DATE	ISSUE / REV. NO.	PAGE / PARA AFFECTED	DESCRIPTION	APPROVAL AUTHORITY
27/11/98	Draft / 0	All		
21/12/01	1 / 0	All	Version for Review & Approval	
11/06/02	1 / 1	All	Introduction of OBMS procedures	
11/09/02	1 / 2	All	Update of OBSMS procedures	SOM *M. Schmidt*
21/02/03	2 / 0	All	General clean-up post Launch All blank pages at the end of a procedure are intentional.	SOM M. Schmidt
02/12/03	2.1	Procedures updated:	OBS_OBSM_0040 OBS_OBSM_0070 OBS_OBSM_0170 OBS_OBSM_0270	SOM M. Schmidt

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2 Vol. 2: Mission Support Procedures

2.2 Book 2: On-Board S/W Maintenance

2.2.1 OBSM Tools

OBS_OBSM_0040 OBSM: Logging on to and starting the OBSMS. Issue: 1.1 Fri 12 Sep 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to indicate how to log on to the IOBSMS, and start the system.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on.			
		If logging on to the machine directly go to step 2.2, if from a PC continue with step 2.			
2		Open a login window to the IOBSMS machine			
2.1		Via the Start button in the bottom left of the screen, steer through Programs, and select iobsms-cde.			This will open the login screen to the IOBSMS machine.
2.2		Log-in using your allocated user name and password.			
		Starting the On-Board Software Maintenance System.			
3		Type obsms at the command line.			
3.1		From the panel created, select the unit of interest.			2 Screens will be started permitting the obs to be run using the symbolic debugger.
4		**END**			
4		END OF PROCEDURE			

OBS_OBSM_0050 OBSM: Generate a new ACC S/W version. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a new version of the ACC OBS, and compile and link such S/W.			
1.1		**REQUIRED INPUT/INTERFACES** An existing version of the ACC S/W should exist as a template.			
		Create a new version.			
2		From the desired user area, create a new directory			mkdir NEW_ACC cd NEW_ACC mkdir IF-3_2
2.1		Go to the 'root' of the reference S/W, and copy over entire tree			cd /opt_local/svf/OUROBS/acc/IF-3_2/. cp -R * /home/mwalker/NEW_ACC/IF-3_2
		Modifying the Build Procedure.			
3		Move to the directory where the build script is located.			cd /home/mwalker/NEW_ACC/IF-3_2
3.1		Edit the build procedure.			vi BuildM3 change WORK_DIR from (for example) /opt_local/svf/OUROBS/acc/IF-3_2 to /home/mwalker/NEW_ACC/IF-3_2
4		Build new software version.			

Step	Time	Event Description	TC	TM	Comments
4.1		Set up the environment.			obsms_env
4.2		Build the newly created version.			BuildM3 All the software copied over from the previous version, plus any modifications will now be compiled and linked within the user area. The final linked version is held in /home mwalker/NEW_ACC/IF-3_2/ REL/IF-3_2.ldm
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0060 OBSM: Executing ACC tests. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the ACC OBS using the OBSMS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on.			
		Starting the On-Board Software Maintenance System.			
2		Create the test directories.			
2.1		From the desired location create a directory tree.			mkdir TESTS/acc/IPS_01r/configuration
2.2		Copy in desired files			cp /opt_local/svf/TESTS/acc/reference_tests/IPS_01r/user.svf, envsim.sil into /home mwalker/TESTS/acc/IPS_01r/. and the files IMU.sil, SC.sil and acc_scenario.sil held in the configuration sub directory into the local configuration sub directory as well.
3		Set up the environment.			
3.1		Set up the general environment.			obsms_env
3.2		Set up the specific environment.			setenv ACC_OBS /home/mwalker/NEW_ACC/IF-3_2 setenv ACC_OBS_LDM ${ACC_OBS}/REL/IF-3_2
3.3		Reset the SHAM			vmereset
4		Run the Test.			

Step	Time	Event Description	TC	TM	Comments
4.1		Move to the location where the user.svf file is held (if necessary).			cd /home/mwalker/TESTS/acc IPS_01r
4.2		Select the ACC TLD system			set_acc
4.3		Run the test.			svf_batch -f $FW_ACC
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0070 OBSM: Generate a .INT file for the ACC OBS. Issue: 1.1 Fri 12 Sep 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a .INT file from a load module (.ldm) for the ACC OBS.			
1.1		**REQUIRED INPUT/INTERFACES** A new version of the ACC OBS should exist in the form of a load module.			
		Start the conversion tool.			
2		Login to the iobsms machine.			
2.1		Go to the location of the desired ldm file.			cd my_directory/etc.
2.2		Start the Tool			$OBSM_TOOLS/ ldm2icdS2K0 filename.ldm SIMG_P_ACC_0640_02560_ F_V_rrr_sss_t.INT 0640 02560 release_name info_text > SIMS_P_ACC_0640_02560_F _V_rrr_sss_t.INT where rrr_sss_t represents the version name, release_name and info_text are 2 strings describ- ing the release generated. The .INT file will be place in the file: SIMG_P_ACC_0640_02560_ F_V_rrr_sss_t.INT
6		**END**			
6		END OF PROCEDURE			

OBS_OBSM_0150 OBSM: Generate a new STR S/W version. Issue: 1.0 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a new version of the STR OBS, and compile and link such S/W.			
1.1		**REQUIRED INPUT/INTERFACES** An existing version of the STR S/W should exist as a template.			
		Create a new version.			
2		From the desired user area, create a new directory			mkdir NEW_STR/INT5_1.5
2.1		Go to the 'root' of the reference S/W, and copy over entire tree			cd /opt_local/svf/OUROBS/str INT5_1.5 cp -R *.* /home/mwalker/ NEW_STR/INT5_1.5/.
		Modifying the Build Procedure.			
3		Move to the directory where the build script is located.			cd /home/mwalker/ NEW_STR/INT5_1.5/ compile_and_link
3.1		Edit the build procedure held in /home/mwalker/ NEW_STR/INT5_1.5/compile_and_link.			vi Compile_All change WORK_DIR from (for example) /opt_local/svf/OUROBS/str/ INT5_1.5 to /home/mwalker/NEW_STR/ INT5_1.5
4		Build new software version.			
4.1		Set up the environment			obsms_env

Step	Time	Event Description	TC	TM	Comments
4.2		Build the newly created version.			Compile_All LinkProm All the software copied over from the previous version, plus any modifications will now be compiled and linked within the user area. The final linked version is held in /home mwalker/NEW_STR/ INT5_1.5/OUTPUT/ MainProm.ldm
5		**END**			
5		END OF PROCEDURE			

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the STR OBS using the OBSMS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on.			
		Starting the On-Board Software Maintenance System.			
2		Create the test directories.			
2.1		From the desired location create a directory tree.			mkdir TESTS/str/large_object
2.2		Copy in desired files			cd /home/mwalker/TESTS/str/ large_object cp -R /opt_local/svf/TESTS/ str/reference_test/large_object/ * .
3		Set up the environment.			
3.1		Set up the general environment.			obsms_env
3.2		Set up the specific environment.			setenv STR_OBS /home/ mwalker/NEW_STR/ INT5_1.5
3.3		Reset the SHAM			vmereset
4		Run the Test.			
4.1		Move to the location where the user.svf file is held (if necessary).			cd NEW_STR/TESTS/str/ large_object
4.2		Run the test.			svf_batch -f $FW_STR
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0170 OBSM: Generate a .INT file for the STR OBS. Issue: 1.1 Fri 12 Sep 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a .INT file from a load module (.ldm) for the STR OBS.			
1.1		**REQUIRED INPUT/INTERFACES** A new version of the STR OBS should exist in the form of a load module.			
		Start the conversion tool.			
2		Login to the iobsms machine.			
2.1		Go to the location of the desired ldm file.			cd my_directory/etc.
2.2		Start the Tool			$OBSM_TOOLS/ ldm2icdS2K0 filename.ldm SIMG_P_STR_0640_18432_ _V_rrr_sss_t.INT 0640 18432 release_name info_text > SIMS_P_STR_0640_18432_ _V_rrr_sss_t.INT where rrr_sss_t represents the version name, release_name and info_text are 2 strings describ-ing the release generated. The .INT file will be place in the file: SIMG_P_STR_0640_18432_ _V_rrr_sss_t.INT
6		**END**			
6		END OF PROCEDURE			

OBS_OBSM_0250 OBSM: Generate a new CDMU S/W version. Issue: 1.0 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a new version of the CDMU OBS, and compile and link such S/W.			
1.1		**REQUIRED INPUT/INTERFACES** An existing version of the CDMU S/W should exist as a template.			
		Create a new version.			
2		From the desired user area, create a new directory			mkdir NEW_CDMU
2.1		Go to the 'root' of the reference S/W, and copy over entire tree			cd /opt_local/svf/OUROBS/cdmu/ver_f cp -R * /home/mwalker/NEW_CDMU/ver_f/.
		Build new software version.			
3		Set up the environment.			obsms_env

Step	Time	Event Description	TC	TM	Comments
3.1		Build the newly created version.			Execute the instructions in the readme.txt file held under ver_f/integral, replacing the first setenv by: setenv XMM /home/mwalker/NEW_CDMU/ver_f/integral All the software copied over from the previous version, plus any modifications will now be compiled and linked within the user area. The final linked version is held in /home/mwalker/NEW_CDMU/ver_f/integral/lib/integral_main.ldm
4		**END**			
4		END OF PROCEDURE			

OBS_OBSM_0260 OBSM: Executing CDMU tests. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the CDMU OBS using the OBSMS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on.			
		Starting the On-Board Software Maintenance System.			
2		Create the test directories.			
2.1		From the desired location create a directory tree.			mkdir /home/mwalker/TESTS cdmu/ISVV/test02 mkdir /home/mwalker/TESTS cdmu/utils/ICUTM

Step	Time	Event Description	TC	TM	Comments
2.2		Copy in desired files			cd /home/mwalker/TESTS/cdmu/ISVV/test02 cp -R /opt_local/svf/TESTS/cdmu/ISVV/ISVV-CDMU-TP2/* . cd ../../utils cp /opt_local/svf/TESTS/cdmu/utils/InitVerC.svf . cp /opt_local/svf/TESTS/cdmu/utils/loadCDMU.svf . cd ICUTM cp /opt_local/svf/TESTS/cdmu/utils/ICUTM/acctm.sil . cp /home/mwalker/runtestCDMU runtest
2.3		Rename test scripts and modify them			Rename test scripts .svf and .sil to user.svf and envsim.sil, the modifications should look like those carried out to the test case ISVV-CDMU-TP-1
3		Set up the environment.			
3.1		Set up the general environment.			obsms_env
3.2		Reset the SHAM			vmereset
4		Run the Test.			
4.1		Move to the location where the user.svf file is held (if necessary).			cd /home/mwalker/TESTS/cdmu/test02
4.2		Run the test.			source runtest
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0270 OBSM: Generate a .INT file for the CDMU. Issue: 1.1 Fri 12 Sep 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a .INT file from a load module (.ldm) for the CDMU.			
1.1		**REQUIRED INPUT/INTERFACES** A new version of the CDMU OBS should exist in the form of a load module.			
		Start the conversion tool.			
3		Login to the iobsms machine.			
2.2		Go to the location of the desired ldm file.			cd my_directory/etc.
2.3		Start the Tool			$OBSM_TOOLS/ ldm2icdS2K0 filename.ldm SIMG_P_CDM_0129_00000_ F_V_rrr_sss_t.INT 0129 00000 release_name info_text > SIMS_P_CDM_0129_00000_ F_V_rrr_sss_t.INT where rrr_sss_t represents the version name, release_name and info_text are 2 strings describ- ing the release generated. The .INT file will be place in the file: SIMG_P_CDM_0129_00000_ F_V_rrr_sss_t.INT
6		**END**			
6		END OF PROCEDURE			

OBS_OBSM_0350 OBSM: Generate a new DPE CSSW version. Issue: 1.0 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to generate a new version of the DPE CSSW, and compile and link such S/W.			
1.1		**REQUIRED INPUT/INTERFACES** An existing version of the DPE CSSW should exist as a template.			
		Create a new version.			
2		From the desired user area, create a new directory			mkdir NEW_DPE
2.1		Go to the 'root' of the reference S/W, and copy over the tar file.			cd /opt_local/svf/OUROBS/ dpe/CSSW/CSSW1_9b cp CSSW_V1_9b.tar /home/ mwalker/NEW_DPE/.
2.2		Untar this file.			tar -xvf CSSW_V1_98.tar
		Compile the CSSW source code			
3		Set up the environment.			obsms_env
3.1		Build the newly created version. It should be noted that the command is successful even when the last line says: Fatal error:Command failed for target 'deplibs'			makeCSSW
		Link the CSSW with a dummy IASW.			
4		Copy over the Dummy IASW software			
4.1		Copy over the Dummy IASW software			cp /opt_local/svf/OUROBS/ dpe/CSSW/CSSW1_9b/code/ DummyIASW_v1.4.tar /home mwalker/NEW_DPE/code/.
4.2		Untar this file			tar -xvf DummyIASW_v1.4.tar

Step	Time	Event Description	TC	TM	Comments
4.3		Go into the directory DummyIASW_v1.4 and Edit the makefile and comment out the 2 lines: # $(CODE)/DPESW/main.ldm \ # $(CODE)/IASW/1750/dpe_iasw.obj \			cd DummyIASW_v1.4 vi makefile
4.4		go back to the NEW_DPE directory and vuild the dummy dpe software. The ldm file containing the CSSW software together with a dummy IASW file will be held in ./code/DummyIASW_v1.4/main.ldm			cd ../ makeDUMMY
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0360 OBSM: Executing DPE tests. Issue: 1.0 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the DPE OBS using the OBSMS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on.			
		Starting the On-Board Software Maintenance System.			
2		Create the test directories.			
2.1		From the desired location create a directory tree.			mkdir NEW_DPE/TESTS/ LOAD
2.2		Copy in desired files			cd /home/mwalker/ NEW_DPE/TESTS cp -R /opt_local/svf/TESTS/ dpe/CSSW/SYSTEM/SVF-DPE-TP-07/dpe_tp_07.svf user.svf cp /opt_local/svf/TESTS/dpe/ CSSW/SYSTEM/SVF-DPE-TP-07/dpe_tp_07.sil envsim.si cp /opt_local/svf/TESTS/dpe/ utils/InitDPE.svf InitDPE.svf cp /home/mwalker/runtestDPE runtest

Step	Time	Event Description	TC	TM	Comments
2.3		Rename test scripts and modify them			Rename test scripts .svf and .si to user.svf and envsim.sil, the modifications should look like those carried out to the test case SVF-DPE-TP-07
3		Set up the environment.			
3.1		Set up the general environment.			obsms_env
3.2		Reset the SHAM			vmereset
4		Run the Test.			
4.1		Move to the location where the user.svf file is held (if necessary).			cd NEW_DPE/TESTS
4.2		Run the test.			source runtest
4.3		Inspect results.			Results are held in file dpe_tp_07_log and user.out
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0361 OBSM: Executing OMC DPE tests using INTIUS. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the OMC DPE OBS using INTIUS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on as OMC, password OMC01			
2		Install new S/W if required.			
2.1		If it is not required to test a new version of the S/W goto step 3			
2.2		Create new directory			cd /opt_local/svf/OUROBS/dpe/IASW/omc mkdir code2/DPESW
2.3		Copy the new load module from local area ./code/DummyIASW_v1.4/main.ldm to new directory.			cp /home/mwalker/NEW_DPE/code/DummyIASW_v1.4/main.ldm /opt_local/svf/OUROBS/dpe/IASW/omc/code/DPESW/main.ldm
2.4		Modify test script held in file /opt_local/svf/svf/scripts/my_load.omc.svf.			Change line from load $DPE_IASW/code/DPESW/main.ldm to load $DPE_SW/code2/DPESW/main.ldm
3		Execute test			
3.1		Move to the bin directory			cd bin
3.2		If it desired to run in batch mode goto step 3.5			
3.3		Run Test			omc test01

Step	Time	Event Description	TC	TM	Comments
3.3.1		An example of how to run interactive tests.			From the terminal session, enter #include ../start then enter ”resume” on the Envsim window Now normal svf commands like sendtc.... or run 64 or quit can be entered.
3.4		Goto step 3.6			
3.5		Run Test			omc_batch test01
3.6		Observe execution			Enjoy pretty graphics
3.7		Inspect results			The results are put in directory /home/omc/tests/test01, inspec the log file.
4		Reset the Sham ready for next test.			vmereset
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0362 OBSM: Executing IBIS DPE tests using INTIUS. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the IBIS DPE OBS using INTIUS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on as IBIS, password IBIS01			
2		Install new S/W if required.			
2.1		If it is not required to test a new version of the S/W goto step 3			
2.2		Create new directory			cd /opt_local/svf/OUROBS/dpe/IASW/ibis mkdir code2/DPESW
2.3		Copy the new load module from local area ./code/DummyIASW_v1.4/main.ldm to new directory.			cp /home/mwalker/NEW_DPE/code/DummyIASW_v1.4/main.ldm /opt_local/svf/OUROBS/dpe/IASW/ibis/code/DPESW/main.ldm
2.4		Modify test script held in file /opt_local/svf/svf/scripts/my_load.ibis.svf.			Change line from load $DPE_IASW/code/DPESW/main.ldm to load $DPE_SW/code2/DPESW/main.ldm
3		Execute test			
3.1		Move to the bin directory			cd bin
3.2		If it desired to run in batch mode goto step 3.5			
3.3		Run Test			ibis test01

Step	Time	Event Description	TC	TM	Comments
3.3.1		An example of how to run interactive tests.			From the terminal session, enter #include ../start then enter ”resume” on the Envsim window Now normal svf commands like sendtc.... or run 64 or quit can be entered.
3.4		Goto step 3.6			
3.5		Run Test			ibis_batch test01
3.6		Observe execution			Enjoy pretty graphics
3.7		Inspect results			The results are put in directory /home/ibis/tests/test01, inspect the log file.
4		Reset the Sham ready for next test.			vmereset
5		**END**			
5		END OF PROCEDURE			

OBS_OBSM_0363 OBSM: Executing JEMX DPE tests using INTIUS. Issue: 1.1 Fri 28 Feb 2003 Author: M. Walker

Step	Time	Event Description	TC	TM	Comments
1		Header			
1		**PURPOSE** Procedure to execute tests of the JEMX DPE OBS using INTIUS.			
1.1		**REQUIREMENTS** The IOBSMS machine should be physically switched on, and the user logged on as JEMX, password JEMX01			
2		Install new S/W if required.			
2.1		If it is not required to test a new version of the S/W goto step 3			
2.2		Create new directory			cd /opt_local/svf/OUROBS/dpe/IASW/jemx mkdir code2/DPESW
2.3		Copy the new load module from local area ./code/DummyIASW_v1.4/main.ldm to new directory.			cp /home/mwalker/NEW_DPE/code/DummyIASW_v1.4/main.ldm /opt_local/svf/OUROBS/dpe/IASW/jemx/code/DPESW/main.ldm
2.4		Modify test script held in file /opt_local/svf/svf/scripts/my_load.jemx.svf.			Change line from load $DPE_IASW/code/DPESW/main.ldm to load $DPE_SW/code2/DPESW/main.ldm
3		Execute test			
3.1		Move to the bin directory			cd bin
3.2		If it desired to run in batch mode goto step 3.5			
3.3		Run Test			jemx test01

Step	Time	Event Description	TC	TM	Comments
3.3.1		An example of how to run interactive tests.			From the terminal session, enter #include ../start then enter ”resume” on the Envsim window Now normal svf commands like sendtc.... or run 64 or quit can be entered.
3.4		Goto step 3.6			
3.5		Run Test			jemx_batch test01
3.6		Observe execution			Enjoy pretty graphics
3.7		Inspect results			The results are put in directory /home/jemx/tests/test01, inspect the log file.
4		Reset the Sham ready for next test.			vmereset
5		**END**			
5		END OF PROCEDURE			

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INTEGRAL
FLIGHT OPERATIONS PLAN

Volume 2
Mission Support Procedures

Book 3
Flight Dynamics

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21/02/03	2 / 0	All	General clean-up post Launch	SOM *M. Schmidt*

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2 Vol. 2: Mission Support Procedures

2.3 Book 3: Flight Dynamics

This book is replaced by other documentation.

The mission planning procedures are described in book 1 of Vol 2.

The Users Manual of the recovery tool provides the procedures that are relevant to the Flight Control Team.

The procedures to operate the FD S/W are provided in the FDS Users Manual.

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21/02/03	2 / 0	All	General clean-up post Launch	SOM *M. Schmidt*

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2 Vol. 2: Mission Support Procedures

2.4 Book 4: Ground System Procedures

This book is replaced by the IMCS and FDS User Manuals.

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Volume 2
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Book 5
OGS Maintenance

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21/12/01	1 / 0	All	Version for Review & Control	
21/02/03	2 / 0	All	General clean-up post Launch	SOM *M. Schmidt*

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2 Vol. 2: Mission Support Procedures

2.5 Book 5: OGS Maintenance

This book provides some high level information concerning the maintenance of the OGS facilities during the Mission Operations Phase.

The maintenance of the various facilities is performed in principle under the responsibility of the relevant ESOC division. A responsible will be nominated for each item. This person is to ensure that the proper maintenance contracts will be in place. These can be mission specific contracts, e.g. for the INTEGRAL Mission Control System, or generic contracts if general infrastructure is concerned, e.g. Computer H/W. Changes, which could impact the mission activities, are only implemented after approval by the SOM.

A QA Manager will be nominated, who is to ensure that the system is properly set-up and that the relevant procedures are followed.

Further information concerning the generic ESOC procedures are provided in the ESOC QMS Manuals.

2.5.1 MOC

The MOC comprises the following items:

- IMCS (incl MPS);
- IOS;
- FDS;
- OBSMS;
- Infrastructure, such as communications, Computer H/W, etc..

IMCS

A special maintenance contract has been set-up. The responsible for this is the nominated Technical Officer of TOS-GC. This contract is to ensure that anomalies are cured and necessary upgrades can be implemented within a reasonable amount of time.

Anomalies will be recorded and tracked using the INTEGRAL Anomaly Recording and Tracking System (ARTS). The QA Manager will support the recording and tracking of the anomalies.
The SOM and the Technical Officer will meet regularly to discuss the anomalies and the required upgrades to assign priorities to them.
The Technical Officer is to ensure that the modifications are correctly implemented. He is to perform some acceptance testing before the system is handed over to the operations team.
The implementation of the system modification will be coordinated between the SOM and the Technical Officer. In case of major system upgrades, the modification is first loaded on the redundant chain. This is to allow the FCT to perform a verification of the modification before the upgrade is operationally used. If this check is successful, the anomaly can be considered as closed and the modification is made applicable to the operational system.

Changes within the Mission Planning functions (MPS) may affect the FDS and / or ISOC mission planning software. Consequently, coordination between the responsible MOC (SOM), FD Manager and ISOC Manager is required.

IOS

The IOS is handled in a similar way as the IMCS. The responsible Technical Officer for the IOS will be from TOS-GMS.

FDS

TOS-GF is in charge of the FDS. An INTEGRAL FD Manager has been nominated, who is to ensure the proper maintenance of the FDS. He is to coordinate updates of the FDS with the SOM.

The FDS is split into several elements. The main part is operated by the Flight Dynamics Team. This part is solely under control of the FD Team. In addition, TOS-GF has delivered some operational tools to the FCT. The FCT will generate anomaly reports (if necessary) and might ask for improvements of the system. Potential modifications will be discussed with the FD Manager. After agreeing on the necessary updates TOS-GF is in charge to implement the relevant modifications.

OBSMS

The OBSMS is a tool, which has been provided by the Project to the MOC.

After the Commissioning Phase the MOC has taken over the responsibility for the OBSM activities including the operations of the OBSMS.

The FCT will operate the OBSMS and will perform the basic set-up and maintenance of the system. However in case of significant problems the MOC may ask for support from the satellite / OBSMS manufacturer.

Infrastructure

The infrastructure will be maintained under the general ESOC maintenance contracts. This includes for example the maintenance of the computer H/W or of the communications network. The SOM will coordinate the necessary activities with the relevant ESOC support team.

2.5.2 Stations

It is necessary to differentiate between the ESA stations and Goldstone, which is under control of JPL.

2.5.2.1 ESA Stations

The stations are part of the general ESA infrastructure. Hence the maintenance of the ESA stations is done under the general maintenance contract, which is under the responsibility of TOS-GS. Necessary updates of the stations that might impact the INTEGRAL mission will be coordinated with the SOM.

Preventive maintenance activities are in general planned as per ESTRACK Operations Manual (EOM) a long time in advance. This allows to consider potential station outages for the mission schedule. Corrective maintenance is performed as required, but will have to be coordinated between the station and MOC teams (SOM).

2.5.2.2 Goldstone

The situation is different for Goldstone. The responsibility for the maintenance of the station is solely with JPL. The station downtimes due to preventive maintenance activities (8 hours / week / fixed day and during daylight time) will be identified in the JPL schedule several months in advance. This will allow to identify and to schedule an alternative antenna (if available). Corrective maintenance will have to be performed, as required. Non-availability of the station due to corrective maintenance can not be considered in the mission schedule. Impact and recovery (switch over to a back-up antenna) will be coordinated between the JPL representative and the SOM.

Though the upgrade of Goldstone is solely under the responsibility of JPL it is expected that INTEGRAL is informed about station modifications that might impact the services. These activities will be coordinated between the JPL representative and the SOM.

2.5.3 Communications

The communications comprise the OGS communications, i.e. the communications between MOC and the Ground Stations and the communications between MOC and SGS.

The OGS communications include:

- MOC – ESA stations : OPSNET
- MOC – Goldstone : OPSNET and NISN (under NASA responsibility)
  B/U : ISDN dial-up (ESA responsibility)
- MOC internal communications : OPSNET.

The MOC – SGS communications consist basically of links between MOC – ISOC (ESACOM, the ESA Intranet) and MOC – ISDC (Frame Relay services, backed up by ISDN dial-up). This communications infrastructure will also be used for the ISOC – ISDC communications.

The responsibility for the Operational Network (excluding the NASA provided communications circuits [NISN]) is with TOS-ON. This includes the maintenance of the network.

Modifications that could impact the mission operations are to be coordinated with the SOM.
Modifications that concern also the SGS are to be coordinated with the SGS representatives.
Modifications that concern the I/F to JPL / Goldstone are to be coordinated with NASA/JPL.

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21/02/03	2 / 0	ALL	• General clean-up post launch	SOM M. Schmidt
--/--/04	3 / 0	2.6.1 / 2.6.2	• Enhancement of the procedure: “Consolidation of the Archive Procedure • Introduction of: “IMCS Procedures” • Introduction of: “Operational log-book Managing Instruction.	
12/09/06	4 / 0	2.6.*	• Procedure update	M.Schmidt
24/11/06	4.1 / 0	2.6.*	• Procedure update	M.Schmidt
05/12/06	4.2 / 0	2.6.*	• Procedure update	M.Schmidt
13/03/07	4.3 / 0	2.6.*	• Procedure update	M.Schmidt
26/06/07	4.4 / 0	2.6.*	• Procedure update	M.Schmidt
20/11/07	4.5 / 0	2.6.*	• Procedure update	M.Schmidt
07/04/08	2.5 / 0	2.6.*	• Total document update to be synchronized with the new SCOS 3.1 release (RAPID)	M.Schmidt
29/10/09	2.6 / 0	2.6.*	• Included version numbering for IMCS procedures • Updated Workstation configuration procedure to disable SSC checking for report packets • Changed naming conventions for DB & CD files	R. Southworth
06/12/10	2.7	2.6.*	• CRP_MCS_0001 - include ISDC phone no • CRP_MCS_0001 - include ISDC phone no • CRP_MCS_0003 – del references to SEIS • CRP_MCS_0004 - include ISDC phone no • CRP_MCS_0004 – del references to SEIS • FCP_CDW_0005 - (new) Restarting CD production • FCP_GAP_0001 - new gap report tool • FCP_GAP_0002 - new gap report tool • FCP_MCS_0003 - change reference to "TM/TC Spacon config procedure" • FCP_MCS_0004 - include TM/TC SPACON settings • FCP_MCS_0010 - include ISDC phone no • FCP_MCS_0011 - include ISDC phone no • FCP_ODB_0009 - (new) Transfer IODB to LCTF	R. Southworth

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2 Vol. 2: Mission Support Procedure

2.6 Book 6: Operational Ground Procedure

This book includes some high level operational procedures to be followed by the operational teams. The detailed procedures are included in the instructions provided to the SPACONs. They are under configuration control to ensure that the SPACONs are aware of the applicable instructions.

2.6.1 IMCS Overview

The following paragraph is a description of the INTEGRAL Mission Control System, of the machines composing it and of the applications running on these machines.

2.6.1.1 IMCS

The following picture describes the IMCS context.

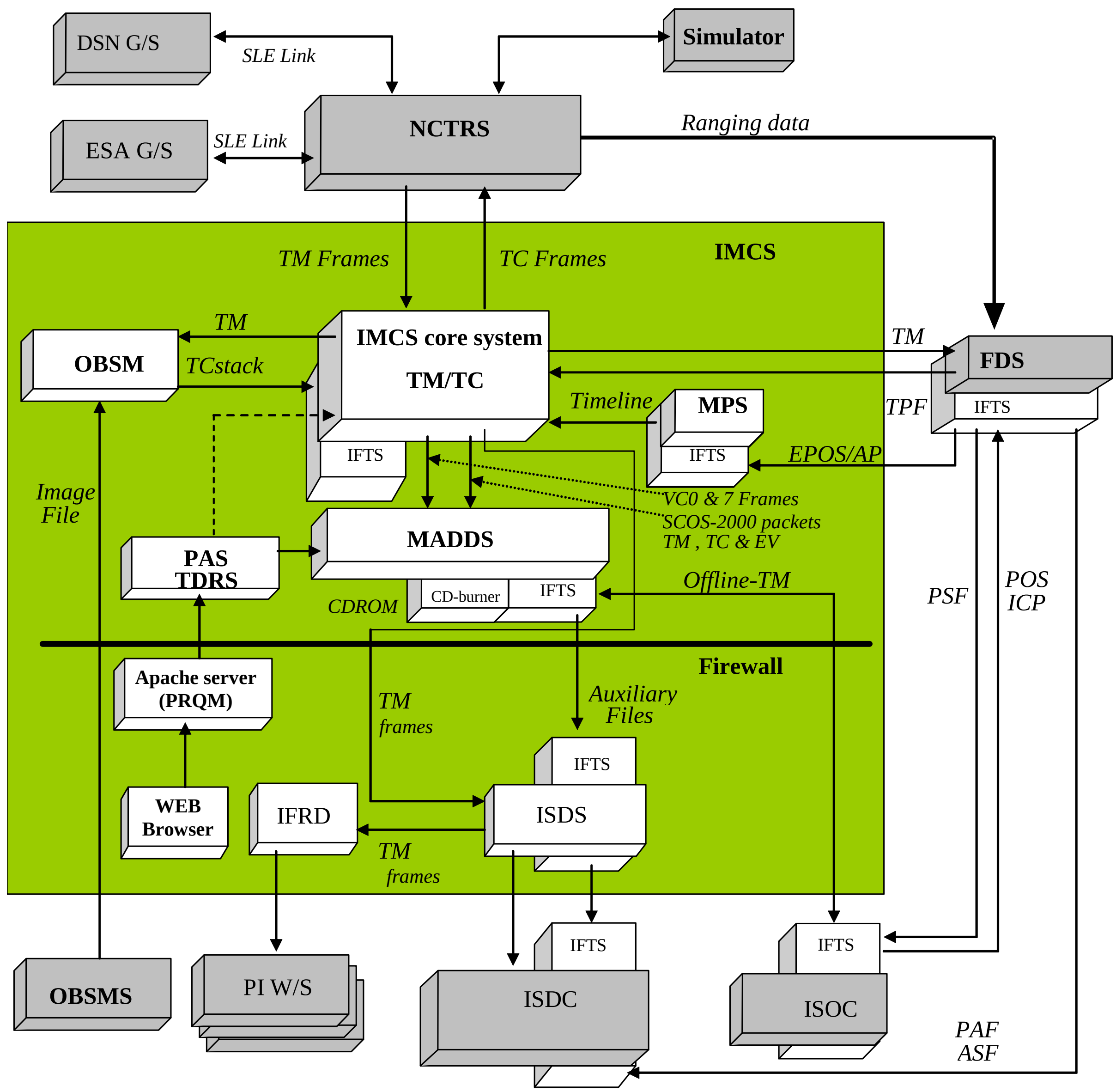


Figure 1 - Integral MCS System Context

The Integral system (IMCS) currently in use is based on SCOS2000 Evolution Release 3.0 (On 18/01/08) plus a set of patches and SCRs

A number of mission specific changes to the functionality provided by SCOS 2000 were performed to adapt it to the requirements of the Integral MCS.
For the same reason, several new subsystems were developed and/or integrated to cover functionalities required by the IMCS not present at the time in that version of the SCOS 2000 kernel.
The IMCS component subsystems are:

- Telemetry Sub-System (TMS)
- Telecommand Sub-system (TCS)
- Mission Planning Sub-system (MPS)
- On-Board Software Maintenance Sub-system (OBSM)
- IMCS Data Distribution Sub-system (MADDS)
- File Transfer Sub-system (IFTS)
- TDRS

2.6.1.2 Telemetry and Monitoring Sub-System

The Integral Telemetry System (TMS) is a set of real-time components with the purpose of providing functionality dedicated to the reception and the processing of the telemetry coming from the spacecraft (through the ground station interface), allowing to perform the required on-ground monitoring of the on-board subsystems parameters.
The figure below provides a representation of the TMS components.
In the figure below three categories of subsystems are identified:

- SCOS2000 generic components used by the Integral mission without any modification.
- SCOS2000 components modified to match the requirements of the Integral mission
- Integral specific components completely developed for the Integral mission.

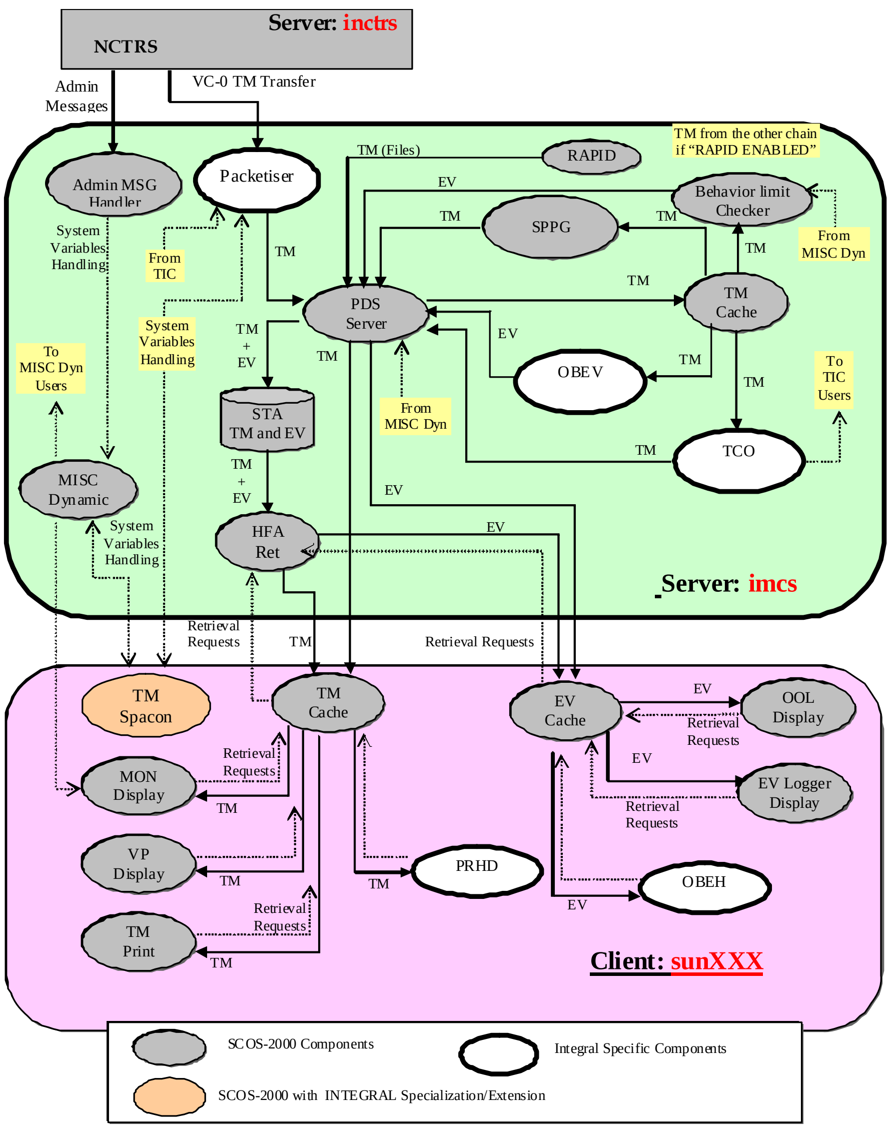


Figure 2 -TMS subsystem

2.6.1.3 Telecommand Sub-system

The Integral TCS is an extension of the SCOS2000 TC System to be able to support the Integral specific requirements. The SCOS2000 commanding System provides a generic commanding facility to allow the user to control the spacecraft.
The figure below provides a representation of the TCS components.
Three categories of subsystems are identified:

- SCOS2000 generic components used by the Integral mission without any modification.
- SCOS2000 components modified to match the requirements of the Integral mission
- Integral specific components completely developed for the Integral mission.

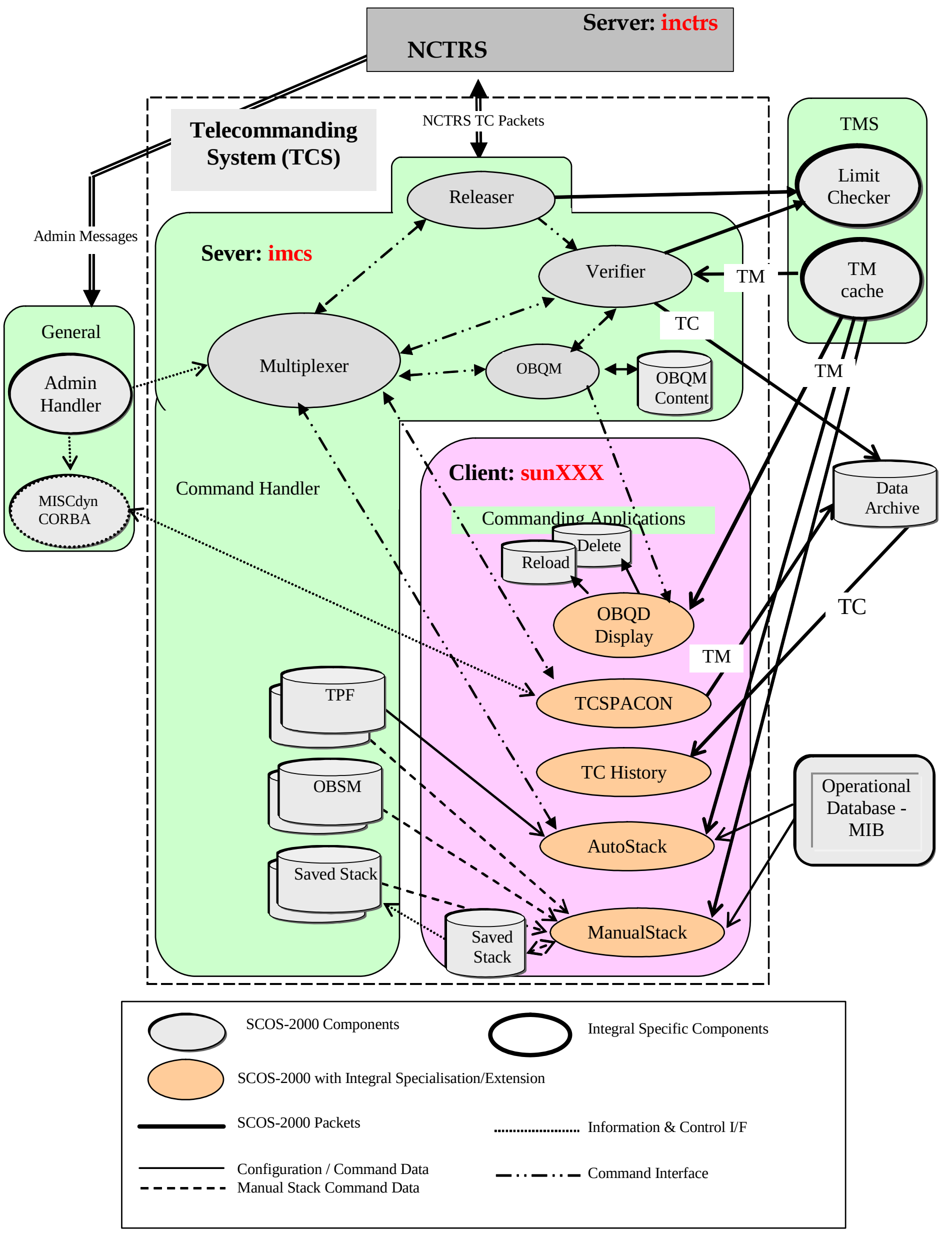


Figure 3 - TCS subsystem

2.6.1.4 Mission Planning Sub-system

The Integral Mission Planning System (MPS) provides functions and capabilities covering the following major areas:

- Operations On File Sets
  - Validating a File Set
  - Timeline Generation
  - Authorising Timeline and Timeline Summary Files
- Viewing Reports/Files
- Filtering File Sets
- Purging File Sets

The Integral MPS is an Integral specific component completely developed for the Integral mission.

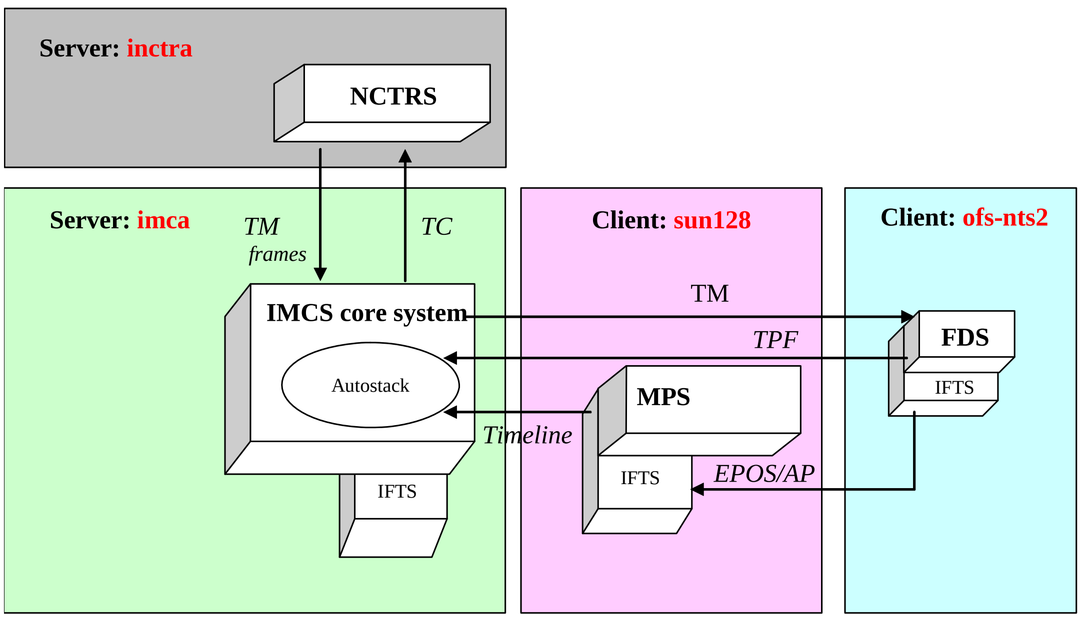


Figure 4 - MPS sub-system

2.6.1.5 On-Board Software Management Sub-system

The On-Board Software Manger is an S2K system to provide the facilities to manage the spacecraft Memory Image. With this subsystem, it is possible to:

- Import and export Memory Images from/to files;
- Compare two archived Memory Images;
- Compare a memory image against a telemetry memory dump;
- Load memory images on spacecraft;
- Edit and modify Memory Images;
- Associate a Configuration Map or a Symbol Map (Memory Models) to a Memory Image when comparing/processing it;
- Import and export Memory Models from/to files;
- Print memory images into an ASCII file and/or to a printer;
- Print memory models into an ASCII file and/or to a printer.

The Integral OBSM is the SCOS2000 OBSM component modified to match the requirements of the Integral mission.

The Integral Specific OBSM allows to:

- Update a memory image;
- Monitor a memory image;
- Load a memory image on spacecraft, with mission specific TC sequences;

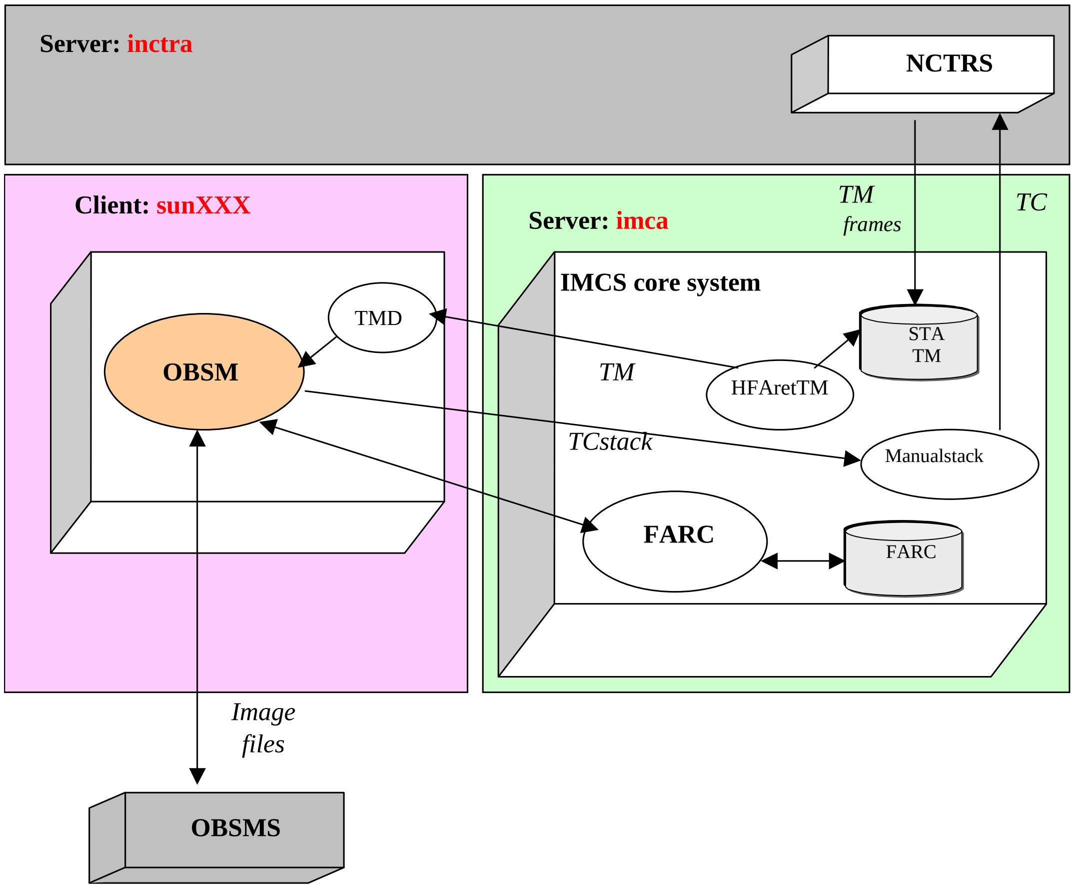


Figure 5 - OBSM sub-system

2.6.1.6 RAPID Sub-system

Due to the separation of the ESOC OPSLAN into two separate LANs and the consequent migration of the INTEGRAL machines into two separate environments (IMCA machines on A LAN and IMCB machines on B LAN) a tool capable of synchronising the archives on the two chains was needed. The tool implemented for this purpose has been named RAPID: “Raw Archive Packet Interceptor and Dumper.

The scope of this chapter is not to describe the design of the tool and the RAPID components but to give an overview of what the tool does.

The items synchronised are: TM Packets; TC (History); Events; TM Frames Real-time; TM Frames Playback and TM Bad Frames.

The archives synchronised are on both A and B chains: STA TM; STA TC; STA EV; LTA TM; LTA TC; LTA EV; VC0 Frames in the Consolidated Archive, VC7 Frames in the Consolidated Archive and, eventhough not used, BAD Frames in the Consolidated Archive

It is important to remember that all the SCOS 2000 applications exchange data in form of SCOS 2000 Packets. RAPID fulfils this synchronization process by exchanging data items in form of files containing SCOS 2000 packets in binary form.

RAPID is an automatic off-line process. It continuously accumulates data on the source machine and then distributes the data according to the defined strategy. As a fundamental concept, if a machine is down or not reachable for a given time, when the machine gets back online, RAPID will automatically synchronize all the machine archives enabled to be synchronized. Note that, depending on the quantity of data to be synchronized, this process may take some time to be fulfilled. Until this synchronization process is complete it is not envisaged to use the machine for its defined operational tasks. This concept is reflected, where needed, in the IMCS procedures.

The following table provides the details of the RAPID synchronisation. As the two chains are completely redundant now, including all the archives, it is now obsolete to identify a "Primary System". The "Prime" chain is simply considered the one to which the TC Link is connected and on which the T/L is running, and "Redundant" identifies the other chain.

CONDITIONS:

- "RAPID Generation" must be "Enabled" on the Prime chain and "Disabled" on the Redundant chain, which means that the latter chain is only receiving data but not transmitting any.
- TM VC0 Link Connected on the Prime and the Redundant chains
- TM VC7Link Connected on the Prime
- TC Link Connected on the Prime

Item	**Source Machine**	**Source Application**	**Destination Machine**	**Destination Application**	**Condition**	**Purpose**
TM VC0 Packets	IMCS Server Prime	PDS Server TM	IMCS Server Redundant	PDS Server TM	VC0 real time TM link on the redundant chain in drop or disconnected	All the applications connected to IMCB PDS Server, in particular the STA, are synchronised. Note: Since the TM packets are not distributed in real time, some applications like the MON Display reportint packets with some seconds delay, some others like the TC Verifier simply will not work.
TM VC0 Packets	IMCS Server Prime	PDS Server TM	IDDS Server Prime	PDS Server TM	Always	Produce the LTA TM
TM VC0 Packets	IMCS Server Prime	PDS Server TM	IDDS Server Redundant	PDS Server TM	Always	Produce the LTA TM
Events Messages	IMCS Server Prime	PDS Server EV	IMCS Server Redundant	PDS Server EV	No TC link on the redundant chain	Produce the STA EV
Events Messages	IMCS Server Prime	PDS Server EV	IDDS Server Prime	PDS Server EV	Always	Produce the LTA EV
Events Messages	IMCS Server Prime	PDS Server EV	IDDS Server Redundant	PDS Server EV	Always	Produce the LTA EV
TC Packets	IMCS Server Prime	PDS Server TC	IMCS Server Redundant	PDS Server TC	No TC link on the redundant chain	Produce the STA TC

Item	**Source Machine**	**Source Application**	**Destination Machine**	**Destination Application**	**Condition**	**Purpose**
TC Packets	IMCS Server Prime	PDS Server TC	IMCS Server Prime	PDS Server TC	Always	Produce the LTA TC
TC Packets	IMCS Server Prime	PDS Server TC	IDDS Server Redundant	PDS Server TC	Always	Produce the LTA TC
TM VC0 Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Prime	TCONmainRT	Always	Produce the VC0 Frame Consolidated Archive
TM VC0 Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Redundant	TCONmainRT	Always	Produce the VC0 Frame Consolidated Archive
TM VC7 Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Prime	TCONmainRT	Always	Produce the VC7 Frame Consolidated Archive
TM VC7 Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Redundant	TCONmainRT	Always	Produce the VC7 Frame Consolidated Archive
TM Bad Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Prime	TCONmainRT	Always	Produce the BAD Frame Consolidated Archive
TM Bad Frames (Real Time)	IMCS Server Prime	TMDSmainRT	IDDS Server Redundant	TCONmainRT	Always	Produce the BAD Frame Consolidated Archive
TM VC0 Frames (Playback)	IMCS Server Prime	TMDSmainPB	IDDS Server Prime	TCONmainPB	Always	Fill the gaps in the VC0 Frame Consolidated Archive
TM VC0 Frames (Playback)	IMCS Server Prime	TMDSmainPB	IDDS Server Redundant	TCONmainPB	Always	Fill the gaps in the VC0 Frame Consolidated Archive
TM VC7 Frames (Playback)	IMCS Server Prime	TMDSmainPB	IDDS Server Prime	TCONmainPB	Always	Fill the gaps in the VC7 Frame Consolidated Archive
TM VC7 Frames (Playback)	IMCS Server Prime	TMDSmainPB	IDDS Server Redundant	TCONmainPB	Always	Fill the gaps in the VC7 Frame Consolidated Archive

2.6.1.7 Data Archiving Sub-System (MADDS)

The MADDS Sub-System provides functions and capabilities covering the following major areas:

- Providing the telemetry data flow from the ground station through the NCTRS for VC0 (house-keeping TM) and VC7 (scientific TM), both in Real Time and Play Back to the INTEGRAL MCS specific interface. Real Time data is stored in a Consolidator archive (and at the same time forwarded outside the ESOC firewall to the ISDS server). Play Back data is stored in the Consolidator archive in order to fill possible gaps that occurred during the Real time reception.

- Providing the NCTRS link management with an automatic connection to NCTRS at start-up and a retry mechanism (in case of connection failure).

- Visibility of the connection status and support for manual control of the connections from TM SPACON

- Data quality checking at transfer frame level

- On-line frame checking for gaps in reception of TM frames (VC0 and VC7) and creation of report-files.

- Long Term Archiving of the incoming packets for TM, EV and TC. This archive contains the whole Mission lifetime archive (and it is accessible even from outside ESOC via TDRS).

In the following sections we describe:

A – The Frame Consolidator

B – The Long Term Archiving

A – The Frame Consolidation

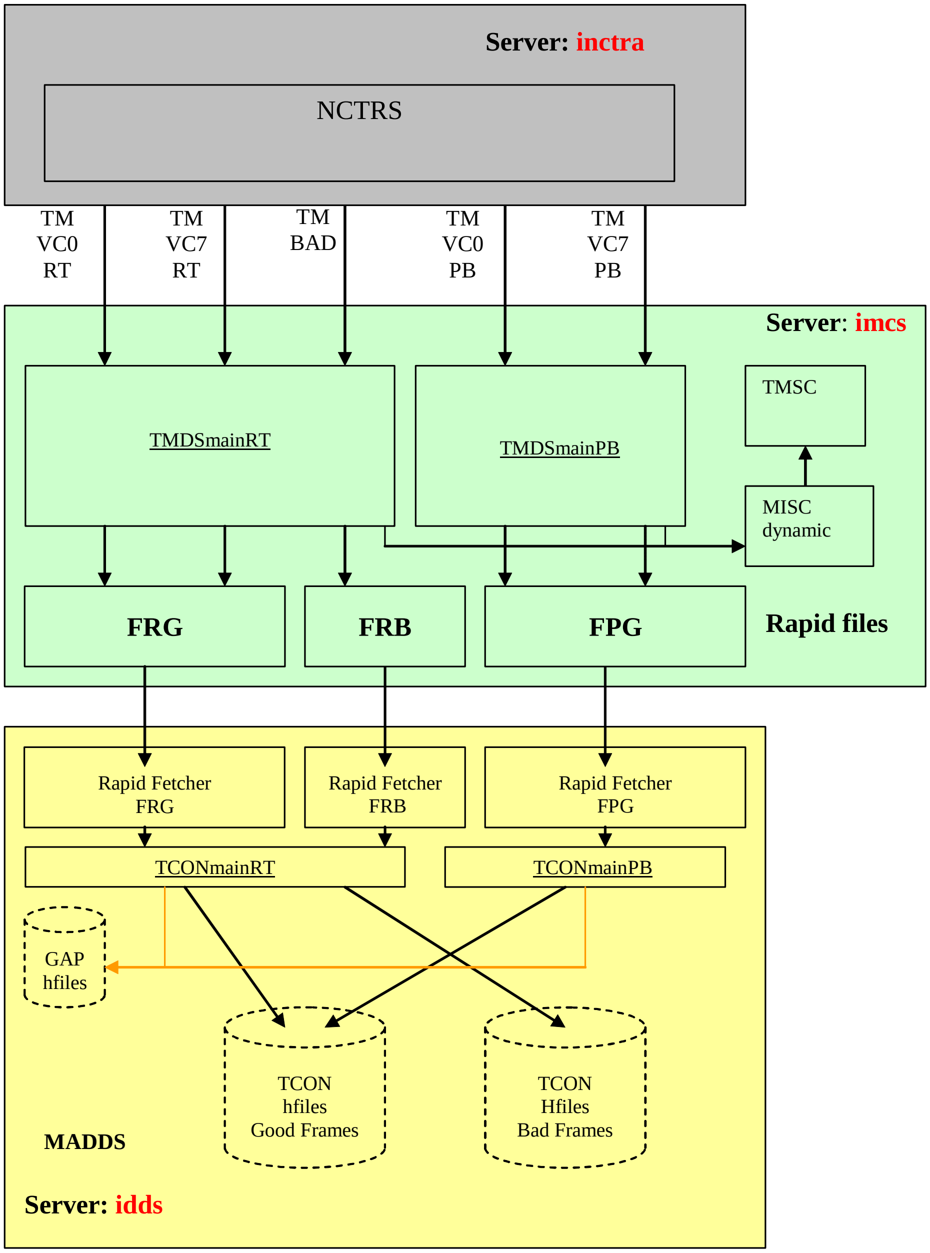


Figure 6 - The Frame Consolidation

B - The Long Term Archiving

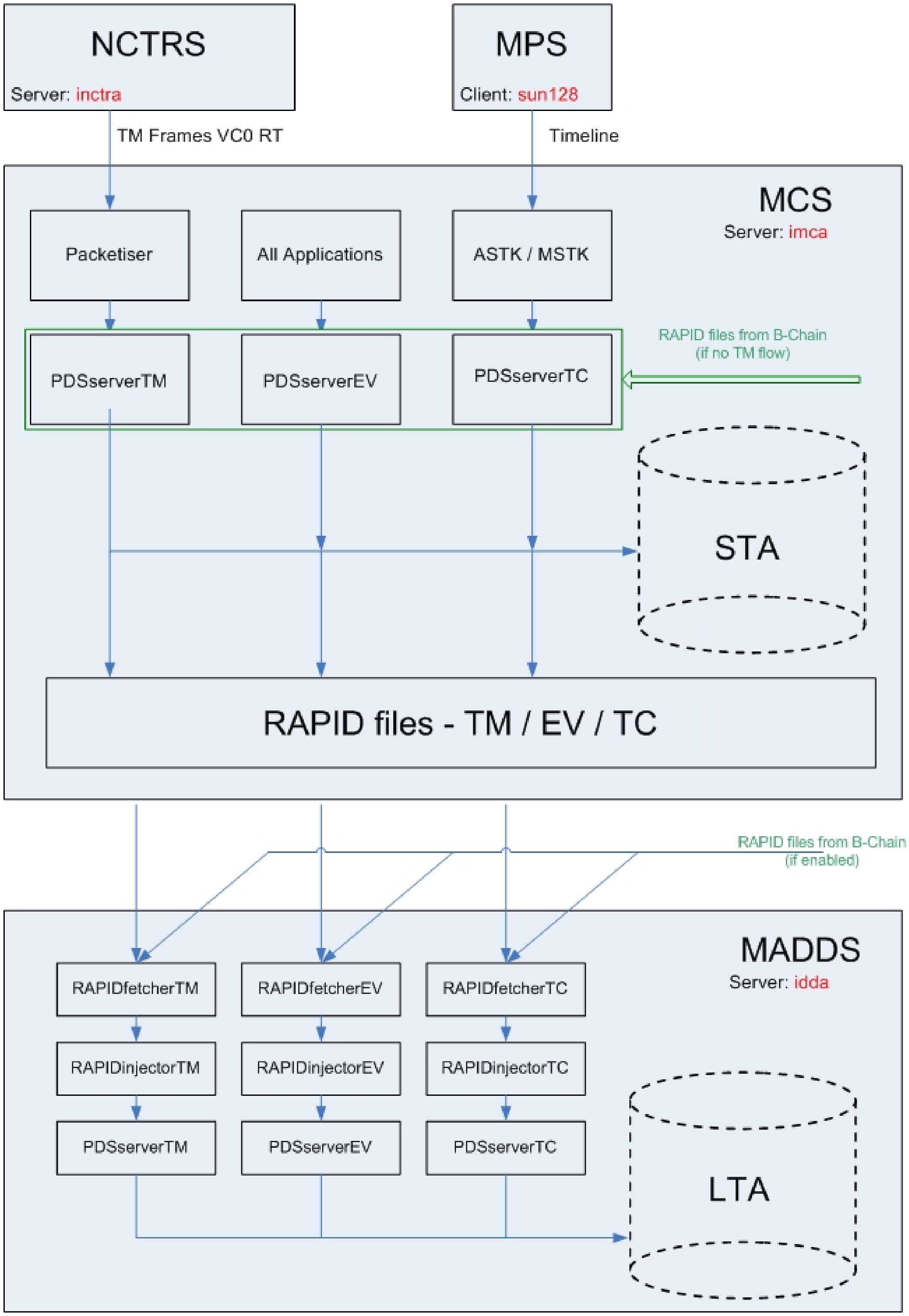


Figure 7 - The Long Term Archiving

2.6.1.8 Data Retrieving Sub-System (MADDS)

The MADDS System provides functions and capabilities covering the following major areas:

- Creation of auxiliary files (OLF and THF files) to be sent to ISDC
- Manual and Automatic Creation of mission Archive CD-ROMs to be sent to ISDC.
- Off-line Frame Check functionality to give the user the opportunity to verify the completeness of data consolidated into the archive (on VC0/VC7/MasterChannel counters).

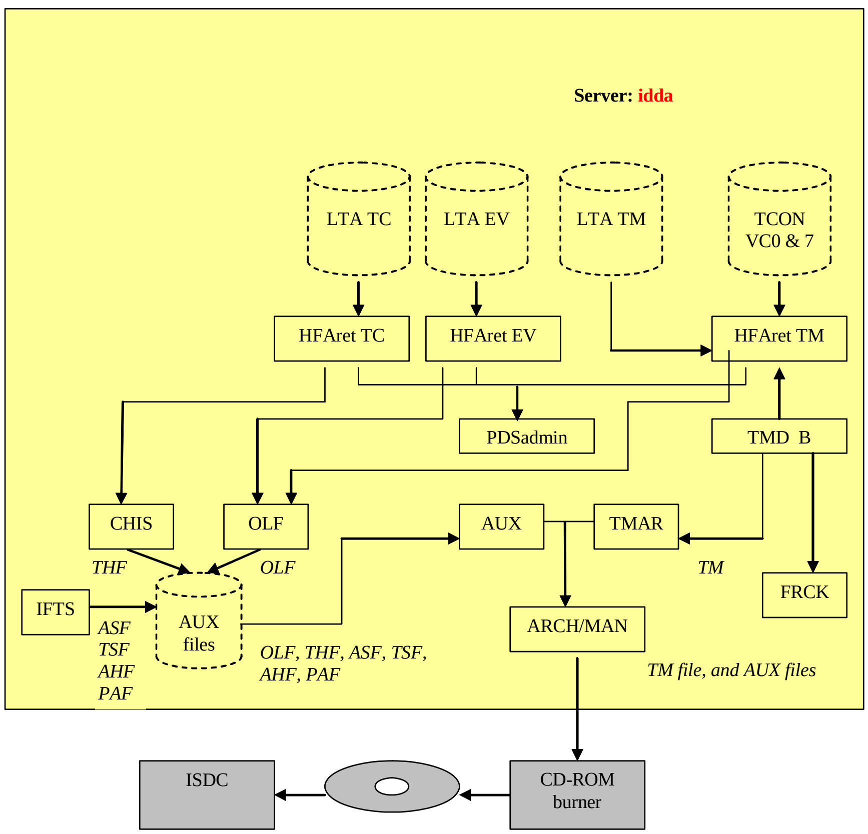


Figure 8 - Data Retrieving Sub-System

2.6.1.9 Data Distribution Sub-system (ISDS/IFRD)

This includes ISDS-IFRD and it is physically part of the MADDS system (ISDS and IFRD are built together with the other MADDS subsystems).

The ISDS System provides functions and capabilities covering the following major areas:

- Providing the INTEGRAL MCS specific interface to the telemetry data flow coming from the ground station through the NCTRS for VC0 (house-keeping TM) and VC7 (scientific TM) in Real Time. Real Time data is forwarded to the ISDC (in Geneva) and to the IFRD system.

- Providing the link management with an automatic connection to the TM Distributor at start-up and a retry mechanism (in case of connection failure).

- Visibility of the connection status and Support for manual control of the connection (between the TM Distributor and the ISDS itself) from TM Spacon

- Visibility of the connection status from the ISDS to ISDC and IFRD

The IFRD System provides functions and capabilities covering the following major areas:

- Construction of TM packets from the received TM frames accessing the MIB
- Forwarding of the built packets to the Integral PI clients.

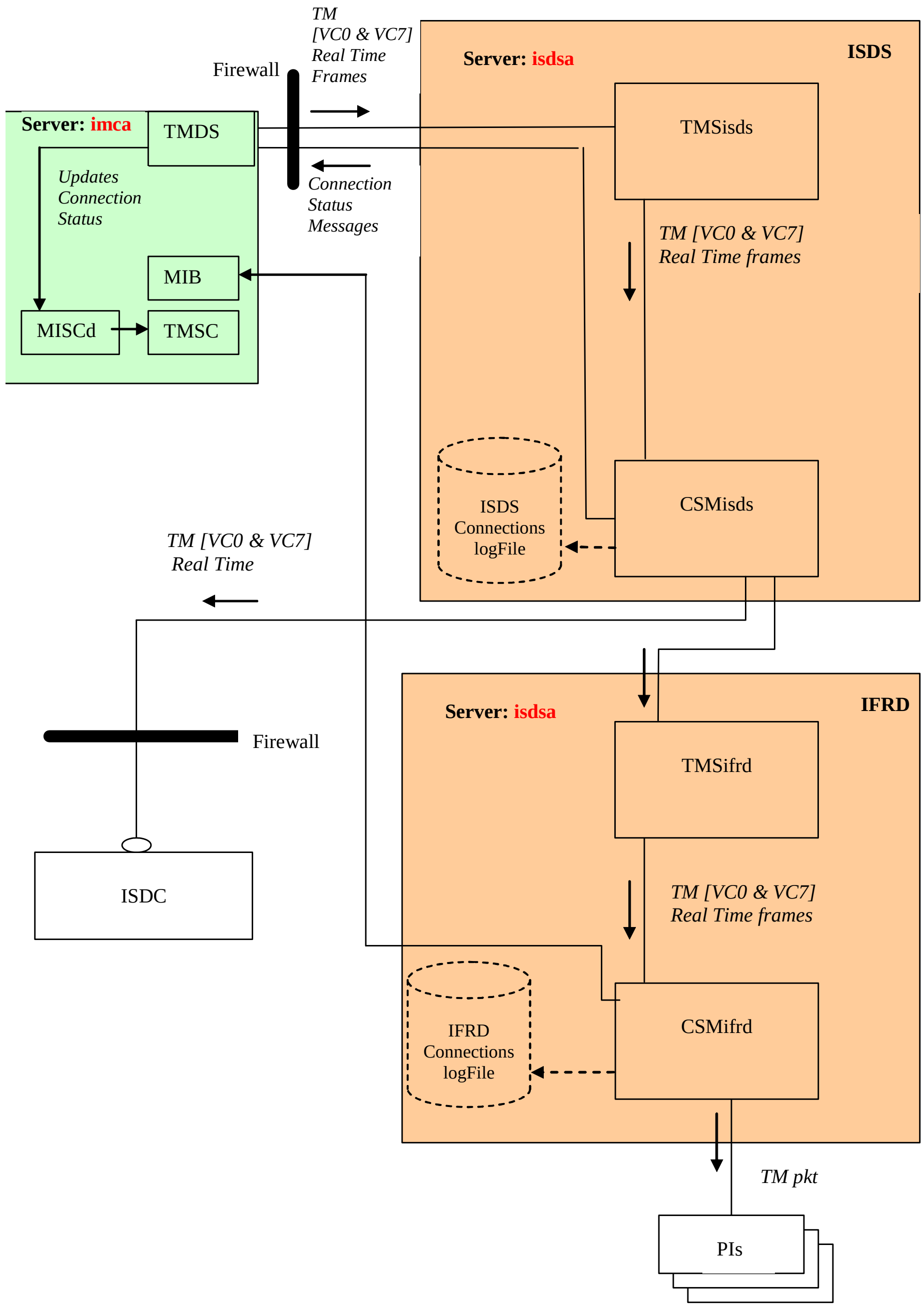


Figure 9 - Data Distribution Sub-system

2.6.1.10 File Transfer Sub-system (IFTS)

The File Transfer Sub-System is the system responsible for transferring the mission files all over the whole machine set of the Integral system.

The system is composed by a run-time set of binaries and libraries and a considerable number of scripts.

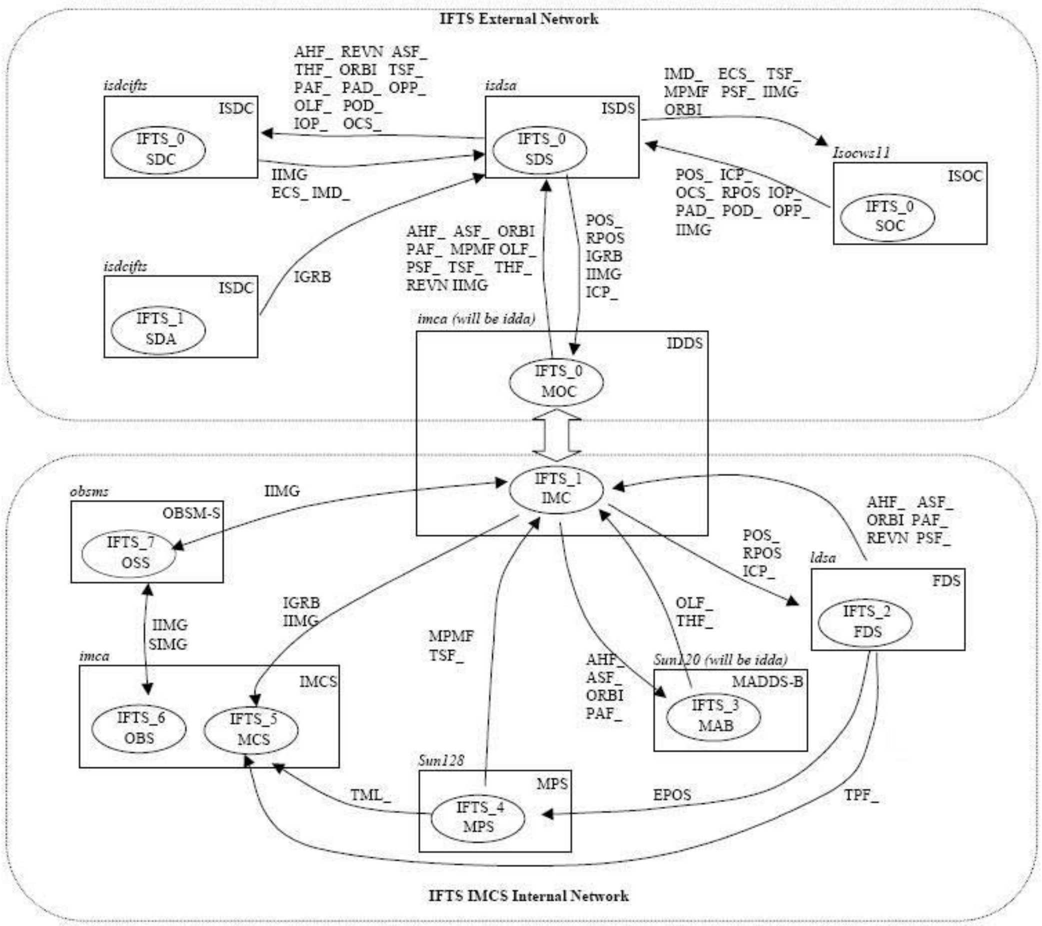


Figure 3 – Summary of Internal/External IFTS file transfer

2.6.1.11 TDRS system

The PAS system is also known as the TDRS system. It allows users to access the mission archive via a web browser and perform queries on it.

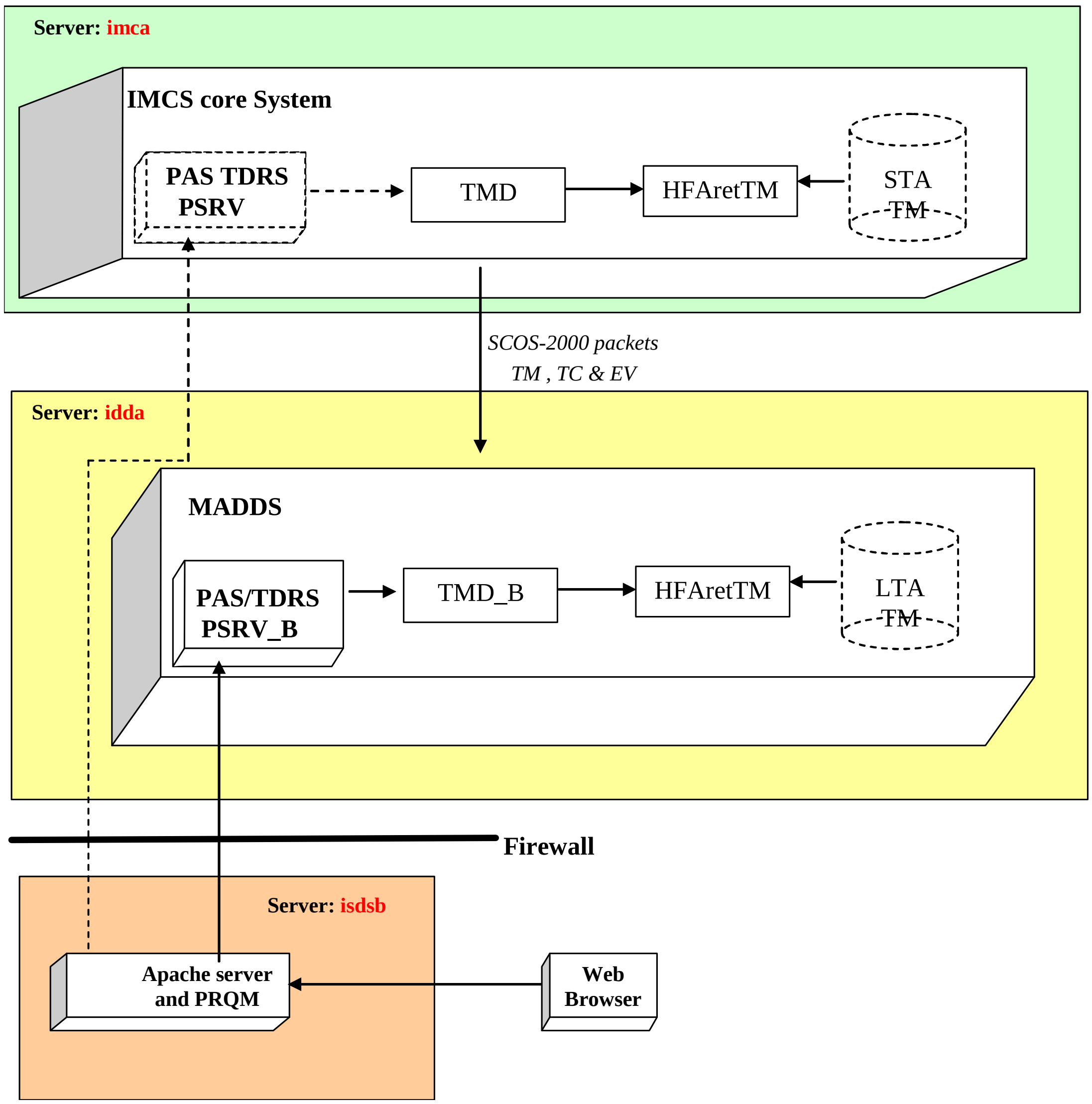


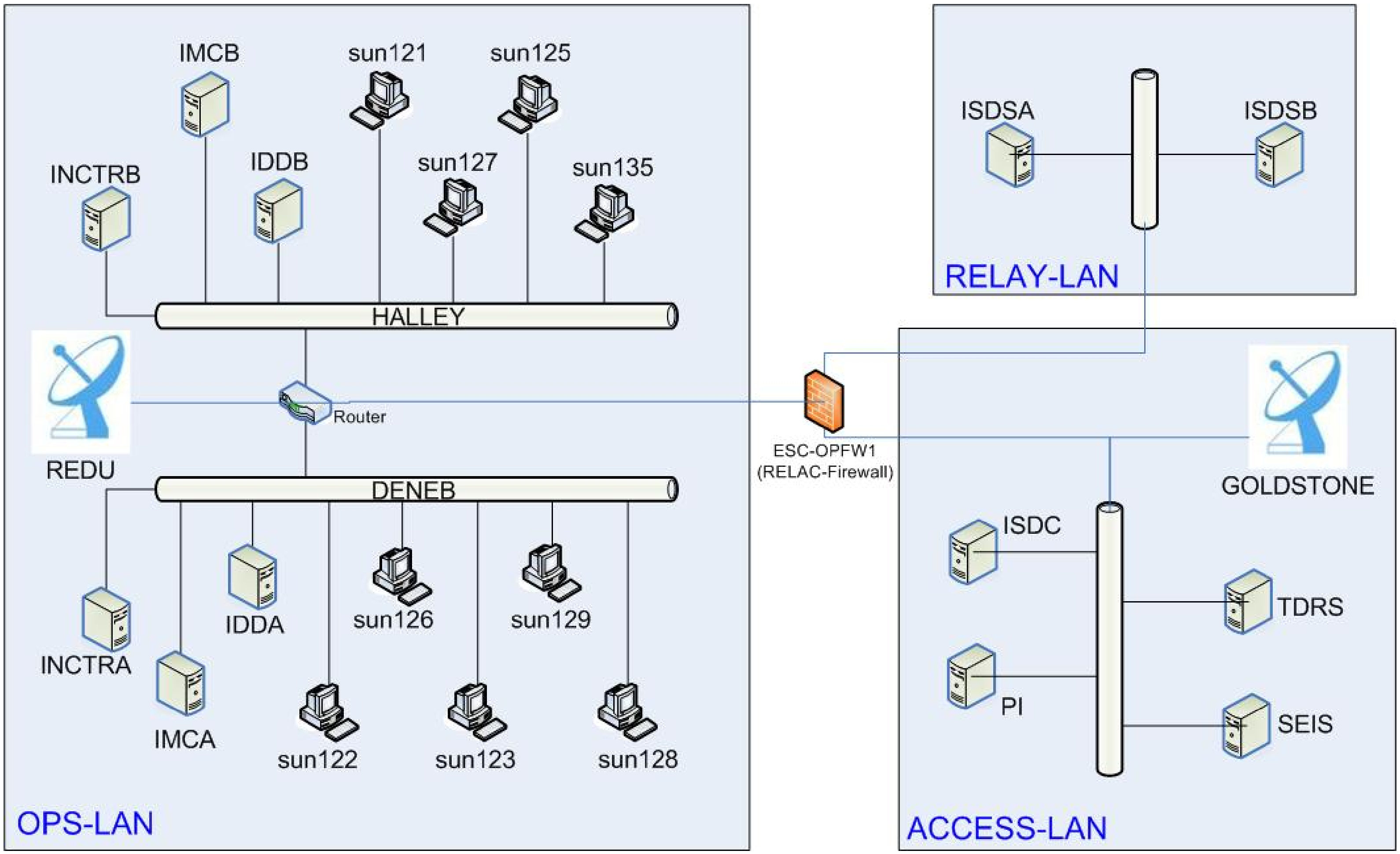
Figure 10 - The TDRS system

2.6.1.12 MCCM

MCCM is the system in charge to monitor the whole IMCS system and detect misbehaviour or failures. It is in charge of;

- Checking whether all the expected tasks on each machine of the IMCS system are really running
- Checking the hardware Resources status:
  - Disk space availability;
  - Memory availability;
  - CPU utilization;
  - Number of sockets opened
- Checking the S/W Release versions
- Distributing S/W Releases

2.6.1.13 OPS-LAN Overview



2.6.2 Consolidation of the Archive

2.6.2.1 Introduction

The MOC is in charge of providing CD ROMs to ISDC with all received TM data. Each CD contains specific Auxiliary files, as already shown in the paragraph describing the IMCS, and a TM File extracted by the Consolidator VC0 and VC7 Frame Archive.

A total of 3 CDs is necessary to contain all the data produced in 24 h. Each CD contains 8 h of data.

1. Day n from 00:00 to 08:00
2. Day n from 08:00 to 16:00
3. Day n from 16:00 to Day (n + 1) 00:00

The data content start and stop times are part of the CD name.

Before the CDs can be produced, MOC is responsible to verify that the Consolidator VC0 and VC7 Frame Archive contain (Nominally) 100% of the TM data received from the satellite by the stations. This means that all the gaps caused by:

1. G/S to MOC link interruption
2. Downtime of the application involved in generating the Consolidated Archive

must be consolidated by playing back the missing data from the G/S that was tracking INTEGRAL when the gap occurred.
Because of practical reasons, the gaps shorter than 40 seconds, unless contiguous to other gaps, are not played back.

The process consists of the following 4 steps:

1. Identify the TM gaps on both VCs
2. Display these gaps on a user friendly report (That is also used to generate some statistics)
3. Execute the necessary playbacks (If any)
4. Produce the CDs of the days that have been checked and consolidated.

An application running on idds and called “TCON_RT”, besides writing the Consolidator TM Frame Archive, automatically traces the gaps that occurred on both TM Virtual Channels. To identify the gaps, the application looks for a discontinuity on the VC Frame Counter. In principle, a new frame shall have the counter incremented by one count with respect to the previous frame. If it is not, it means that one or more frames in-between have not been received. Note that, if during the gap, the Virtual Channel Frame Counter has an exact wrap around (e.g. from 55 to 56 with a multiple of 255 TM frame in-between not received) the application is not able to identify a gap. Since the low probability that such event occurs, the tool has been accepted as is.

The application produces two files every day, one for VC0 and one for VC7 containing the list of the TM gaps which occurred on the given VC in a 24 hours period (From 00:00:00.000 to 23:59:59.999). <u>The file is produced when the first TM gap occurs</u>. <u>If in one day no TM gaps occur, the file is then not produced</u>. Each TM gap it is written in a new line of the file.

Each line contains:

1. The ERT of the last received TM Frame before the gap occurrence.
2. The G/S ID of the last received TM Frame before the gap occurrence.
3. The VCC of the last received TM Frame before the gap occurrence.
4. The ERT of the first received TM Frame after the gap occurrence.
5. The G/S ID of the first received TM Frame after the gap occurrence.
6. The VCC of the first received TM Frame after the gap occurrence.

In case, during the DoY in object, the application "TCON_RT" was stopped, the TCON_RT is writing:

1. The time when it was stopped
2. The last received frame ERT and VCC.
3. The time when the application was restarted.
4. The first received frame ERT and VCC.

2.6.2.2 Procedures

2.6.2.2.1 FCP_GAP_0001 - Preparation of the Form “Rev nnn Gap Report”

The “Rev nnn Gap Report.xls” are Excel worksheets used to display, in a user friendly manner, the gaps reported in the TCON_RT gap files.
This procedure describes how to prepare one blank copy (No TM Gaps reported) of this form.

			Version 1.2 13/10/10
Step	**Description**	**Comments**	**Remarks**
10	On the INTEGRAL T/S create a copy of the latest gap report: D:\INTEGRAL\PRIVAT\CONSOLIDATION\gap_tool • “Rev (nnn) Gap Report.xls” Rename the copy to: • “Rev (nnn + 1) Gap Report.xls”	nnn = revolution number	
20	If completely filled-in, move the original “Rev nnn Gap Report.xls” worksheet into the INTEGRAL T/S directory: • D:\INTEGRAL\PUBLIC\REPORTS\gap_report	nnn = revolution number	
30	End of procedure		

2.6.2.2.2 FCP_GAP_0002 - Population of the Form “Rev nnn Gap Report”

Version 1.2
13/10/10

Step	Description	Comments	Remarks
10	By using “WS_FTP_Pro” (Or a similar program) import from idda directory: • /home/imcsops/MADDS/gap to the INTEGRAL T/S directory: • D:\INTEGRAL\PRIVAT\CONSOLIDATION\fmck <u>the VC0 and VC7 gap files of the concluded day/s</u>	**The files are named: VC*x*RT_*dddyy*** **Were:** • **x is either 0 for VC0 or 7 for VC7.** • **ddd is the DoY reported without leading zeros.** • **yy is the year.**	**In case in a given day there were no gaps at all, the relevant file is not produced. This is not a malfunction.**
20	If not already selected – select the ‘data’ worksheet		
30	Enter the Revolution number in the yellow field and click on ‘Update Revolution number’		
40	Click on “Clear all entries”		
50	Click on “Import EPOS”	Select the EPOS for revolution nnn+1	
60	Click on “Update Graphics”		
70	Click on “Select gap file location”	select the directory where the gap files are located	
80	Check that all the automatically filled in values are correct		
90	Click on “Import VC 0”		

Version 1.2
13/10/10

Step	Description	Comments	Remarks
100	Click on “Filter VC 0”		
110	Click on “Import VC 7”		
120	Click on “Filter VC 7”		
130	The tool should now have imported all the VC 0 & VC 7 gap files and filtered out any gaps during groundstation handovers or perigee.		
140	**IMPORTANT WARNING:** **In case, during the DoY in object, the application “TCON_RT” was stopped, the TCON_RT writes:** • **The time when it was stopped** • **The last received frame ERT and VCC.** • **The time when the application was restarted.** • **The first received frame ERT and VCC.** • **These messages formats are not compatible with the output format of the tool (i.e. the tool may not correctly identify these). Therfore the values may need to be manually entered for that day.**		
150	End Of procedure		

2.6.2.2.3 FCP_GAP_0003 - TM Frame Consolidated Archive Gap Filling

Version 1.1
02/06/09

Step	Description	Comments	Remarks
10	Open the Worksheet "Rev nnn Gap Report" located in: D:\INTEGRAL\PRIVAT\CONSOLIDATION\gap_tool which contains the DoY that still needs to be consolidated (If applicable).		
20	Identify the real TM gaps and discard: • Gaps caused by the uplink sweep (carrier up).* • G/S H/O short gaps • Non repetitive gaps which are shorter than 40 seconds.		* Ref to "AOS; 1st H/O; 2nd H/O; LOS times"
30	Identify if the remaining TM gaps (Not discarded in the previous step) can be played back by correlating the gap/s with the event reported on the SPACON LOG and / or on the NCTRS EV Log.		In principle it makes sense to try to playback all the gaps that clearly did not occur because the TM Frames were never received at the station. Ex: Antenna stop tracking; G/S Receiver failure; RFI causing BAD Frame reception.
40	Prepare a list identifying: • The VC to playback. • The G/S from which the data shall be retrieved. • The start time of the gap and DoY • The stop time of the gap and DoY		As general rule: • Group together the consecutive short PB even if this is making playing back some telemetry already archived. • Split in more than one request VC0 window longer then 2 hours and VC7 window longer then 30'.
50	Execute the playback.		**In case of necessity ask for the support of the Shift Coordinator.**

Version 1.1
02/06/09

Step	Description	Comments	Remarks
60	A first analysis of the result of the PB can be done by checking on the NCTRS MMI how many frame has been received considered that INTEGRAL is producing an average of: • 60 VC0 frame every minutes. • >900 VC7 frames every minute. To check exactly if a given window has been consolidated run the Off-line FRCK		If after the execution of a PB the gap in the Consolidated Archive is still present, this means that the TM is lost forever.
70	After that all the PBs of a given day have been performed the CDs production of that day can be authorized.		
80	End of Procedure.		

2.6.2.2.4 FCP_GAP_0004 - Offline TM gaps Investigation

Sometime it is necessary to perform an offline check of the TM Frame Consolidated Archive, for example to very if a given playback filled a gap. This can be done by using the idds application called FRCK.

			Version 1.1 02/06/09
Step	**Description**	**Comments**	**Remarks**
10	Start the idds Desktop on an IMCS client, login and disable the alarms.		
20	Start the idds application: • “PDS_Admin”		
30	On the PDS_Admin MMI select: • “ List” On “List” select: • “Frame Checker”		
40	On the “Frame Checker” form select: • Data Stream: <dddyy> • Spid: <10> • From <yyy.ddd.hh.mm.ss.000> • To <yyy.ddd.hh.mm.ss.000> And select the VC (0 or 7) that must be checked		ddd = DoY number without leading 0 Start time of the window that must be checked. End time of the window that must be checked
50	While running the application writes a Log file called: • “FRCK.log” This can be found in the directory /tmp.		
60	The application produces an output file called: • “FRCK.out” This can be found in the directory /tmp.		**The format of the “ FRCK.out” file is not compatible with the macros of the worksheet “ Rev nnn Gap Report**
70	End of Procedure		

2.6.3 INTEGRAL Data CD Production

2.6.3.1 Introduction

The automatic CD production is controlled by a file named “list.dat” located on idda:/home/imcsops/MADDS/log.

It looks like this:

```
1       22   8
2008    62   0    S
2008    62   8    S
2008    62   16   S
2008    63   0    S
2008    63   8    S
2008    63   16   S
2008    64   0    S
2008    64   8    S
2008    64   16   S
2008    65   0    S
2008    65   8    N
2008    65   16   N
2008    66   0    N
```

The first line defines the CD production configuration and shall be left untouched to “`1 22 8`” (The last 8 indicates that the CDs contain 8 hours of data).

The other lines identify the CDs and their production status:

- The first number is the CD’s year
- The second number is the CD’s DoY written without leading zeros.
- The third number is the CD’s data window **end** time: 0 is corresponding to 00:00:00 Z; 8 corresponds to 08:00:00 Z; 16 corresponds to 16:00:00 Z. This means that if you want to authorize the production of the 3 CDs covering for example DoY 063, 2008 you have to authorize: `2008 63 8; 2008 63 16; 2008 64 0`
- The last character identifies the production status: N = Not Authorized to be produced; A = Authorized to be produced; P = Pending Production Completion; S = Successfully Produced; F = Failed to be Produced.

Important Note: The system will automatically cancel the production of a CD if the TM is less then 100MB or if some mandatory AUX files are missing. In this case the CD must be produced using the “MAN” tool as described in the procedure: CD Manual Production Step by Step Procedure

The CD production has now been automated. A script is run every day to authorise the production of the TM received 10 days earlier.
Before authorising the new CDs, the status of any previous CD production is checked. In case any is still pending the script will wait 10 minutes and recheck the status. This will be repeated for one hour. If at this time the status is still pending the production is assumed failed.
Any CDs identified as failed will be added to the new list of authorised CDs.

Procedures

2.6.3.1.1 FCP_CDW_0001 – Authorise new CD for automatic production

Version 1.1
02/06/09

Step	Description	Comments	Remarks
10	Open a terminal on idda and login as imcsops		
20	By using an editor like “textedit” open the CDs authorization file. • “list.dat” Located in the directory • /home/imcsops/MADDS/log		
30	Authorise the production of the CDs for the days where all TM gaps have been checked and consolidated by setting the CD production status to: • “A”	N= Not Authorized P = Pending A = Authorized S = Successfully Produced F = Failed Production	**IMPORTANT: The maximum number of CDs that can be authorised or pending at the same time is 9**
40	Save the table		
50	If not already running, Start the idds application: • “ARCH”		
60	After some time verify that the CDs have been produced by checking their production status in the file: • “list.dat”		**The system will automatically not burn CD if the TM is less then 100MB or if some mandatory AUX files are missing.**
70	Once the CDs have been produced, they can be collected in the CCC area.		
80	End of Procedure		

2.6.3.1.2 FCP_CDW_0002 - CD Production failure analysis

			Version 1.1 02/06/09
Step	**Description**	**Comments**	**Remarks**
10	Check the CDs production Status in the file: • “list.dat” If the production status of one or more CDs is: • “F” Proceed with the following steps.		**NOTE: The status of all CDs can also be checked in the automatic production script’s log file. The logfiles are located under ‘/home/imcsops/log’ and are named “cdwriter_YYYY_MM.log”**
20	If still running stop the idds application: • “ARCH”		
30	Delete all the files (If any) located in the directory: • /home/imcsops/MADDS/rep		
40	Stop and restart the idds applications: • “AUX”		
50	Authorise the production of the CD of the days whose production failed by setting to: • “A” The CD production status	N= Not Authorized P = Pending A = Authorized S = Successfully Produced F = Failed Production	**Mandatory: The maximum number of CDs that can be authorised or pending at the same time is 9**
60	Save the table		
70	Start the idds application: • “ARCH”		
80	After some time verify that the CDs have been produced by checking their production status on the file: • “list.dat” If their production failed again proceed with the following steps, otherwise: End of Procedure		**The system will automatically not burn CDs if the TM is less than 100MB or if mandatory files are missing (8 OLF Files; some ASF files; 1 PAF file; some THF Files must be present in each CD).**

Version 1.1
02/06/09

Step	Description	Comments	Remarks
90	Examine the reason why the production failed reported on the file: • “errors.log” Located in the directory /home/imcsops/MADDS/log In case the error message is: • TM File less then …” → Produce the CDs Manually by running the procedure: “FCP_CDW_0003 - Manual CD Production” • CD Burner Fails → Go to CCC, tell to operator to check that the CD burner used by INTEGRAL is OK and when it is authorise again the automatic production of the failed CDs. • “No (AUX File), ARCH exit, Please restart AUX” Continue with the procedure.		
100	Check in the directory: • /home/imcsops/MADDS/aux Which auxiliary files are missing		
110	Check if the missing Auxiliary Files can be reproduced: • If yes, produce them and authorize the automatic production of the failed CDs. • If not, Produce the CDs Manually by running the procedure: → “FCP_CDW_0003 - Manual CD Production”		
120	End of Procedure		

2.6.3.1.3 FCP_CDW_0003 - Manual CD Production

			Version 1.1 02/06/09
Step	**Description**	**Comments**	**Remarks**
10	Start the idds Desktop on one IMCS client login and disable the alarms.		
20	Start the idds application: • “MAN”		
30	On the “Time Period” window • Select the “End Time” using the format already displayed • Set the “Duration” to 8 h		
40	On the “DATA” window select: • Telemetry • AUX File • “VC – 7 and VC – 0”		
50	Start the CD production by clicking on the box: • “Start”		
60	Wait for the “Current State” getting back to: • “Idle” On both the “Telemetry” and “AUX File” Boxes		
70	End of procedure		

2.6.3.1.4 FCP_CDW_0004 - CD Delivery

			Version 1.1 02/06/09
Step	**Description**	**Comments**	**Remarks**
10	Collect the burned CDs from the CCC area.		
20	Check that the content of each CD is correct. Each CD shall contain at least: • 1 TM File (~424 M) [subtract 51 MB for each hour of P.P.] • 8 OLF Files • Some ASF Files • 1 PAF file • Some THF Files.		
30	If the CDs relevant to four days have been correctly produced according to the above checks, fill in the form: • " AF_yyyy_mm_dd.doc" Located on the INTEGRAL T/S in the directory: • D:\INTEGRAL\PRIVAT\CONSOLIDATION\cd_delivery_files\to_be_sent	yyyy_mm_dd = This is **NOT** the date the file was created / edited. The date to be reflected is the date of the Telemetry → the date of the first cd on the form.	
40	Print 2 copies of the Authorization Form and sign them.		
50	If an new authorization form is needed: Copy the previous one and save the copy as: • AF_yyyy_mm_dd.doc • Change the " CD Label DATA START" of the 12 listed CDs		
60	Bring the CDs and the relevant authorization form to CCC for shipment.		
70	Move the forms for CDs that have been shipped to: • D:\INTEGRAL\PRIVAT\CONSOLIDATION\cd_delivery_files\sent		
80	End of Procedure		

2.6.3.1.5 FCP_CDW_0005 – Restarting CD Production

			Version 1.0 29/11/10
Step	**Description**	**Comments**	**Remarks**
10	This Procedure is to be executed if the following event message appears on the MCS event logger: `"CD Production failed! Please restart AUX then start ARCH."`		
20	Select the 'others' tab on the IDDA server application MMI		
30	• Verify that the 'ARCH' task is not running (if it is running please stop the task)		
40	Select the 'MADDS' tab on the IDDA server application MMI		
50	• Stop the AUX task		
60	• Start the AUX task		
70	Select the 'others' tab on the IDDA server application MMI		
80	• Start the ARCH task		
90	End of Procedure		

2.6.4 IMCS Procedures

2.6.4.1 Routine Procedures

2.6.4.1.1 FCP_MCS_0001 - Workstation Start

		Version 1.1 02/06/09
	FCP_MCS_0001 - Workstation Start	
Step	**Description**	**Remarks**
10	Logon to a W/S **- login: imcsops** **- Password: xxx**	
20	Click the right mouse button and choose "Start SCOS Client (A or B)-Chain" from the following options: - **Start SCOS A-Chain Client** - **Start SCOS B-Chain Client** - **Start SCOS Default Client** - **...** - **...**	Note: Start SCOS Default Client starts the client on the chain that it is usually connected to. Login to SCOS as: sun121 - spacon sun122 - spacon sun123 - spacon sun127 - spacon sun128 - plan sun129 - soft
30	End of Procedure	

2.6.4.1.2 FCP_MCS_0002 - Workstation Stop

		Version 1.1 02/06/09
FCP_MCS_0002 - Workstation Stop		
Step	**Description**	**Remarks**
10	Stop all SCOS client applications - **Click the right mouse button and choose "SCOS-2000 Shutdown"**	
20	Logout of workstation (if needed) - **Click the right mouse button and choose "SCOS-2000 Shutdown and Logout Workstation"**	Notes: This is only necessary if major problems are experienced on the workstation. It is not necessary after a server (imca/b) restart.
30	End of procedure	

2.6.4.1.3 FCP_MCS_0003 - Workstation configuration

Version 1.2 03/08/10		
FCP_MCS_0003 - Workstation configuration		
Step	**Description**	**Remarks**
	sun121	
	Start relevant applications from Application Launcher On screen 0 – TM-Desk (Radiation Monitor) On screen 1 – TM-Desk (AOCS SOE displays) On screen 2 – TM-Desk (RF-OPS)	Login to SCOS as: spacon
	sun122	Login to SCOS as: spacon
	Start relevant applications from Application Launcher On screen 0 – OOL, Event-Logger, TM-Desk, VPD On screen 1 – ManStk, OBEH, TM-Desk On screen 2 – AutoStk, TC-History, TC-SPACON, TM-SPACON	NOTE: This screen configuration is a recommendation which includes all necessary SCOS applications to operate INTEGRAL.
	Verify the correctness of the TC Spacon and TM Spacon settings by following the procedure: **“FCP_MCS_0004 - System status check”**	

Version 1.2
03/08/10

FCP_MCS_0003 - Workstation configuration

Step	Description	Remarks
	sun123	Login to SCOS as: spacon
	Start relevant applications from Application Launcher On screen 0 – TM-Desk (SPI SOE displays) On screen 1 – TM-Desk (IBIS SOE displays) On screen 2 – TM-Desk (OMC & JEM-X SOE displays)	
	sun127	Login to SCOS as: spacon
	Start relevant applications from Application Launcher On screen 0 – OOL, Event-Logger, TM-Desk, VPD On screen 1 – ManStk, OBEH, TM-Desk On screen 2 – AutoStk, TC-History, TC-SPACON, TM-SPACON	
	Start server MMIs On screen 0 – IMCB, IDDB On screen 1 – none On screen 2 – IMCA, IDDA	Click the right mouse button and choose: SPACON → OPEN MMI → (select the machine)
	sun128	Login to SCOS as: plan
	Start relevant applications from Application Launcher On screen 0 – MPS Client	

Version 1.2
03/08/10

FCP_MCS_0003 - Workstation configuration

Step	Description	Remarks
	<u>sun129</u>	Login to SCOS as: soft
	Start NCTRS & MCCM MMIs On screen 0 – NCTRS-B On screen 1 – MCCM On screen 2 – NCTRS-A	Click the right mouse button and choose: SPACON → OPEN MMI → (select the machine)

2.6.4.1.4 FCP_MCS_0004 - System status check

Important Note:
The scope of this procedure is to check the correctness of the IMCS Status at System Level: IMCA + IMCB + IDDA + IDDB + ISDSA + ISDSB and Clients
It has to be executed:

- **After that the IMCS has been restarted**
- **At each SPACON handover**
- **Periodically, in particular to assess the status of the backup chain**

		Version 1.2 03/08/10
FCP_MCS_0004 - System status check		
Step	**Description**	**Remarks**
10	Status of NCTRS - **Check link to IMCA/B** - **Check TM link VC0, VC7 and Bad Frames** - **Check TC link**	NOTE: If checks of this procedure fail contact the relevant support. (on-call outside working hours)
20	Status of server - **Check application status of IMCA/B server on MMI** - **Check application status of IDDA/B server on MMI**	
30	T/L correctness: - **Check that the T/L loaded on the Command Autostack, on both chains, corresponds to the one indicated on the applicable T/L Cover Sheet.**	If not already done before.

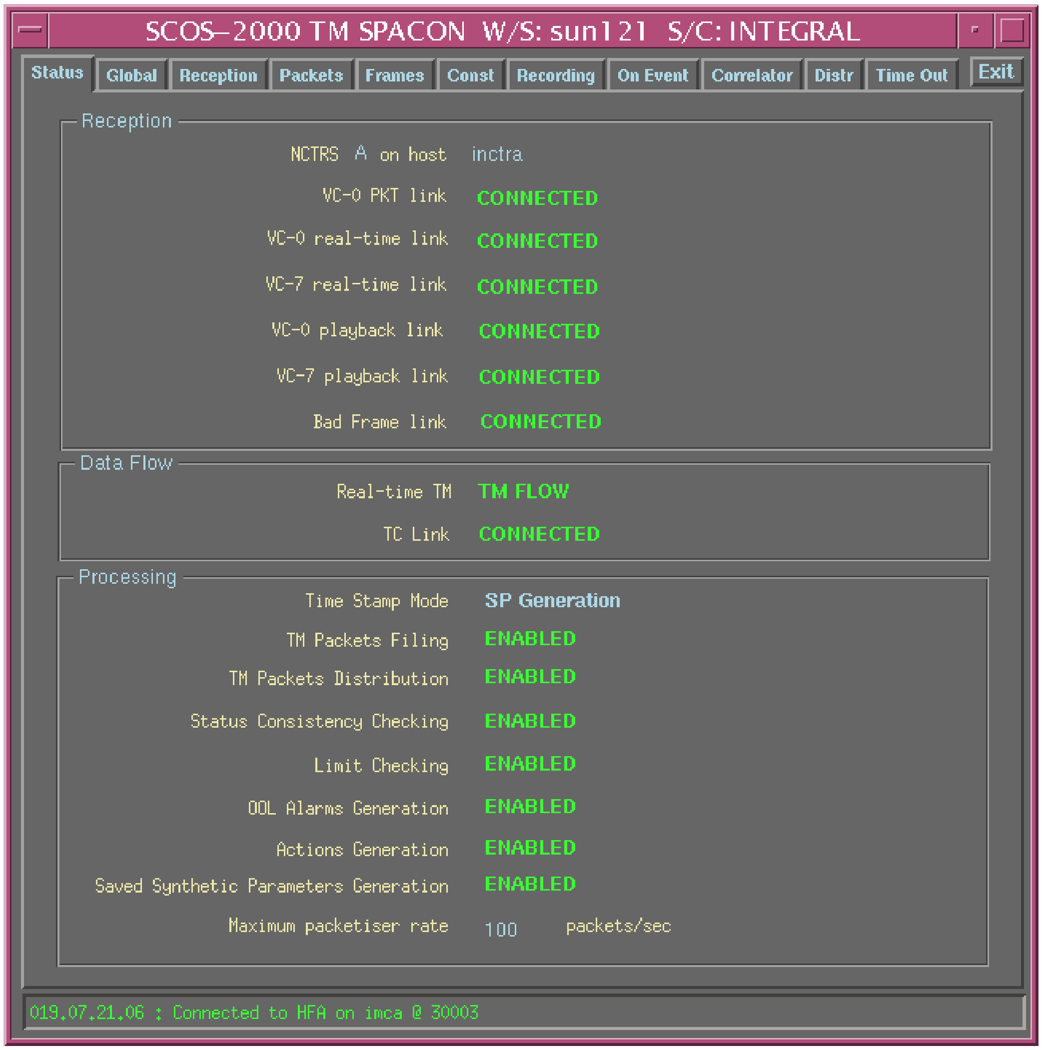
Version 1.2
03/08/10

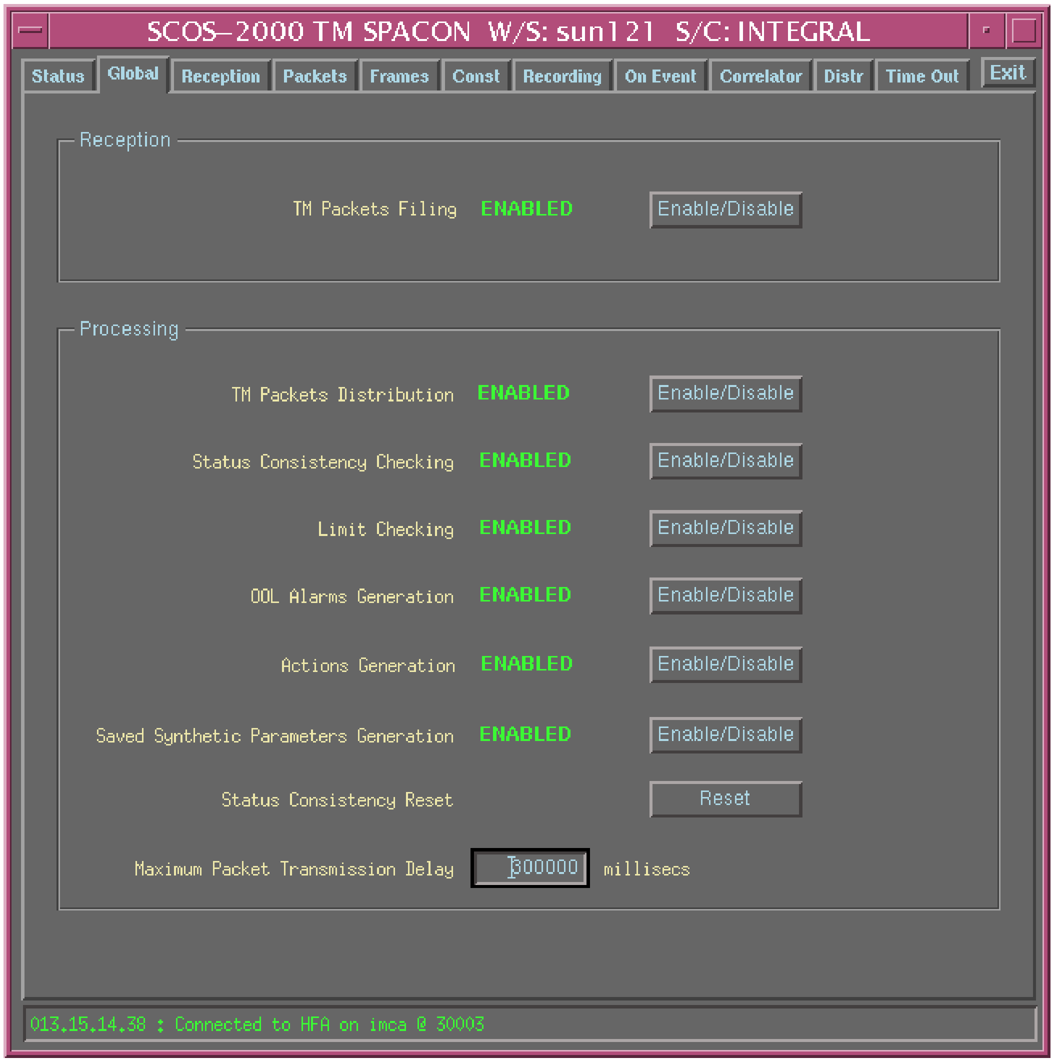
FCP_MCS_0004 - System status check

Step	Description	Remarks
40	Slew Update - **Check that the next slew in the T/L has been correctly updated by verifying the relevant sequence TC parameters has got the same values reported in the FDS TPF printout.** **In case of errors, produce again the FDS updating TPF.**	
50	Status of FDS - **Check TM reception on sun125 on the panel STR_ARD_ACC and the Wheel-Profile panel** - **Confirm TPF file transfer between FDS and IMCA/B (e.g. slew update)**	

60

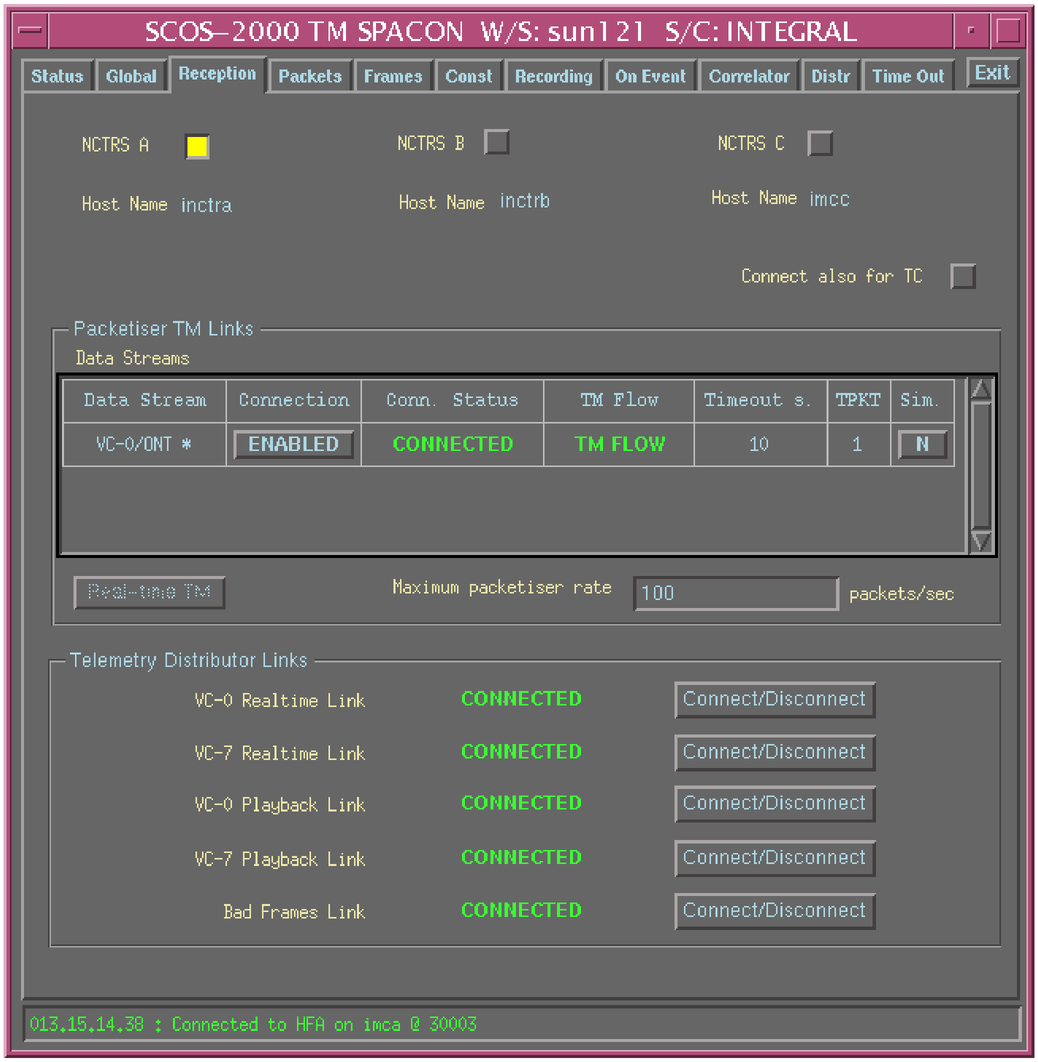
Check TM SPACON settings

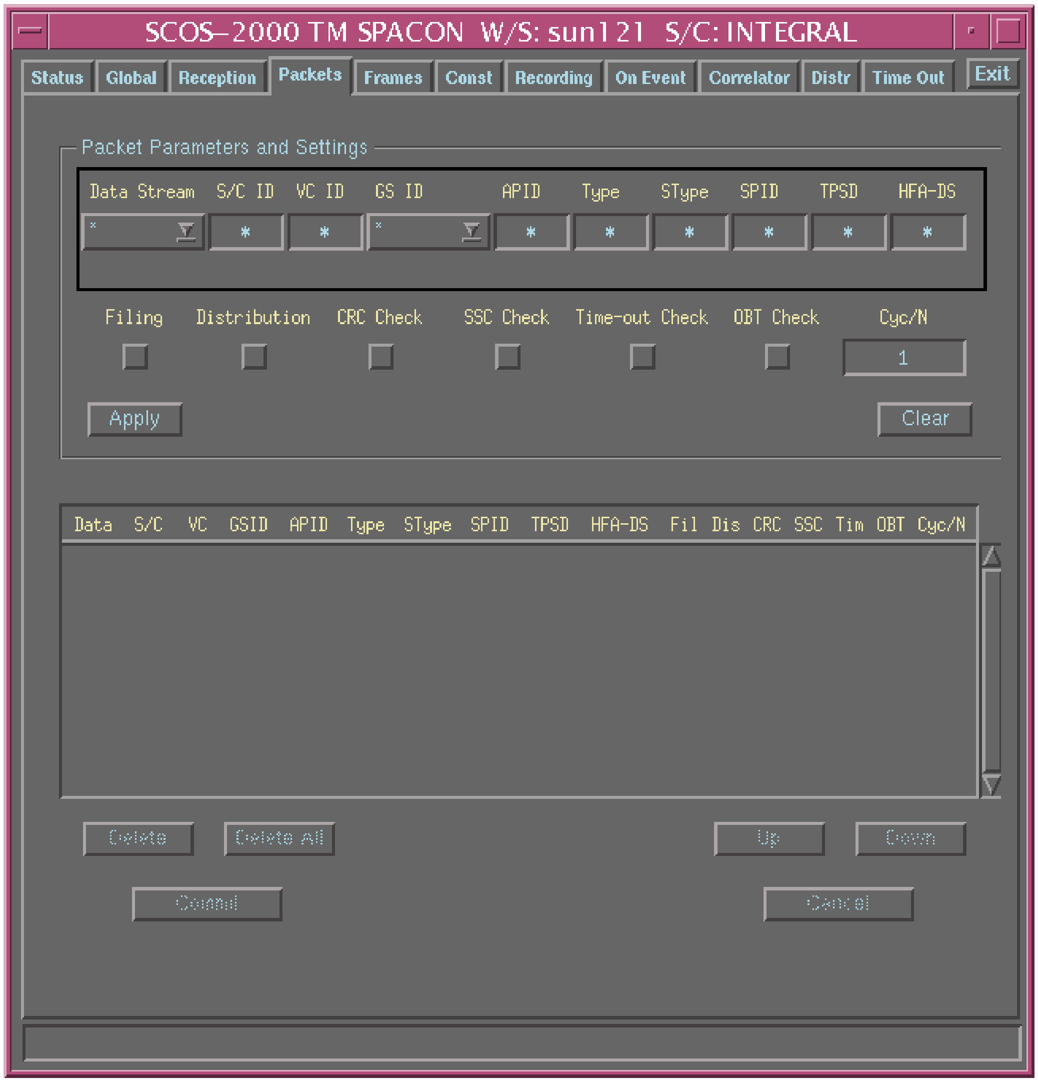


70	

SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
Reception
TM Packets Filing ENABLED Enable/Disable
Processing
TM Packets Distribution ENABLED Enable/Disable
Status Consistency Checking ENABLED Enable/Disable
Limit Checking ENABLED Enable/Disable
OOL Alarms Generation ENABLED Enable/Disable
Actions Generation ENABLED Enable/Disable
Saved Synthetic Parameters Generation ENABLED Enable/Disable
Status Consistency Reset Reset
Maximum Packet Transmission Delay 300000 millisecs
013.15.14.38 : Connected to HFA on imca @ 30003

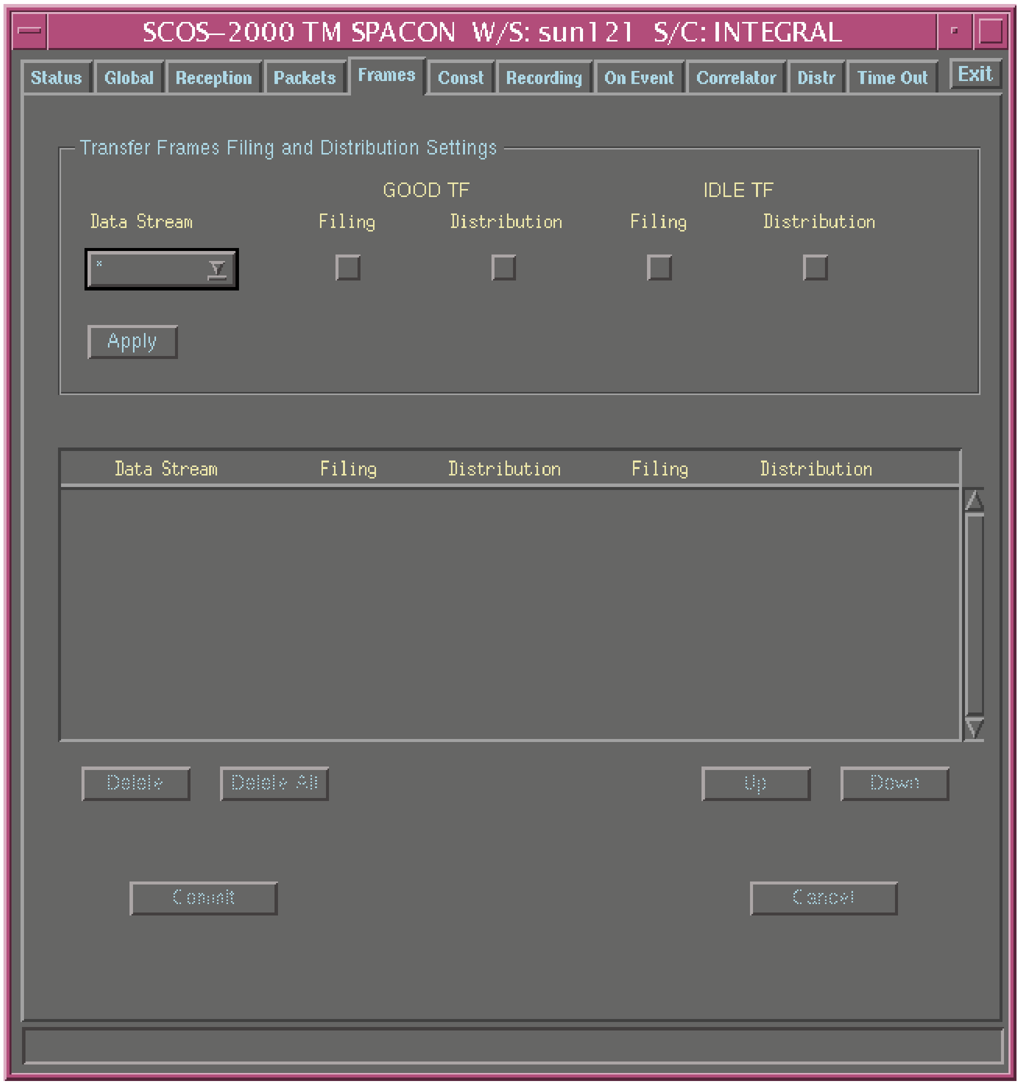
80


SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
NCTRS A
NCTRS B
NCTRS C
Host Name inctra
Host Name inctrb
Host Name imcc
Connect also for TC
Packetiser TM Links
Data Streams
Data Stream
Connection
Conn. Status
TM Flow
Timeout s.
TPKT
Sim.
VC-0/ONT *
ENABLED
CONNECTED
TM FLOW
10
1
N
Real-time TM
Maximum packetiser rate
100
packets/sec
Telemetry Distributor Links
VC-0 Realtime Link
VC-7 Realtime Link
VC-0 Playback Link
VC-7 Playback Link
Bad Frames Link
CONNECTED
Connect/Disconnect
013.15.14.38 : Connected to HFA on imca @ 30003

90	 Compare to values in SPACON config folder

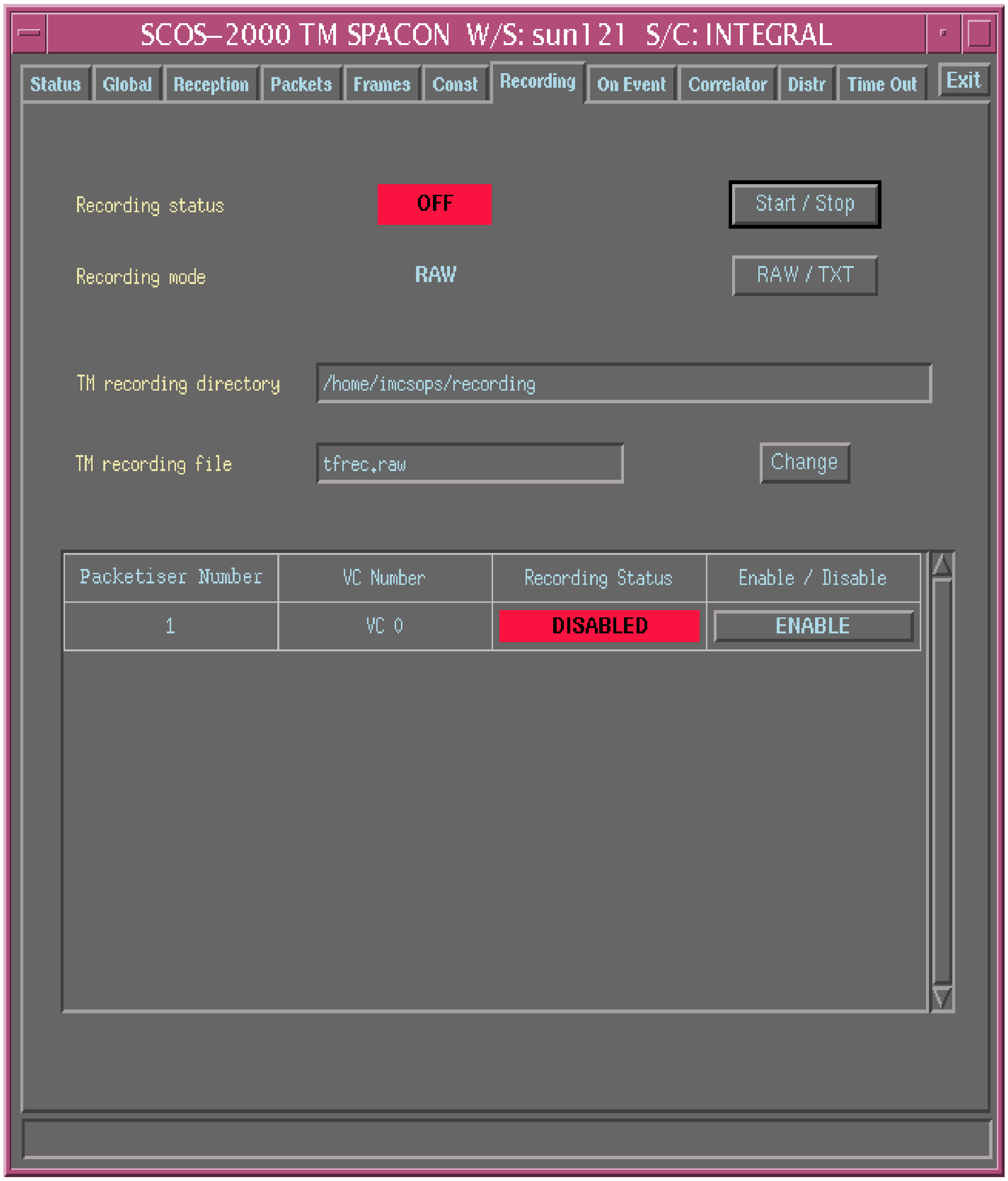
100

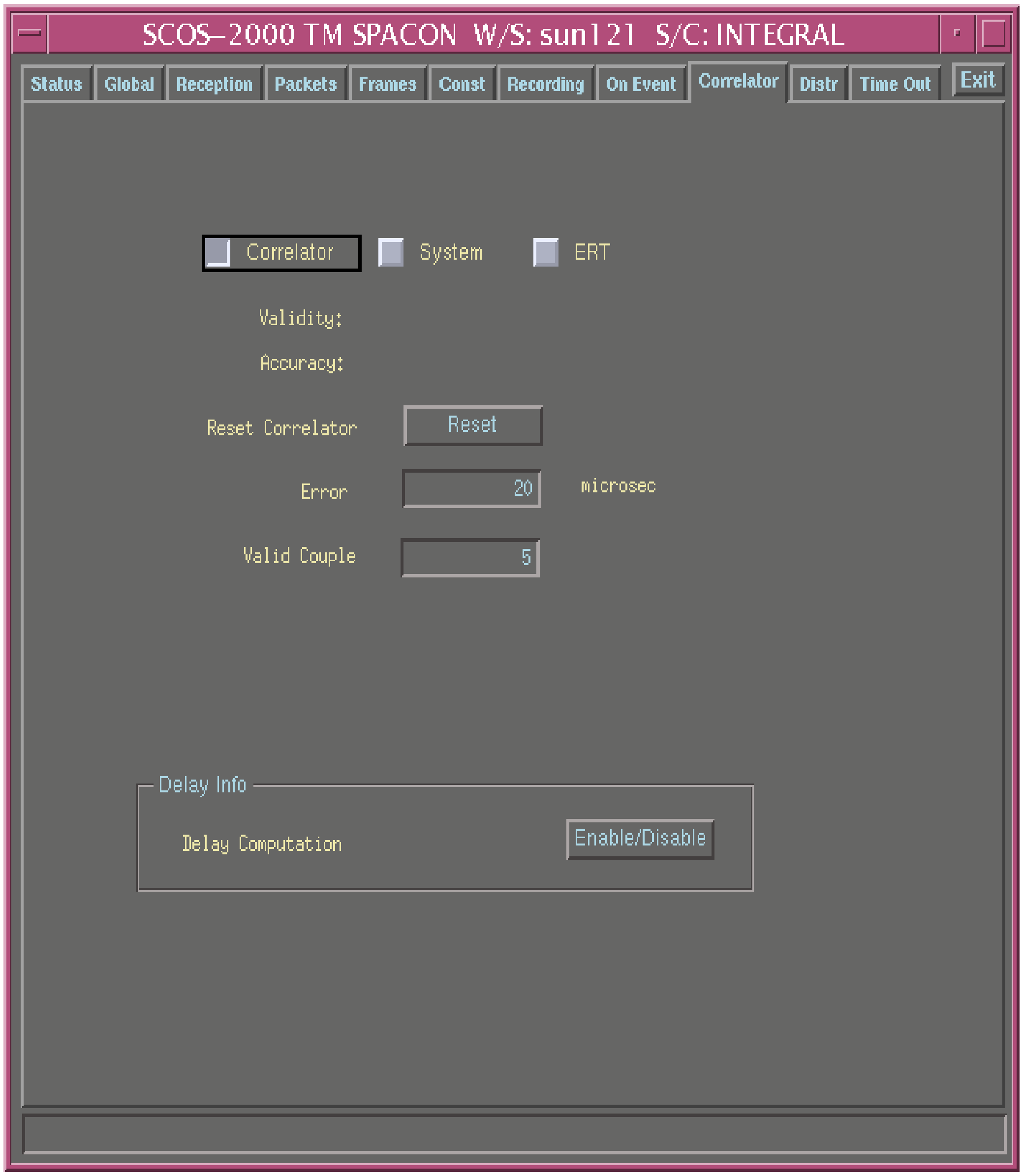
Compare constant values to printout in the (red) SPACON CONFIGURATION FOLDER.

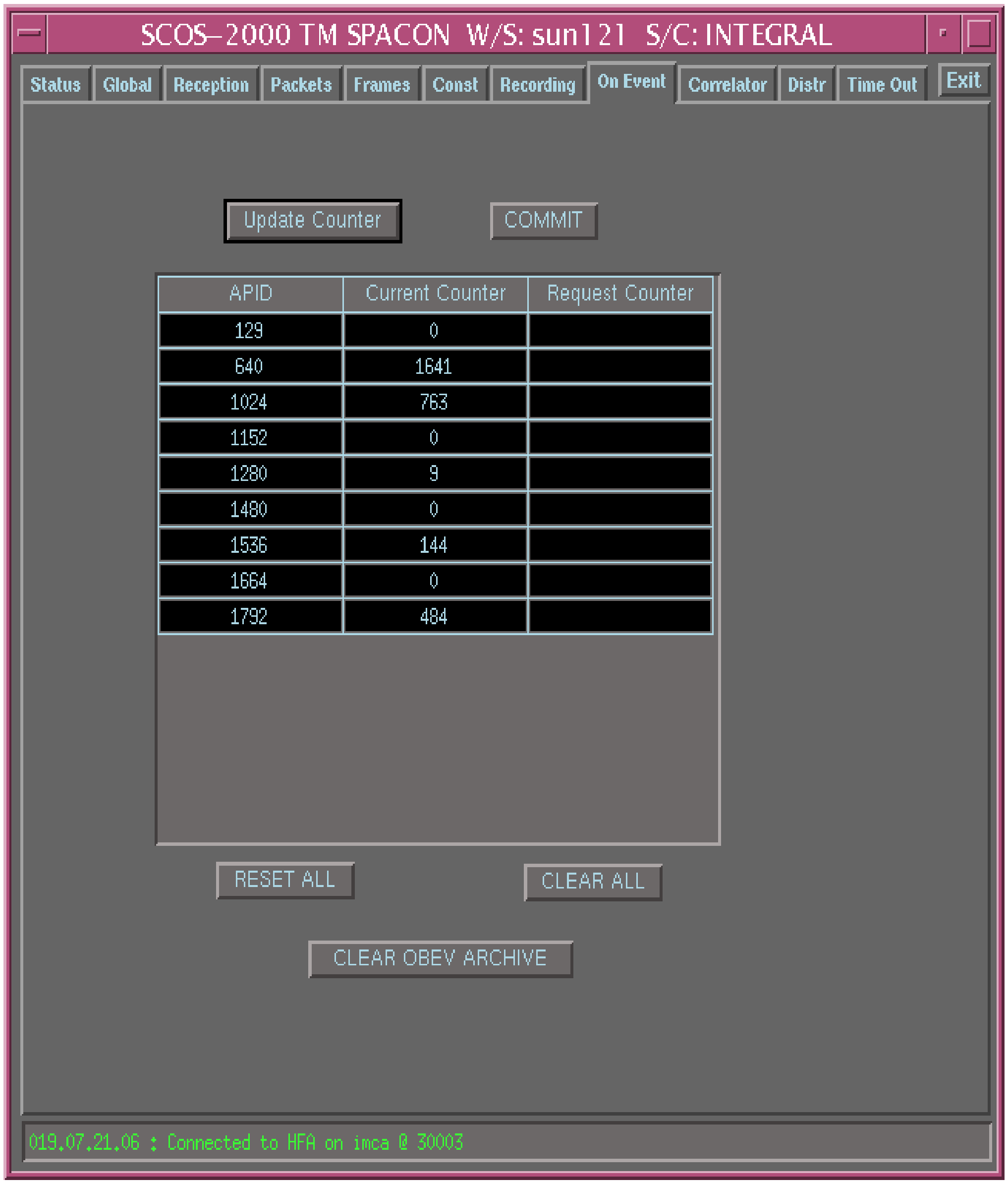
110	

SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
Transfer Frames Filing and Distribution Settings
GOOD TF
IDLE TF
Data Stream
Filing
Distribution
Filing
Distribution
Apply
Data Stream
Filing
Distribution
Filing
Distribution
Delete
Delete All
Up
Down
Commit
Cancel

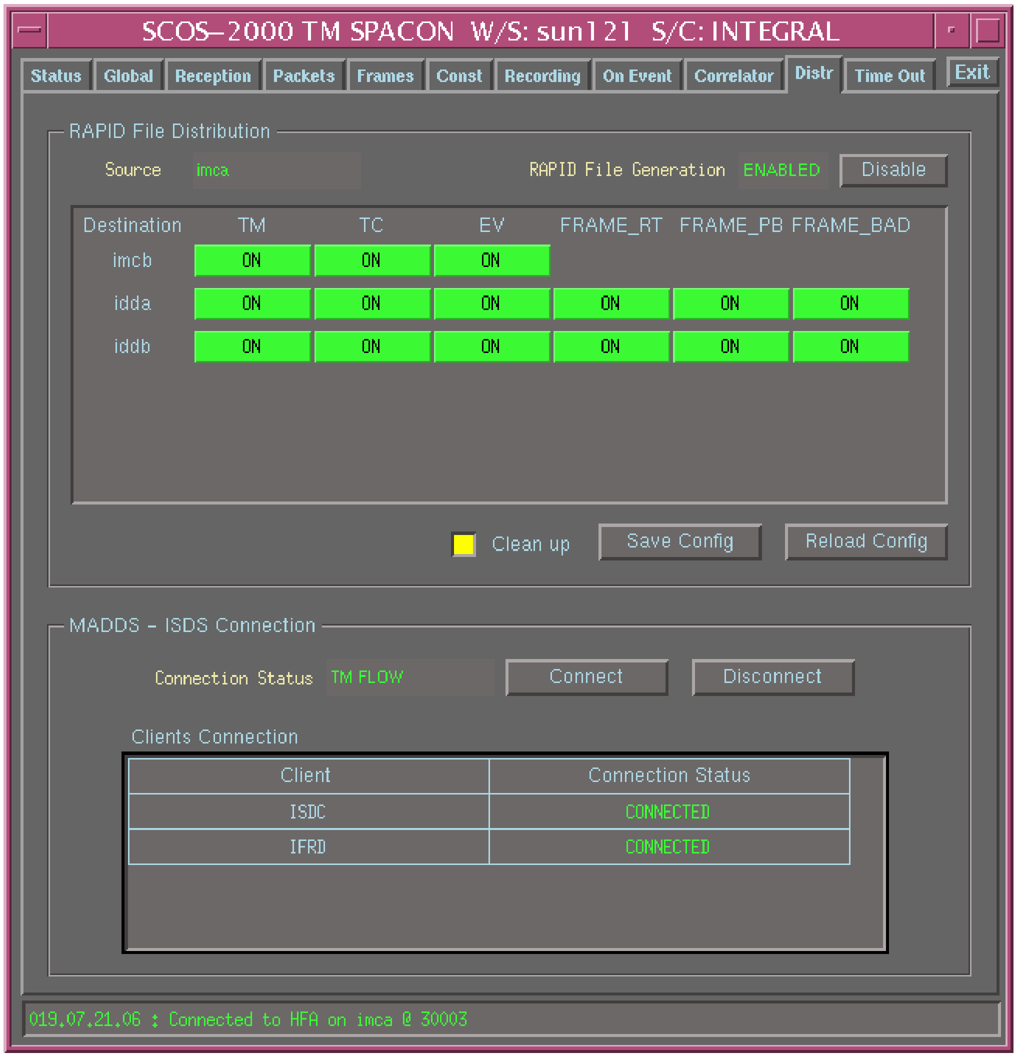
120


SCOS-2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
Recording status
OFF
Start / Stop
Recording mode
RAW
RAW / TXT
TM recording directory
/home/imcsops/recording
TM recording file
tfrec.raw
Change
Packetiser Number
VC Number
Recording Status
Enable / Disable
1
VC 0
DISABLED
ENABLE


SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
Correlator
System
ERT
Validity:
Accuracy:
Reset Correlator
Reset
Error
20
microsec
Valid Couple
5
Delay Info
Delay Computation
Enable/Disable

130	

SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL
Status
Global
Reception
Packets
Frames
Const
Recording
On Event
Correlator
Distr
Time Out
Exit
Update Counter
COMMIT
APID | Current Counter | Request Counter
129 | 0
640 | 1641
1024 | 763
1152 | 0
1280 | 9
1480 | 0
1536 | 144
1664 | 0
1792 | 484
RESET ALL
CLEAR ALL
CLEAR OBEV ARCHIVE
019.07.21.06 : Connected to HFA on imca @ 30003

140	 - **Check that “RAPID File Generation is enabled on the active chain and disabled on the backup chain** - **Check reception of data with ISDC**

150	SCOS–2000 TM SPACON W/S: sun121 S/C: INTEGRAL Status Global Reception Packets Frames Const Recording On Event Correlator Distr Time Out Exit NOT IMPLEMENTED Transfer Frame Transfer Frame Timeout DISABLED Enable/Disable Timeout value 10 sec. Commit Source Packet Timeout Checking DISABLED Enable/Disable Interval Time Checking DISABLED Enable/Disable Time-out Delay msec. Commit Interval Tolerance msec. Commit NOT IMPLEMENTED

160	Check TM distribution to PI W/S - **Confirm TM reception on PI W/S**	
170	End of procedure	

2.6.4.1.5 FCP_MCS_0005 - Opening an MMI

		Version 1.1 02/06/09
	FCP_MCS_0005 – Opening an MMI	
Step	**Description**	**Remarks**
10	Click the right mouse button and choose: SPACON → OPEN MMI → (select the machine)	

20	The following message should appear:
	
	`"Which screen would you like the MMI to appear on?"`
	
	`"(0) LEFT"`
	`"(1) CENTER"`
	`"(2) RIGHT"`
	
	Select the screen (1, 2 or 3) and press “Enter”.
		NOTES:
		The MCCM Central Monitor MMI can be run on any client workstation, but is usually started on sun129.

30	The MMI should appear on the selected screen, if it does then end the procedure here.	
40	If for any reason the MMI does not appear, you can start the MMI manually using the following steps:	

Version 1.1
02/06/09

FCP_MCS_0005 – Opening an MMI

Step	Description	Remarks
50	1. open a terminal window 2. type ‘xhost +’ 3. telnet to the remote machine (e.g. ‘telnet imca’) 4. enter username and password 5. type ‘setenv DISPLAY xxx’ 6. type ‘openMMI’	(xxx = client machine and screen - e.g. ‘sun129:0.**1**) Screen: 0 – left 1 – middle 2 - right
60	End of procedure	

2.6.4.1.6 FCP_MCS_0010 - Operations Swap IMCA to IMCB

This procedure shall be executed in case the Prime IMCS is not able to support operations.
In any case it is not allowed to stay with just one working chain. Therefore, after the operations have safely been moved to the redundant chain, the problems on the primary chain have to be fixed, the system restarted and Operations moved back to the primary chain. In case of controversy escalate the problem to the SOM

		Version 1.2 01/12/09
FCP_MCS_0010 – Operations Swap IMCA to IMCB		
Step	**Description**	**Remarks**
10	Contact on-call FD - **Inform FD on call of the operations swap**	
20	Before moving operations, check the status of the B-Chain - **Verify relevant applications running** - **Check the TM and TC SPACON settings**	→ see FCP_MCS_0004 - System status check procedure
30	On A-Chain TM SPACON “Distributor” panel: - **Disable the “RAPID File Generation”**	RAPID File Generation must never be enabled on both chains
40	On B-Chain TM SPACON “Distributor” panel: - **Enable the “RAPID File Generation”**	
50	NOTE: If the following event messages appear: “PDSserverEV - Store of Packet 100x …” This is caused by RAPID being enabled on both chains – disable RAPID on the unusedchain.	

Version 1.2
01/12/09

FCP_MCS_0010 – Operations Swap IMCA to IMCB

Step	Description	Remarks
60	Move TC/TM links to the B-Chain - **Stop the timeline on the A-Chain** - **Move all TM and TC links to B-Chain** - **IMPORTANT: Remember to send SET V(R) commands** - **Verify TC capability by sending a few test commands**	
70	Move TM delivery to FDS - **Confirm the communication of the B-Chain and FDS together with FD-Support; TM must be delivered from B-Chain client to FDS & TPF must be delivered from FDS to B-Chain client**	
80	Update Timeline with relevant TPF - **Run the SOE-Tool on FDS to update the Timeline on the B-Chain with the latest TPF** - **Verify updated values in Timeline before starting to release commands**	
90	Inform ISDC of chain swap - **CALL THE ISDC ON-CALL TELEPHONE NUMBER**	The phone number is listed on the official FCT Phone list in the SPACON config folder or on the console.
NOTE: The next steps should ONLY be executed if you are planning to stay on the B-Chain for a longer time.		
100	Contact SWS and inform them that the IFTS needs to be reconfigured	SEISRT = name of the SEIS server
110	Stop SEIS to free resources on ISDSB - **Close the Command Prompt (DOS Terminal) on SEISRT where D:\WINNT\system32\cmd.exe is running**	SEISRT = name of the SEIS server

Version 1.2
01/12/09

FCP_MCS_0010 – Operations Swap IMCA to IMCB

Step	Description	Remarks
120	Start TM delivery to ISDC - **Ask ISDC to stop the link to ISDSA** - **Ask ISDC to start the link to ISDSB** - **Ask ISDC to confirm reception of good TM**	
130	Inform the SOE on-call (during working hours) that the P/I workstations are not receiving telemetry anymore.	It is responsibility of the SOE on-call to decide if to contact the instruments SOEs to configure the P/I workstations to acquire TM from the B-Chain
140	Configure an additional client for the backup chain by restarting it as B-Chain client.	
150	End of procedure.	

2.6.4.1.7 FCP_MCS_0011 - Operations Swap IMCB to IMCA

		Version 1.2 01/12/09
FCP_MCS_0011 - Operations Swap IMCB to IMCA		
Step	**Description**	**Remarks**
10	Contact on-call FD - **Inform FD on call of the operations swap**	
20	Before moving operations, check the status of the A-Chain - **Verify relevant applications running** - **Check the TM and TC SPACON settings**	→ see FCP_MCS_0004 - System status check procedure
30	On B-Chain TM SPACON "Distributor" panel: - **Disable the "RAPID File Generation"**	RAPID File Generation must never be enabled on both chains
40	On A-Chain TM SPACON "Distributor" panel: - **Enable the "RAPID File Generation"**	
50	Move TC/TM links to the A-Chain - **Stop the timeline on the B-Chain** - **Move all TM and TC links to A-Chain** - **<u>IMPORTANT:</u> Remember to send SET V(R) commands** - **Verify TC capability by sending a few test commands**	
60	Move TM delivery to FDS - **Confirm the communication of the A-Chain and FDS together with FD-Support; TM must be delivered from A-Chain client to FDS & TPF must be delivered from FDS to A-Chain client**	

Version 1.2
01/12/09

FCP_MCS_0011 - Operations Swap IMCB to IMCA

Step	Description	Remarks
70	Update Timeline with relevant TPF - **Run the SOE-Tool on FDS to update the Timeline on the A-Chain with the latest TPF** - **Verify updated values in Timeline before starting to release commands**	
80	Start TM delivery to ISDC - **Ask ISDC to stop the link to ISDSB** - **Ask ISDC to start the link to ISDSA** - **Ask ISDC to confirm reception of good TM**	
90	Inform the SOE on-call that the P/I workstations are not receiving telemetry anymore.	
100	Configure an additional client as backup by restarting it as A-Chain client.	
110	Inform ISDC of chain swap - **CALL THE ISDC ON-CALL TELEPHONE NUMBER**	The phone number is listed on the official FCT Phone list in the SPACON config folder or on the console.
120	End of procedure.	

2.6.4.1.8 FCP_MCS_0012 - NCTRS swap to cross configuration

		Version 1.1 02/06/09
FCP_MCS_0012 - NCTRS swap to cross configuration		
Step	**Description**	**Remarks**
10	Initial status: • **IMCA connected to INCTRA / IMCB connected to INCTRB**	
20	Ask to NETWORK to move the TM and TC links to NCTRS-B	Check the status on the MMI
30	On IMCA MMI Stop the following applications: • **NCDU-Admin** • **Releaser**	
40	On IMCB MMI Stop the following applications: • **NCDU-Admin** • **Releaser**	
50	Disconnect the TM links to IMCA • **A-Chain TM-SPACON: go to the Reception panel and disconnect all links (VC0 to Packetiser, VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
60	Disconnect the TM links to IMCB • **B-Chain TM-SPACON: go to the Reception panel and disconnect all links (VC0 to Packetiser, VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
70	Connect INCTRA with B-Chain and INCTRB with A-Chain • **On the B-Chain TM-SPACON go to the Reception panel at the top and select NCTRS A (Host Name inctra)** • **On the A-Chain TM-SPACON go to the Reception panel at the top and select NCTRS B (Host Name inctrb)**	NOTE: this action will automatically re-connect the real time TM VC0 Link to the IMCS Packetiser identified as “VC-0/ONT *” on the TM SPACON Reception Panel

Version 1.1
02/06/09

FCP_MCS_0012 - NCTRS swap to cross configuration

Step	Description	Remarks
80	On IMCA MMI Start the following applications: • **NCDU-Admin** • **Releaser**	
90	On IMCB MMI Start the following applications: • **NCDU-Admin** • **Releaser**	
100	Connect the TM links to IMCA • **A-Chain TM-SPACON: go to the Reception panel and connect all links (VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
110	Connect the TM links to IMCB • **B-Chain TM-SPACON: go to the Reception panel and connect all links (VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
120	Final status: • **IMCA connected to INCTRB / IMCB connected to INCTRA**	
130	Ask NETWORK to start TM and TC Links as needed	
140	Check functionality of system - **SYSTEM_STATUS_CHECK_procedure**	
150	End of procedure	

2.6.4.1.9 FCP_MCS_0013 - NCTRS swap to nominal configuration

		Version 1.1 02/06/09
	FCP_MCS_0013 - NCTRS swap to nominal configuration	
Step	**Description**	**Remarks**
10	Initial status: • **IMCB connected to INCTRA / IMCA connected to INCTRB**	
20	Ask to NETWORK to move the TM and TC links to NCTRS-A	Check the status on the INCTRA MMI
30	On IMCA MMI Stop the following applications: • **NCDU-Admin** • **Releaser**	
40	On IMCB MMI Stop the following applications: • **NCDU-Admin** • **Releaser**	
50	Disconnect the TM links to IMCA • **A-Chain TM-SPACON: go to the Reception panel and disconnect all links (VC0 to Packetiser, VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
60	Disconnect the TM links to IMCB • **B-Chain TM-SPACON: go to the Reception panel and disconnect all links (VC0 to Packetiser, VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
70	Connect INCTRA with A-Chain and INCTRB with B-Chain • **On the A-Chain TM-SPACON go to the Reception panel at the top and select NCTRS A (Host Name inctra)** • **On the B-Chain TM-SPACON go to the Reception panel at the top and select NCTRS B (Host Name inctrb)**	NOTE: this action will automatically re-connect the real time TM VC0 Link to the IMCS Packetiser identified as “VC-0/ONT *” on the TM SPACON Reception Panel

Version 1.1
02/06/09

FCP_MCS_0013 - NCTRS swap to nominal configuration

Step	Description	Remarks
80	On IMCA MMI Start the following applications: • **NCDU-Admin** • **Releaser**	
90	On IMCB MMI Start the following applications: • **NCDU-Admin** • **Releaser**	
100	Connect the TM links to IMCA • **A-Chain TM-SPACON: go to the Reception panel and connect all links (VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
110	Connect the TM links to IMCB • **B-Chain TM-SPACON: go to the Reception panel and connect all links (VC0/7 Realtime, VC0/7 Playback and Bad Frames)**	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
120	Final status: • **IMCA connected to INCTRA / IMCB connected to INCTRB**	
130	Ask NETWORK to start TM and TC Links as needed	
140	Check functionality of system - **SYSTEM_STATUS_CHECK_procedure**	
150	End of procedure	

FCP_MCS_0014 - Connecting a TM Simulator to an Operational Chain

While connecting a TM Simulator ("Sim 68"; PSS used at the stations) to an operational chain **it is fundamental that the simulated telemetry it is not going to contaminate the Satellite TM Archives**. Scope of this procedure is avoiding this event to occur.

Version 1.1
02/06/09

FCP_MCS_0014 - Connecting a TM Simulator to an Operational Chain

Step	Description	Remarks
10	Procedure start	**IMPORTANT:** **The following steps shall be executed on the chain that will be connected to the simulator**.
20	Note: If a PSS is to be used the Spacecraft ID needs to be changed in the MISCconfig file and the server needs to be restarted.	**This change should only be performed by an Analyst or by SWS.**
30	On TM SPACON "Distributor" Panel disable the: • **RAPID File Generation**	Note that the RAPID File Generation shall be enabled only on the Chain in use to conduct the satellite operations. Therefore on IMCB and IMCC is normally already disabled.
40	On TM SPACON "Global" Panel disable the: • **TM Packets Filing**	
50	On TM SPACON "Reception" Panel disable the: • **Telemetry Distributor Link** o VC0 Realtime o VC7 Realtime o VC0 Playback o VC7 Playback o Bad Frames	Check the effective status on the NCTRS MMI. (The indication on TM-SPACON may be inconsistent. To refresh them swap on another TM SPACON panel and back on the Reception one.)
60	After the execution of the steps 20 to 40 the chain is ready to be used in conjunction with a simulator.	

Version 1.1
02/06/09

FCP_MCS_0014 - Connecting a TM Simulator to an Operational Chain

Step	Description	Remarks
70	At the end of the test, after that the simulator has been disconnected from the IMCS, restore the original system configuration.	
80	Check functionality of system by running the: • **SYSTEM_STATUS_CHECK_procedure**	
90	End of procedure	

2.6.4.1.10 FCP_MCS_0015 - REDU – LCTF Start-up

Version 1.1
02/06/09

FCP_MCS_0015 - REDU – LCTF Start-up

Step	Description	Remarks
10	Power up IWSR2 (MCS/MPS client), IMCR2 (MCS server) INCTRR2 (NCTRS client) and NCPIR1 (printer).	NOTE: IMCR2 and INCTRR2 are mounted in the server rack.
20	Login as **imcsops** on IMCR2. Open a terminal and confirm the query to start SERVER APPLICATIONS with “Y”. Once all applications are running, start the RELEASER APPLICATION manually.	NOTE: IFTS instances MCS, OBS and OSS should come up automatically with the execution of the start procedure.
30	Login as **imcsops** on IWSR2. Open a terminal and confirm the query to start CLIENT APPLICATIONS with “Y”. Login to the SCOS-Desktop with a SPACON account and start all relevant TC/TM applications on the centre and the right screen.	NOTE: Only the imcsops account on IWSR2 is configured to run the start procedure. NOTE: IFTS instances MPS should come up automatically with the execution of the start procedure.
40	Disable access control for X. Open a terminal on IWSR2 and enable access control: **% xhost +**	NOTE: This is necessary to display the NCTRS MMI on IWRS2.

Version 1.1
02/06/09

FCP_MCS_0015 - REDU – LCTF Start-up

Step	Description	Remarks
50	Open a terminal on the left screen on IWSR2 and telnet to INCTRR2: **% telnet inctrr2** Login as **nctrsops** on INCTRR2. Start the NCTRS application: **% NCTRSstart OVERVIEW** Login as **network** and press the INTEGRAL button to start relevant applications.	NOTE: The passwords to access INCTRR2 and to login to the NCTRS application are required.
60	Select the printer NCPIR1 on the SCOS-Desktop.	
70	End of procedure.	

2.6.4.2 Recovery Procedures

2.6.4.2.1 CRP_MCS_0001 - Management of a failure on IMCA

		Version 1.2 01/12/09
CRP_MCS_0001 - Management of a Failure on IMCA		
Step	**Description**	**Remarks**
10	Identify the kind of error: - **If it is just a SCOS application that died: Restart the application (If possible, on the IMCS MMI print the log of a faulty application) and continue operation from the A-Chain > Report the event on the SPACON Logbook trying to give as much details as it is possible, >End of Procedure** - **If it is a more complex situation continue with the following steps**	NOTE: A-Chain = prime, B-Chain = backup
20	Execute the procedure: - **Swap operations from Prime to Backup IMCS** - **Once the operations are smoothly running from the B-Chain continue with the following steps**	**WARNING:** **In case you are going to restart the Primary chain without executing the procedure:** **“Swap operations from Prime to Backup IMCS”** **Contact immediately FD because it can be that the FDS GTPs are getting disconnected and shall be restarted by FD personnel**.
30	Log the error - **Write down the event log message of the error** - **Write down a verbally reported error (e.g. from CCC)**	
40	Inform ISDC of chain swap - **CALL THE ISDC ON-CALL TELEPHONE NUMBER**	The phone number is listed on the official FCT Phone list in the SPACON config folder or on the console.

Version 1.2
01/12/09

CRP_MCS_0001 - Management of a Failure on IMCA

Step	Description	Remarks
50	Try to identify error: - **SCOS applications error / Machine not responding** or - **NO-SCOS error** - **In the first, <u>or unknown,</u> case proceed with the following steps** - **Otherwise escalate the problem to the relevant specialists: SWS or/end UNIX SPOD. In case of controversy, contact the SOE on-call and ask how to proceed. Note that only the SOM or his deputy can decide to run the Operation with just one chain working.**	NO-SCOS error could be: - UNIX issues (e.g. low disk space) - H/W failures - LAN problems
60	Stop all the clients connected to the A-Chain by executing the procedure: - **Workstation Stop Procedure**	
70	Restart all IMCA applications - **Ask CCC to perform an application restart of IMCA** - **Run Workstation Start Procedure** - **Run Workstation configuration procedure** - **Run the System Status Check Procedure.** - **If the result of the check is OK and the T/L is actually running on the B-Chain, > Run the procedure: Operation Swap from Backup to Prime IMCS. > End of procedure** - **If the result of the check is not OK or if the IMCA did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.
80	Stop all the clients connected to the A-Chain by executing the procedure: – **Workstation Stop Procedure**	

Version 1.2
01/12/09

CRP_MCS_0001 - Management of a Failure on IMCA

Step	Description	Remarks
90	Reboot the IMCA server - **Ask CCC to perform a reboot of IMCA and then to perform an application restart.** - **Run Workstation Start Procedure** - **Run Workstation configuration procedure** - **Run the System Status Check Procedure.** - **If the result of the check is OK and the T/L is actually running on the B-Chain, > Run the procedure: Operation Swap from Backup to Prime IMCS. > End of procedure** - **If the result of the check is not OK or if the IMCA did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.
100	In case the problem cannot be fixed even by rebooting IMCA the problem needs to be investigate by experts: - **During working hours contact SWS and ask for an intervention.** - **Outside working our contact the SOE on-call and ask how to proceed. Note that only the SOM or his deputy can decide to run the Operation with just one chain working.**	
110	End of procedure	

2.6.4.2.2 CRP_MCS_0002 - Management of a failure on IMCB

Note:
Both chains shall be maintained in an operational state. Therefore, if during the periodic check of the IMCS it is noticed that the IMCB has got a problem, it has to be fixed.

		Version 1.2 01/12/09
	CRP_MCS_0002 - Management of a Failure on IMCB	
Step	**Description**	**Remarks**
10	Identify the kind of error: - **If it is just a SCOS application that died: Restart the application (If possible, on the IMCS MMI print the log of a faulty application) and continue operation from the A-Chain > Report the event on the SPACON Logbook trying to give as much details as it is possible, >End of Procedure** - **If it is a more complex situation continue with the following steps**	NOTE: A-Chain = prime, B-Chain = backup
20	Log the error - **Write down the event log message of the error** - **Write down a verbally reported error (e.g. from CCC)**	
30	Try to identify error: - **SCOS applications error / Machine not responding** or - **NO-SCOS error** - **In the first, <u>or unknown,</u> case proceed with the following steps** - **Otherwise escalate the problem to the relevant specialists: SWS or/end UNIX SPOD. In case of controversy, contact the SOE on-call and ask how to proceed. Note that only the SOM or his deputy can decide to run the Operation with just one chain working.**	NO-SCOS error could be: - UNIX issues (e.g. low disk space) - H/W failures - LAN problems

Version 1.2
01/12/09

CRP_MCS_0002 - Management of a Failure on IMCB

Step	Description	Remarks
40	Stop all the clients connected to the B-Chain by executing the procedure: - **Workstation Stop Procedure**	
50	Restart all IMCB application - **Ask CCC to perform an application restart of IMCB** - **Run Workstation Start Procedure** - **Run Workstation configuration procedure** - **Run the System Status Check Procedure.** - **If the result of the check is OK > End of procedure** - **If the result of the check is not OK or if the IMCB did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.
60	Stop all the clients connected to the B-Chain by executing the procedure: - **Workstation Stop Procedure**	
70	Reboot the IMCB server - **Ask CCC to perform a reboot of IMCA and then to perform an application restart.** - **Run Workstation Start Procedure** - **Run Workstation configuration procedure** - **Run the System Status Check Procedure.** - **If the result of the check is OK > End of procedure** - **If the result of the check is not OK or if the IMCB did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.

Version 1.2
01/12/09

CRP_MCS_0002 - Management of a Failure on IMCB

Step	Description	Remarks
80	In case the problem cannot be fixed even by rebooting IMCA the problem needs to be investigated by experts: - **During working hours contact SWS and ask for an intervention.** - **Outside working our contact the SOE on-call and ask how to proceed. Note that only the SOM or his deputy can decide to run the Operation with just one chain working.**	
90	End of procedure	

2.6.4.2.3 CRP_MCS_0003 - Management of a Failure on IDDA/B

Note:
Thanks to RAPID, if IDDA is down only the real time generation function of the auxiliary files is not available, while no archive data is lost. For this reason, if an unrecoverable failure occurs on IDDA, the machine can be left down for a maximum of 48 h.

Version 1.2
03/08/10

CRP_MCS_0003 - Management of a Failure on IDDA/B

Step	Description	Remarks
10	Identify the kind of error: - **If it is just a SCOS application that died: Restart the application (If possible, on the IDDS MMI print the log of a faulty application) and continue operations from the A-Chain > Report the event on the SPACON Logbook trying to give as many details as possible,** **>End of Procedure** - **If it is a more complex situation continue with the following steps**	NOTE: A-Chain = prime, B-Chain = backup
20	Log the error - **Write down the event log message of the error** - **Write down a verbally reported error (e.g. from CCC)**	

Version 1.2
03/08/10

CRP_MCS_0003 - Management of a Failure on IDDA/B

Step	Description	Remarks
30	Try to identify error: - **SCOS applications error / Machine not responding** or - **NO-SCOS error** - **In the first, <u>or unknown,</u> case proceed with the following steps** - **Otherwise escalate the problem to the relevant specialists: SWS and/or UNIX SPOD. In case the specialists are not available the machine can be left down for a maximum of 48 h before it has to be restarted. > Verify that the needed support will be available in less the 48 h and manage to have them contacted on time. Otherwise contact (Between 09:00 and 22:00) the SOE on-call and ask how to proceed.**	NO-SCOS error could be: - UNIX issues (e.g. low disk space) - H/W failures - LAN problems
40	Restart all IDDS application - **Ask CCC to perform an application restart of IDDS** - **Run the "FCP_MCS_0004 - System Status check" procedure** - **If the result of the check is OK > End of procedure** - **If the result of the check is not OK or if the IDDS did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.
50	Reboot the IDDS server - **Ask CCC to perform a reboot of IDDS and then to perform an application restart.** - **Run the "FCP_MCS_0004 - System Status check" procedure** - **If the result of the check is OK > End of procedure** - **If the result of the check is not OK or if the IDDS did not come-up correctly continue with the following steps.**	NOTE: Report the reason of the request to CCC.

Version 1.2
03/08/10

CRP_MCS_0003 - Management of a Failure on IDDA/B

Step	Description	Remarks
60	In case the problem cannot be fixed even by rebooting IDDS the problem needs to be investigate by experts: - **During working hours contact SWS and ask for an intervention.** - **In case the specialist are not available the machine can be let down for a maximum of 48 h before it has to be restarted. > Verify that the needed support will be available in less the 48 h and manage to have them contacted on time. Otherwise contact (Between 09:00 and 22:00) the SOE on-call and ask how to proceed.**	
70	End of procedure	

2.6.4.2.4 CRP_MCS_0004 - NO TM delivery to ISDC or PI Stations

		Version 1.2 03/08/10
CRP_MCS_0004 - NO TM delivery to ISDC or PI Stations		
Step	**Description**	**Remarks**
10	Click the right mouse button and choose: SPACON → SHUTDOWN SERVER → ISDSA	

20	The following message should appear:
	
	`“Stopping ISDS and IFRD on isdsa”`
	`“Please enter the password:”`
	
	Type in the password and press “Enter”.	

30	Click the right mouse button and choose: SPACON → START SERVER → ISDSA	
40	A window will appear showing the start-up information. ISDS will start first, then after 1 minute IFRD will start.	
50	In case it was not possible to establish the link with ISDC try a second time. If the problem still persists continue with the following steps.	
60	Restart all applications on ISDSA - **Ask CCC to perform an application restart on ISDSA**	In case they cannot find the appropriate procedure: - **Ask CCC to restart ISDS and IFRD on ISDSA**
70	If this fixed the problem end the procedure here, otherwise continue with the following steps:	

Version 1.2
03/08/10

CRP_MCS_0004 - NO TM delivery to ISDC or PI Stations

Step	Description	Remarks
80	Reboot the ISDSA server - **Ask CCC to perform a reboot of ISDSA**	
90	Start TM delivery to ISDC - **Ask CCC to start ISDS on ISDSA**	**Never start ISDS and IFRD at the same time**
100	Wait 5 minutes	
110	Start TM delivery to PI W/S - **Ask CCC to start IFRD on ISDSA**	
120	- **Execute PI W/S IREM start TM procedure** - **Execute PI W/S IBIS start TM procedure**	
130	In case it was not possible to establish the link with ISDC Continue with the following steps.	
140	Inform ISDC about the problems and ask them to swap to B-chain - **CALL THE ISDC ON-CALL TELEPHONE NUMBER**	The phone number is listed on the official FCT Phone list in the SPACON config folder and on the console.
150	Start TM delivery to ISDC - **Ask NETWORK to connect VC-0 & VC-7 to NCTRS-B** - **Ask ISDC to connect to ISDSB** - **Ask ISDC to confirm reception of good TM**	
160	Inform (Between 09:00 and 22:00) the SOE on-call that the P/I workstations are not receiving telemetry anymore.	It is responsibility of the SOE on-call to decide if to contact the instruments SOEs to configure the P/I workstations to acquire TM from the B-Chain

Version 1.2
03/08/10

CRP_MCS_0004 - NO TM delivery to ISDC or PI Stations

Step	Description	Remarks
170	As soon as working hours start, inform SWS about the problem and ask for an intervention.	
180	When ISDSA is back online ask SWS to re-establish the nominal connectivity configuration.	
190	End of procedure	

2.6.4.2.5 CRP_MCS_0005 - PI W/S IREM – start TM procedure

		Version 1.1 02/06/09
	CRP_MCS_0005 - PI W/S IREM - start TM	
Step	**Description**	**Remarks**
10	Unlock screensaver **- User: Administrator** **- Password: xxx**	
20	IREM EGSE application is not running - **Double click the desktop icon IREM_realtime**	NOTE: If the application is minimized the name on the taskbar is [ExAnIREM]
30	IREM EGSE application is running but not receiving TM - **Press [Disconnect]** - **Press [init & reconnect]** - **Confirm TM reception in log window** - **Press [Current Graphs]** - **Press [Running Charts]** - **If TM doesn’t start inform the SOE on-call**	NOTE: [Disconnect] and [init & reconnect] are the same button with a changing label NOTE: Sometimes the initialisation doesn’t work with the first attempt. Try then to press [Disconnect] and [init & reconnect] twice.
40	End of procedure	

2.6.4.2.6 CRP_MCS_0006 - PI W/S IBIS – start TM procedure

		Version 1.1 02/06/09
	CRP_MCS_0006 - PI W/S IBIS - check TM	
Step	**Description**	**Remarks**
10	Unlock screensaver **- User: ecoe** **- Password: xxx**	
20	Check TM reception - **On DESKTOP – Console go to TERMINAL – Telemetry Transponder** - **The number of "sent bytes" should increment** - **If it is not incrementing inform the SOE on-call**	
30	End of procedure	

2.6.4.2.7 CRP_MCS_0007 - No TPF transfer from FDS procedure

		Version 1.1 02/06/09
CRP_MCS_0007 - No TPF transfer from FDS		
Step	**Description**	**Remarks**
10	Re-start of IFTS on IMCA/B - **ask CCC to re-start IFTS_MCS on IMCA (or B)**	NOTE: Report the reason of the request to CCC. IFTS_MCS = IFTS_5
20	Check if TPF file transfer is re-established	
30	Re-start of FDS IFTS - **ask CCC to re-start IFTS_FDS on ofs_nfs2**	IFTS_FDS = IFTS_2
40	Check if TPF file transfer is re-established: If it is not contact FD on-call and ask to fix the problem	
50	During working hours inform FD about the occured problem	
60	End of procedure	

2.6.4.2.8 CRP_MCS_0008 - Auxiliary Files Not Delivered to ISDC

Version 1.1
02/06/09

CRP_MCS_0008 - Auxiliary Files Not Delivered to ISDC

Step	Description	Remarks
10	Verify that the TPF files are correctly transferred from FDS Flight Dynamics Machine. If the TPF are correctly transferred from FDS to IMCS: Continue Otherwise run the relevant procedure:” No TPF transfer from FDS procedure”	This because the source of the AUX File is the FDS.
20	Report to CCC about the problem	
30	Ask CCC operator to **restart IFTS_MOC** (IFTS 0) task on “**idda**”	
40	Verify that the TPF files are transferred to ISDC machine. If Yes = End of procedure. If Not = Continue with the following steps	
50	Ask CCC operator to **restart IFTS_IMC** (IFTS 1) task on “**idda**”	
60	Verify that the TPF files are transferred to ISDC machine. If Yes = End of procedure. If Not = Continue with the following steps	
70	Ask CCC operator to **restart IFTS_SDS** (IFTS 0) task on “**isdsa**” machine	
80	Verify that the TPF files are transferred to ISDC machine. If Yes = End of procedure. If Not = Continue with the following steps	

Version 1.1
02/06/09

CRP_MCS_0008 - Auxiliary Files Not Delivered to ISDC

Step	Description	Remarks
90	Inform ISDC that they are going to lose the TM	
100	Ask CCC to: – Stop all the application running on isdsa – Reboot the isdsa machine – Restart all the isdsa application	
110	Verify that the relevant IMCS error messages are gone.	
120	Verify with ISDC operator that the TM flow is re-established and that the TPF are passed.	
130	Ask to the SOE to close and reopen the connection on the PI stations	
140	**If the problem is fixed** log the problem and produce an Anomaly Report. **Otherwise continue the procedure**	
150	Run the procedure: “Management of a Failure on IDDA/B Procedure ”	
160	Verify that the relevant IMCS error message are gone	
170	Verify with ISDC operator that the TM flow is re-established and that the Auxiliary files are passed.	
180	End of procedure	

2.6.4.2.9 CRP_MCS_0009 - Manual OLF generation procedure

		Version 1.1 02/06/09
	CRP_MCS_0009 - Manual OLF generation	
Step	**Description**	**Remarks**
10	Open a terminal	
20	Login to IDDA as imcsops **% telnet idda**	
30	Go to the directory MADDS /admin **% cd MADDS /admin** Generate missing/incomplete OLF file **% ./MADDSB.OLFmanual yyyy-mm-ddThh:mm:ssZ**	NOTE: The directory MADDS /admin is in the HOME directory of the IMCSOPS account: */home/imcsops /MADDS /admin* EXAMPLE: **% ./MADDSB.OLFmanual 2006-06-09T02:00:00Z** This command would produce an OLF file from 01:00z – 02:00z for the 09.06.2006.
40	Go to the directory MADDS /aux **% cd ../aux** Check manually generated OLF **% ls -lrt**	NOTE: The directory MADDS /aux is in the HOME directory of the IMCSOPS account: */home/imcsops /MADDS /aux* NOTE: Confirm reception and content of OLF file with ISDC.
50	Logoff from IDDA **% exit**	

Version 1.1
02/06/09

CRP_MCS_0009 - Manual OLF generation

Step	Description	Remarks
60	Close the terminal **% exit**	
70	End of procedure	

2.6.5 INTEGRAL Database

2.6.5.1 Introduction

The INTEGRAL databases managed by the team analyst are 5:

- **IODB**: INTEGRAL Operational Database. It is installed on the INTEGRAL Mission Control System and it is maintained by an editor running on the INTEGRAL T/S
- **FOPGEN Database**: INTEGRAL Procedure Editor DB. It contains the part of the IODB that the system needs to access to construct / compile the Commands Sequences. A part of the FOPGEN Database, the sequences related tables are assembled by FOPGEN itself.
- **ISDC Database**: Copy of the IODB in ACCESS 97 format containing also the Science Packet and the TM Parameters Long Description imported by the SDB (Satellite Database provided by the industry and not used for operations)
- **Database Handbook**: Copy of the IODB to be delivered to the Mission Control Team to allow them to investigate / query the Operational Database without accessing the Master IODB
- **Event Designator Database**: Contains part of the IODB. In particular it contains all the DB tables needed by ISOC to execute their part of Mission Planning (Generating the POS). It contains all the commands and sequences related tables

In Operations, the IODB is the “master DB” from which all the other DBs are derived. It is derived from the industry SDB (Satellite Database) + MOC user defined modifications. And it is compliant with the MIB ICD SCOS 2000 Release 3.0.

2.6.5.2 Procedures

2.6.5.2.1 FCP_ODB_0001 - Import a new IODB on C-Chain

		Version 1.1 02/06/09
FCP_ODB_0001 - Import a new IODB on C-Chain		
Step	**Description**	**Remarks**
10	On the INTEGRAL T/S empty directories: *D:\INTEGRAL\PRIVAT\DATABASE\iodb\ExportFiles* *D:\INTEGRAL\PRIVAT\DATABASE\iodb\ExportFOP* *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Synpara*	
20	Run MASTER-EDITOR on TS (Icon on desktop) Click button: **Utilities -> Export all Database Tables**	
30	Run the Consistency Check on the T/S MASTER-EDITOR Click button: **Utilities -> Consistency Check**	Corrections of db or rollback due to consistency check result.
40	In case any new errors are shown fix errors and go back to step 10, otherwise continue with the following steps.	
50	Create opsdata zip file - Zip all files in: *D:\INTEGRAL\PRIVAT\DATABASE\iodb\ExportFiles* as: *opsdata_yyyy_mm_dd*	
60	Create opssyn zip file - Zip all files in: *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Synpara* as: *opssyn_yyyy_mm_dd*	

Version 1.1
02/06/09

FCP_ODB_0001 - Import a new IODB on C-Chain

Step	Description	Remarks
70	Ftp zip files from the T/S to the one of the C-Chain machine on the directories: *opsdata_yyyy_mm_dd.zip* → ***/home/imcsdb/ASCII*** *opssyn_yyyy_mm_dd.zip* → ***/home/imcsdb/ASCII***	
80	On the selected machine open a terminal window and login as **imcsops**	
90	Stop all the SCOS applications running on the selected machine, either from the Application Launcher, or by running the script: **% Shutdown**	
100	On the selected machine open a second terminal window and login as **imcsdb**	
110	Using the terminal logged in as **imcsdb** - delete all files from the directory: **/home/imcsdb/ASCII/synthetic**	
120	Copy the file: *opssyn_yyyy_mm_dd.zip* to the directory: **/home/imcsdb/ASCII/synthetic**	
130	Unzip the file: *opssyn_yyyy_mm_dd.zip* located in the directory: **/home/imcsdb/ASCII/** by using the unix command: **% unzip –a <filename>**	

Version 1.1
02/06/09

FCP_ODB_0001 - Import a new IODB on C-Chain

Step	Description	Remarks
140	Delete the copied *opssyn_yyyy_mm_dd.zip* file from the directory **/home/imcsdb/ASCII/synthetic**	
150	Unzip the file: **opsdata_yyyy_mm_dd.zip** located in the directory: **/home/imcsdb/ASCII** by using the unix command: **% unzip –a <filename>**	Overwrite all the existing files Open the VDF table to check that it is the right release
160	Close the terminal window which is logged in as **imcsdb**	
170	Select the terminal window which is logged in as **imcsops**	
180	Execute import script <IMPT> located in the directory: **/home/imcsops/admin/tools/** by executing, on the other terminal the command: **%./IMPT** Note that the <IMPT> script when logged into the machine as *imcsops* can be executed from whatever directory by executing the command: **%IMPT**	The script is importing at run-time the ASCII DB table located in the directories /home/imcsdb/ASCII and /home/imcsdb/ASCII/Synthetic.
190	The <IMPT> script is creating a log whose name is reported in the scrolling lines appearing below the entered % IMPT command	The last line of the <IMPT> script log is: “DONE” This identify that the script was completely executed.
200	When the <IMPT> completes check the produced log file for errors and warning. In case any new errors are shown, fix errors in the T/S IODB and go back to step 10, otherwise continue with the following steps.	

Version 1.1
02/06/09

FCP_ODB_0001 - Import a new IODB on C-Chain

Step	Description	Remarks
210	Ftp or copy to the other C-Chain machines the zip files from the C-Chain machine where the IODB was already successfully imported at run-time opsdata_yyyy_mm_dd.zip → **/home/imcsdb/ASCII** opssyn_yyyy_mm_dd.zip → **/home/imcsdb/ASCII**	
220	On the selected machines run this procedure from step 80	
230	At this point the IODB is imported at run-time on all the C-Chain machines. The SCOS applications can be restarted.	
240	For completeness: Start a “Telemetry Desktop”, click the button “Config” and verify on the “Database” panel that the IODB release is correct.	
250	End of procedure.	

2.6.5.2.2 FCP_ODB_0002 - Create a new IODB Release

Version 1.1
02/06/09

FCP_ODB_0002 - Create a new IODB Release

Step	Description	Remarks
10	When all the SOE have checked, on the Test Chain, that all the requested modifications have been correctly implemented, proceed with the following steps. Otherwise, in case any errors are identified, fix the errors in the INTEGRAL T/S IODB and run again the procedure: “**Import a new IODB on a Test Environment (C-Chain)”**	
20	On the INTEGRAL T/S directory: **D:\INTEGRAL\PRIVAT\DATABASE\iodb_archive** Prepare a new folder and name it: **nnnn_yyyy_mm_dd** Where: nnnn is the a progressive number identifying the release and yyyy_mm_dd is the date of the release.	
30	Write the following files: - **<IMPT> script log file** - **INTEGRAL T/S Editor log file** - **opsdata_yyyy_mm_dd.zip** - **opssyn_yyyy_mm_dd.zip** - **Master ODB**	**Mandatory:** **All the items must be the one generated after the validation of the new IODB release on the INTEGRAL Test Chain.**
40	End of procedure	

2.6.5.2.3 FCP_ODB_0003 - Distribute IODB to OPSLAN Machines

Version 1.1
02/06/09

FCP_ODB_0003 – Distribute IODB to OPSLAN Machines

Step	Description	Remarks
10	Before importing a new Database, check that the TM SPACON constant settings in TM are the same as the SPACON printout, if not then CORRECT the printout. It will be necessary to reset the TM SPACON constants after the import.	
20	After that the new DB release have been successfully installed on the C-Chain and checked by the INTEGRAL SOEs proceed with the following steps. Important Note: the following steps can be done at whatever time even during the Operations execution	
30	NOTE: If importing the new DB during perigee, after the server restart the following event messages may appear: “PDSserverEV - Store of Packet 1003 …” This is caused by RAPID being enabled on both chains – disable RAPID on the Backup chain.	
40	Ftp or copy to all the INTEGRAL OPSLAN machines the zip files of the new IODB release validated on the C-Chain opsdata_yyyy_mm_dd.zip → **/home/imcsdb/ASCII** opssyn_yyyy_mm_dd.zip → **/home/imcsdb/ASCII**	INTEGRAL OPSLAN Machines A-Chain B-Chain imca imcb idda iddb sun121 sun127 sun122 sun123 sun128 sun129 **Mandatory: Take note of the machines where the new files have been copied to avoid forgetting one.**
50	On all the machines delete all files from the directory: **/home/imcsdb/ASCII/synthetic**	**Mandatory: Take note of the machines where the synthetic have been deleted to avoid forgetting one.**

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FCP_ODB_0003 – Distribute IODB to OPSLAN Machines

Step	Description	Remarks
60	Copy on all the machine the file: **opssyn_yyyy_mm_dd.zip** from the directory: **/home/imcsdb/ASCII** to the directory: **/home/imcsdb/ASCII/synthetic**	**Mandatory: Take note of the machines where the new files have been copied to avoid forgetting one.**
70	On all the machines, unzip the file: **opsdata_yyyy_mm_dd.zip** located in the directory: **/home/imcsdb/ASCII** by using the UNIX command: **% unzip –a <filename>**	Overwrite all the existing files. Open the VDF table to check if it was unzipped the right release **Mandatory: Take note of the machines where the new opssyn files have been unzipped to avoid forgetting one.**
80	On all the machines, unzip the file: **opssyn_yyyy_mm_dd.zip** located in the directory: **/home/imcsdb/ASCII/** by using the UNIX command: **% unzip –a <filename>**	**Mandatory: Take note of the machines where the new opssyn files have been unzipped to avoid forgetting one.**
90	On the MPS in use (Namely sun128) stop all the SCOS application **except the one reported on the “Daemon” panel**.	**FDS is acquiring the AOCS telemetry from sun128 Telemetry Cash.**
100	On the MPS in use (Namely sun128) open two terminals and login as *imcsops*	
110	On one of the 2 terminals prepare the command: % tail -f	

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FCP_ODB_0003 – Distribute IODB to OPSLAN Machines

Step	Description	Remarks
120	Execute import script <IMPT> located in the directory: **/home/imcsops/admin/tools/** by executing, on the other terminal the command: **%./IMPT** Note that the <IMPT> script when logged into the machine as *imcsops* can be executed from whatever directory by executing the command: **%IMPT**	The script is importing at run-time the ASCII DB table located in the directories /home/imcsdb/ASCII and /home/imcsdb/ASCII/Synthetic.
130	The <IMPT> script is creating a log whose name is reported in the scrolling lines appearing below the entered % IMPT command. Copy the path and the name of the Import log on the side of the prepared <tail –f> command in order to monitor the correct execution of the <IMPT> script.	The last line of the <IMPT> script log is: "DONE" This is identifying that the script was completely executed.
140	After the import execution was completed, restart all the necessary SCOS applications on the MPS and inform the team Mission Planner that the system is ready to re-generate the necessary timelines with the new IODB	
150	For completeness: Start a "Telemetry Desktop", click the button "Config" and verify on the "Database" panel that the IODB release is correct.	
160	The next steps must be performed during the INTEGRAL Perigee Pass Non visibility period.	
170	As soon TM is lost at Perigee Pass, ask CCC to stop the INTEGRAL Servers: - **imca** - **imcb** - **idda** - **iddb** Reporting that the reason for the request is the new IODB installation	
180	Stop all A-Chain and B-Chain clients excluded the MPS where the new IODB release have been already been installed	The SPACON on shift can support this activity.

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FCP_ODB_0003 – Distribute IODB to OPSLAN Machines

Step	Description	Remarks
190	On all the selected machines open two terminals and login as *imcsops*	
200	On all the selected machine, on one of the 2 terminals prepare the command: % tail -f	
210	On all the selected machines execute import script <IMPT> located in the directory: **/home/imcsops/admin/tools/** by executing, on the other terminal the command: **%./IMPT** Note that the <IMPT> script when logged into the machine as *imcsops* can be executed from whatever directory by executing the command: **%IMPT**	The script is importing at run-time the ASCII DB table located in the directories /home/imcsdb/ASCII and /home/imcsdb/ASCII/Synthetic. **Mandatory: Take note of the machine where the <IMPT> script run to avoid forgetting one.**
220	The <IMPT> script is creating a log whose name is reported in the scrolling lines appearing below the entered % IMPT command. Copy the path and the name of the Import log on the side of the prepared <tail –f> command in order to monitor the correct execution of the <IMPT> script.	The last line of the <IMPT> script log is: “DONE” This is identifying that the script was completely executed.
230	At this point the IODB is imported at run-time on all the INTEGRAL OPSLAN machines.	
240	Ask to CCC to restart the INTEGRAL Servers: - **imca** - **imcb** - **idda** - **iddb**	
250	Restart all the stopped clients of both the chains	The SPACON on shift can support this activity.

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FCP_ODB_0003 – Distribute IODB to OPSLAN Machines

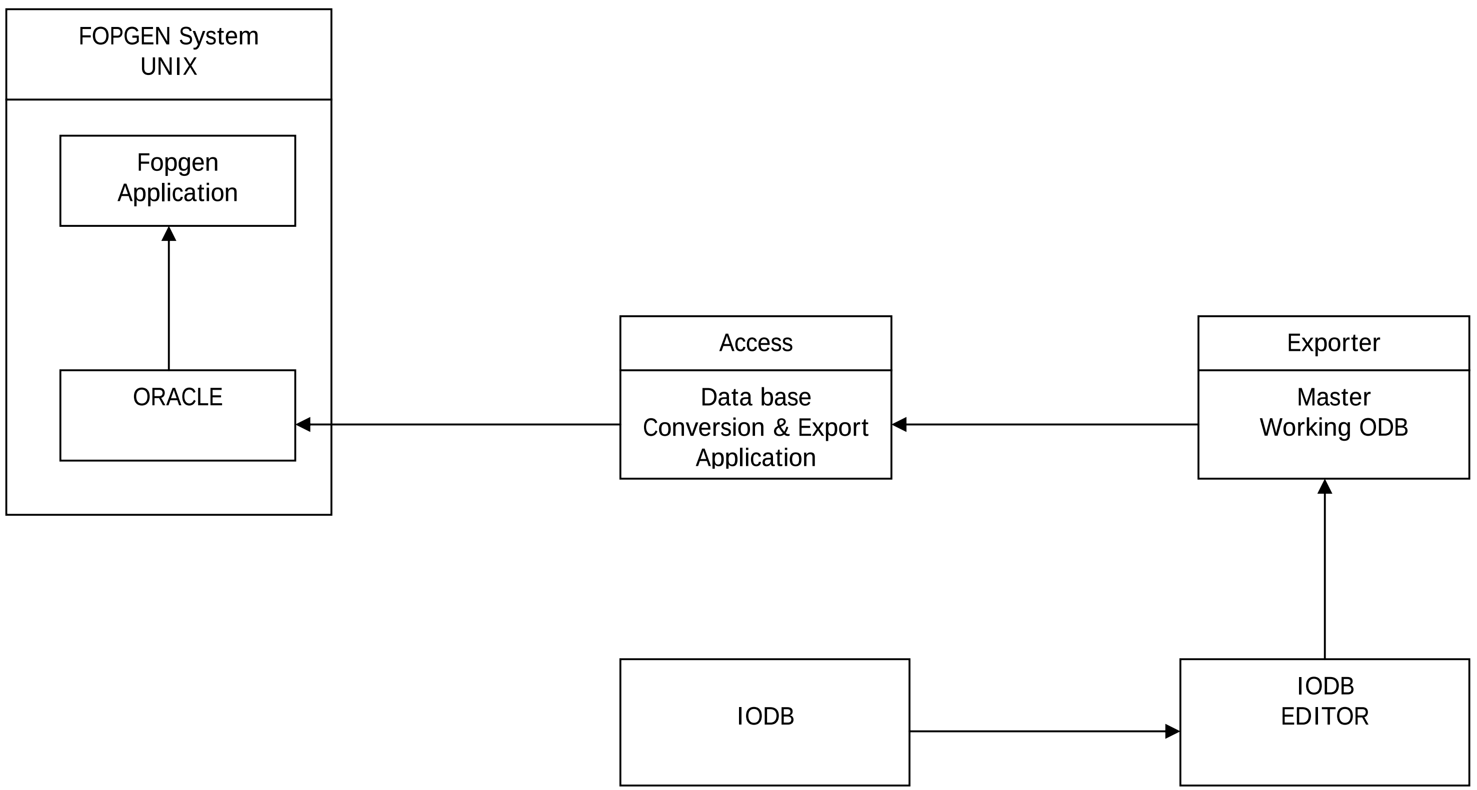
Step	Description	Remarks
260	For completeness: Start a “Telemetry Desktop”, click the button “Config” and verify on the “Database” panel that the IODB release is correct.	
270	Check the TM SPACON constants	
280	Run the procedure: “**Workstation Configuration Procedure**”	The SPACON on shift can support this activity.
290	Run the procedure: “**Workstation sun129 Configuration Procedure**”	The SPACON on shift can support this activity.
300	Run the procedure: “**System status check procedure**”	The SPACON **shall** run this procedure
310	End of procedure.	

2.6.5.2.4 FCP_ODB_0004 - Export IODB to IFOP3

IODB Tables contained in the FOPGEN DB

FOPGEN DB Tables	Tables existing in FOPGEN DB but not updated by the FOPGEN DB Tool	IODB Tables missing in FOPGEN DB
CAF DCF PRV CAP DPC PSF CCA DPF PSM CCF GPC PST CCS GPF PSV CDF MCF PTV CPC PAF PVS CPS PAS SDF CSF PCF PST CSP PDF SPF CSS PID TXF CVE PLF TXP CVP PPF VDF CVS PRF VPD	CCFEXTRA CPS OEM PID PROCEDETAILS PSM PST PSV PVS VPD (In case any of the listed tables needs to be synchronized it must to be done manually)	OCF OCP PCDF PCPC PIC SPC SPE TCP TPCF

FOPGEN DB Update Flux Diagram



FOPGEN Automatic Synchronization Procedure

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FCP_ODB_0004 – FOPGEN Automatic Synchronization

Step	Step	Description
10	Notify procedure authors that you are updating the Database	
20	Verify that no maintenance and / or modifications are under implementation and delete all files from the following folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB	Note: This step is not needed if the “Working ODB” located in the folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB It is already the last IODB release
30	**Extract the last release of *‘Master_31_IODB.mdb’* from the zip file located in:** D:\INTEGRAL\PRIVATE\DATABASE\iodb_archive\nnnn_yyyy_mm_dd **and move it to:** D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB	Note: This step is not needed if the “Working ODB” located in the folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB It is already the last IODB release
40	**Delete all files in the following folders:** ***D:\INTEGRAL\PRIVATE\DATABASE\iodb\ExportFiles*** *D:\INTEGRAL\PRIVATE\DATABASE\iodb\ExportFOP* *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Synpara*	
50	**Open the *‘Master_31._IODB.mdb’***	
60	Export the Database	

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FCP_ODB_0004 – FOPGEN Automatic Synchronization

Step	Step	Description
70	Clear FOPGEN ORACLE tables on the required machine by: Start an SQL+ prompt: --> sqlplus fopgennew/integral Delete the tables: SQL> start ClearFOPGEN.sql	Start a telnet session on the requested machine: ifop3: Login: fopgen (DEVLAN) PWD: 1fopgen
80	Exit SQL+ and the TELNET session: exit exit do you want to save? NO	
90	Run “FOPGEN”	
100	Select: “Synchronize all the remote FOPGEN Tables on ifop3”	ODBC Password: integral
110	Update version number and date	
120	After the successful completion of the synchronization run: Tools -> Database Utilities -> Compact and Repair Database…	
130	End of Procedure	

FOPGEN Manual Synchronization Procedure

To proceed manually to update the tables not automatically synchronized it is necessary before to delete the content of the FOPGEN DB tables, then the tables can be updated by the following:

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FCP_ODB_0004 – FOPGEN Manual Synchronization Procedure		
Step	**Step**	**Description**
10	Notify procedure authors that you are updating the Database	
20	Verify that no maintenance and / or modifications are under implementation and delete all files from the following folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB	Note: This step is not needed if the “Working ODB” located in the folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB It is already the last IODB release
30	**Extract the last release of *‘Master_31_IODB.mdb’* from the zip file located in:** D:\INTEGRAL\PRIVATE\DATABASE\iodb_archive\nnnn_yyyy_mm_dd **and move it to:** D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB	Note: This step is not needed if the “Working ODB” located in the folder: D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB It is already the last IODB release
40	**Delete all files in the following folders:** ***D:\INTEGRAL\PRIVATE\DATABASE\iodb\ExportFiles*** *D:\INTEGRAL\PRIVATE\DATABASE\iodb\ExportFOP* *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Synpara*	
50	**Open the *‘Master_31._IODB.mdb’***	
60	Export the Database	

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FCP_ODB_0004 – FOPGEN Manual Synchronization Procedure

Step	Step	Description
70	Start an SQL session on FOPGEN machine: Start an SQL+ prompt: --> sqlplus fopgennew/integral	Start a telnet session on the requested machine: ifop3: Login: fopgen (DEVLAN) PWD: 1fopgen
80	Delete the old table with the SQL command: SQL> delete from PID SQL> delete from VPD SQL> delete from OEM SQL> delete from CCF Extra SQL> delete from PSF Extra SQL> delete from TM_PKT_MFN_GEN	
90	Exit SQL+ and the TELNET session: exit exit do you want to save? NO	
100	Rebuild the tables by running the following queries on the FOPGEN Tool: build – fopgen – PID build – fopgen – VPD build – fopgen – OEM – Intermediate build – fopgen – OEM build – fopgen – CCF Extra build – fopgen – PSF Extra build – fopgen – TM_PKT_MFN_GEN	
110	Update version number and date	

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FCP_ODB_0004 – FOPGEN Manual Synchronization Procedure

Step	Step	Description
120	End of Procedure	

2.6.5.2.5 FCP_ODB_0005 - Import TC Sequences from IFOP3

		Version 1.1 02/06/09
FCP_ODB_0005 - Import TC Sequences from IFOP3		
Step	**Description**	**Remarks**
10	Clean following directories on TS: D:\INTEGRAL\PRIVAT\DATABASE\iodb\TC_Sequences\ D:\INTEGRAL\PRIVAT\DATABASE\iodb\IMPORT Files\	Files to delete are: CSF.txt CSP.txt CSS.txt SDF.txt
20	Ftp files from ifop3 to TS: from IFOP3: /home/fopgen/TC_SEQUENCES/ to TS: D:\INTEGRAL\PRIVAT\DATABASE\iodb\TC_Sequences\	Files to ftp are: CSF.txt CSP.txt CSS.txt SDF.txt *Id: fopgen* Pw: 1fopgen
30	Run FOPGEN on TS (Icon on desktop) Click button: Process FOPGEN Sequences Files Result: CSF.txt CSP.txt CSS.txt SDF.txt in D:\INTEGRAL\PRIVAT\DATABASE\iodb\IMPORT Files\	
40	Run MASTER-EDITOR on TS (Icon on desktop) Click button: Utilities -> Import Sequences	After importing tables from FOPGEN verify that no “- (minus)” records are written in the CCS table, CSS_ILSCOPE and/or CSS_ILSTAGE column. Inn case delete them.
50	On the INTEGRAL T/S empty directories: D:\INTEGRAL\PRIVAT\DATABASE\iodb\ExportFiles\ D:\INTEGRAL\PRIVAT\DATABASE\iodb\ExportFOP\ D:\INTEGRAL\PRIVAT\DATABASE\iodb\Synpara\	
60	Run MASTER-EDITOR on TS (Icon on desktop) Click button: **Utilities -> Export all Database Tables**	While exporting all tables the Editor will prompt: “Do you want to rebuild CCF N PARS” Just required if number of TC changed in db. After exporting verifies ASCII tables (check VDF is correct).

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FCP_ODB_0005 - Import TC Sequences from IFOP3

Step	Description	Remarks
70	Run the Consistency Check on the T/S MASTER-EDITOR Click button: **Utilities -> Consistency Check** And check the Sequences.	Corrections of db or rollback due to consistency check result.
80	In case any new errors are shown notify them to the SOE that wrote the sequences. Otherwise: End of Procedure	**Mandatory:** **In case some new errors are present on the Sequences side of the IODB, the obtained release must not be distributed on the INTEGRAL OPSLAN Machines**

2.6.5.2.6 FCP_ODB_0006 - Database Handbook Synchronization

Database Handbook Tables

CAF	DCF	PIC	SPE	TC_PARA	(From SDB)
CAP	DPC	PID	SPF	TC_PKT	(From SDB)
CCA	DPF	PLF	TCP	TC_PKT_STRUCT	(From SDB)
CCF	GPC	PPF	TPCF	TM_PARA	(From SDB)
CCS	GPF	PRF	TXF	TM_PKT	(From SDB)
CDF	MCF	PRV	TXP	TM_PKT_STRUCT	(From SDB)
CPC	OCF	PSF	VDF		
CPS	OCP	PSM	VDF_ALL		
CSF	PAF	PST	VPD		
CSP	PAS	PSV			
CSS	PCDF	PTV			
CVE	PCF	PVS			
CVP	PCPC	SDF			
CVS	PDF	SPC			

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FCP_ODB_0006 - Database Handbook Synchronization

Step	Description	Remarks
10	Verify that no maintenance and / or modifications are under implementation and delete all files from the following folder: *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB*	
20	Extract the last release of Master_31_IODB.mdb from the zip file located in: *D:\INTEGRAL\PRIVATE\DATABASE\iodb_archive\nnnn_yyyy_mm_dd* and move it to: *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB*	nnnn = incrementing number (Take the highest)

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FCP_ODB_0006 - Database Handbook Synchronization

Step	Description	Remarks
30	Run the Database Handbook. *D:\INTEGRAL\PUBLIC\DB_HANDBOOK\Database Handbook 2000.mdb*	
40	Display table layout by clicking the "*Database Window*" button.	
50	Import the new data from the Working ODB. Click to *'File'* > *'Get External Data'* and select *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Working ODB\Master_31_IODB.mdb*	
60	In the Import object Click *'Options'* and deselect *'Relationships'* from the field *'Import'*. (everything must be deselected in *'Import'*)	
70	Select all the tables to be imported (as a minimum all tables where changes where performed) and run the import.	
80	Rename the imported tables by removing the extension *'1'* If asked to remove relationships select *'Yes'*	
90	Compact the Database. *'Tools'* > *'Database Utility'* > *'Compact and Repair Database…'*	
100	Inform Integral team and others about updated version of DB_handbook via email and make it available for download (set user permissions on INTEGRAL T/S).	
110	End of Procedure	

2.6.5.2.7 FCP_ODB_0007 - ISDC Database Synchronization

ISDC Database Tables

CAF	DCF	PIC	SPE	PCF_SCIENCE
CAP	DPC	PID	SPF	PID_SCIENCE
CCA	DPF	PLF	TCP	PLF_SCIENCE
CCF	GPC	PPF	TPC	
CCS	GPF	PRF	TXF	
CDF	MCF	PRV	TXP	
CPC	OCF	PSF	VDF	
CPS	OCP	PSM	VDF_ALL	
CSF	PAF	PST	VPD	
CSP	PAS	PSV		
CSS	PCDF	PTV		
CVE	PCF*	PVS		
CVP	PCPC	SDF		
CVS	PDF	SPC		

* The Structure of the ISDC DB “PCF” table is modified respect the IODB. It contains 2 additional fields: “PCF_LONG_DESCR”, located after “PCF_SPTYPE” and “PCF_Supplementary_Information” located after “PCF_LONG_DESCR”.

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FCP_ODB_0007 - ISDC Database Synchronization

Step	Description	Remarks
10	Verify that no maintenance and / or modifications are under implementation and delete all files from the following folder: *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB*	
20	Extract the last release of Master_31_IODB.mdb from the zip file located in: *D:\INTEGRAL\PRIVATE\DATABASE\iodb_archive\nnnn_yyyy_mm_dd* and move it to: *D:\INTEGRAL\PRIVATE\DATABASE\iodb\Working ODB*	nnnn = incrementing number (Take the highest)

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FCP_ODB_0007 - ISDC Database Synchronization

Step	Description	Remarks
30	Create a copy of the ISDC Database file: *D:\INTEGRAL\PRIVATE\DATABASE\isdc\ISDC_yyyy_mm_dd.2k.mdb*	
40	Open the copy of the ISDC Database file	By using the INTEGRAL T/S
50	Import the new data from the Working ODB. Click on *'File'* > *'Get External Data'* and select: *D:\INTEGRAL\PRIVAT\DATABASE\Working ODB\Master_31_IODB.mdb*	
60	In the import object click on *'Options'* and on the *'Import'* panel deselect *'Relationships'*. (Everything must be deselected in *'Import'*)	
70	Select all the tables to be imported (as a minimum all tables where changes were performed) and run the import.	
80	Rename the imported tables by removing the extension *'1'* If asked to remove relationships select *'Yes'*	
90	Import the science data (if modified) from the Science_Packets.mdb. Click on *'File'* > *'Get External Data'* and select: *D:\INTEGRAL\PRIVAT\DATABASE\isdc\Science_Packets.mdb*	Contains the following tables: PCF_Science PID_Science PLF_Science
100	Import Long Description into PCF table: modify PCF table: add two new columns > *PCF_LONG_DESCR* and *PCF_Supplementary_Information* import PCF table from previous db (containing *PCF_LONG_DESCR, PCF_Supplementary_Information*) which will appear as PCF1 table run the update-query: *'update_query_pcf_pcf1'* delete the PCF1 table after import	

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FCP_ODB_0007 - ISDC Database Synchronization

Step	Description	Remarks
110	Compact Database. *Tools > Database Utilities > Compact and Repair Database…*	
120	Convert the Database to Access 97 format. *Tools > Database Utilities > Convert Database > to Access 97 file format* Save the new version as *D:\INTEGRAL\PRIVATE\DATABASE\isdc\ISDC_yyyy_mm_dd.mdb*	Note: Access97 version of the ISDC Database is not to contain '2k' in the filename.
130	Create a .zip file containing the new ISDC Database. *D:\INTEGRAL\PRIVATE\DATABASE\isdc\ISDC_yyyy_mm_dd.zip*	
140	Remove the old ISDC Database *D:\INTEGRAL\PRIVATE\DATABASE\isdc\ISDC_yyyy_mm_dd.2k.mdb*	
150	Ftp file as *.zip from Terminal server to FTP server: from TS: *D:\INTEGRAL\PRIVAT\DATABASE\isdc\ISDC_yyyy_mm_dd.zip* to FTP server: /private/integusr/Integral	
160	Rename the copy of the ISDC Database to *D:\INTEGRL\PRIVATE\DATABASE\isdc\ISDC_yyyy_mm_dd.2k.mdb*	
170	Inform ISDC team and others about updated version of new ISDC DB via email and make it available for download on FTP server.	Mohamed Tahar MEHARGA <Mohamed.Meharga@obs.unige.ch>, Mathias.Beck@obs.unige.ch, isdc-operator@unige.ch
180	End of Procedure	

2.6.5.2.8 FCP_ODB_0008 - Event Designator Database Synchronization

Event Designator Database Tables

CCA	CPC	PAF	SDF
CCF	CSF	PAS	VDF
CCS	CSP	PRF	
CDF	CSS	PRV	

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FCP_ODB_0008 - Event Designator Database Synchronization

Step	Description	Remarks
10	Verify that no maintenance and / or modifications are under implementation and delete all files from the following folder: *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Working ODB*	
20	Extract the last release of Master_31_IODB.mdb from the zip file located in: *D:\INTEGRAL\PRIVAT\DATABASE\iodb_archive\nnnn_yyyy_mm_dd* and move it to: *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Working ODB*	nnnn = incrementing number (Take the highest)
30	Create a copy of the Event Designator Database file: *D:\INTEGRAL\PRIVAT\DATABASE\event_designator\Event_Designator_yyyy_mm_dd.mdb*	
40	Run the Copy of the Event Designator Database. *D:\INTEGRAL\PRIVAT\DATABASE\event_designator\Event_Designator_yyyy_mm_dd.mdb*	
50	Display table layout by clicking the '*Database Window*' button.	

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FCP_ODB_0008 - Event Designator Database Synchronization

Step	Description	Remarks
60	Import the new data from the Working ODB. Click on 'File' → 'Get External Data' *D:\INTEGRAL\PRIVAT\DATABASE\iodb\Working ODB* and select: Master_31_IODB.mdb	
70	In the 'Import' Object click 'Options' and deselect 'Relationships' from the field 'Import'. (Everything must be deselected in 'Import')	
80	Select all the tables to be imported (as a minimum all tables where changes were performed) and run the import.	
90	Rename the imported tables by removing the extension 1 if asked to Remove Relationship: click 'Yes'	
100	Compact the Database. 'Tools' → 'Database Utility' → 'Compact Database'	
110	Inform ISOC team and others about updated version of ed_db via email and make it available for download on FTP server.	Add a summary of implemented changes into the email. Recipient: isocdev@sciops.esa.int
120	Ftp file as *.zip from TS to FTP server: from TS: *D:\INTEGRAL\DATABASE\event_designator\Event_Designator_yyyy_mm_dd.zip* to FTP server: /private/integral/Event Designator	
130	End of Procedure	

2.6.5.2.9 FCP_ODB_0009 – Transfer IODB to LCTF

		Version 1.0 20/10/09
	FCP_ODB_0009 - Transfer IODB to LCTF	
Step	**Description**	**Remarks**
10	Contact the on-site personnel at Redu and request them to power-on the machine 'imcr'.	NOTE: Contact details can be found in the SPACON CONFIG folder
20	The files to be copied to the LCTF machine can be found on the terminal server ESCTOSWTS02 in the following folder: *D:\INTEGRAL\PRIVATE\DATABASE\iodb_archive\xxxx_yyyy_mm_dd*	"xxxx" = IODB version number "yyyy" = year, "mm" = month, "dd" = day (e.g. 0064_2010_07_28)
30	In case the folder has not been created – or if any of the required files are not present, please follow the procedure FCP_ODB_0002	
40	Create a zip file with the full contents of the folder and name the zip file: *xxxx_yyyy_mm_dd.zip*	Use the same values for x, y, m, d as the folder name (e.g. 0064_2010_07_28.zip)
50	Copy the zip file **in binary mode** to IDDA (using ftp) to the directory /home/imcsops/tmp	
60	Copy the zip file **in binary mode** to imcr2 (using ftp) to the directory /home/imcsops/IODB_ARCHIVE	To connect to imcr2 it is necessary to enter the FQDN (i.e. "imcr2.redu.ops.esa.int")
70	Remove the zip file from the temporary directory on IDDA /home/imcsops/tmp	
80	End of Procedure	

2.6.6 Groundstation Procedures

2.6.6.1 FCP_GST_0001 – G/S handover to 'SLE'

		Version 1.1 02/06/09
	FCP_GST_0001 – G/S handover to 'SLE'	
Step	**Description**	**Remarks**
10	60 minutes before the scheduled handover: - check the time of the DEBPG200 command in the Timeline - add ~ 3 minutes to the time - ask NETWORK to bring the carrier up at that time	
20	Wait for the DEBPG200 to be uplinked and verified	Check parameter D5213 = 'HAND OVER'
30	Inform NETWORK that the last command has been uplinked	
40	Wait for NETWORK to disconnect the TC link	
50	On TC SPACON in the 'Uplink Configuration' panel - Verify that 'CLTU Mode' is selected - Select 'BD' mode - Click on 'Generate Packet'	

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02/06/09

FCP_GST_0001 – G/S handover to 'SLE'

Step	Description	Remarks
60	Load the following commands on the manual stack: - SETVR (2x) - TEST1 (2x)	
70	Wait for NETWORK to finish the handover	
80	Verify that all Links have been configured correctly ⇨ VC0 Online Timely PROCESS 10 kb/s ⇨ VC7 Online Complete PROCESS 100 kb/s ⇨ Bad Frames Online Complete PROCESS 0 kb/s	
90	Check that ONLY Transponder 1 is locked	AND: R100 R1004 'TRSP1 RX LOSTAT' = 'LOCKED' R2004 'TRSP2 RX LOSTAT' = 'UNLOCKED'
100	Verify that on both stacks (MS/AS) the LINK-status for TM and TC is displayed 'GREEN'	
110	Wait for NETWORK to 'CLEAR FOR COMMANDING'	
120	Send 1st 'SETVR' command	Verify on TC SPACON that AD service is initialised **AD INITIALISED**

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FCP_GST_0001 – G/S handover to 'SLE'

Step	Description	Remarks
130	On TC SPACON in the 'Uplink Configuration' panel - Change the uplink VC ID (0 or 7) - Click on 'Generate Packet'	
140	Send 2nd 'SETVR' command	Verify on TC SPACON that AD service is initialised **AD INITIALISED**
150	Send 1st TEST1 ('LINK TEST') command	D5024 'NUM TCPS GND' = increased by 1
160	On TC SPACON in the 'Uplink Configuration' panel - Change back the uplink VC ID (0 or 7) - Click on 'Generate Packet'	
170	Send 2nd TEST1 ('LINK TEST') command	D5024 'NUM TCPS GND' = increased by 1
180	Inform NETWORK if test commands were successful or failed	

2.6.6.2 FCP_GST_0002 – G/S handover to 'non SLE'

		Version 1.1 02/06/09
FCP_GST_0002 – G/S handover to 'non SLE'		
Step	**Description**	**Remarks**
10	60 minutes before the scheduled handover: - check the time of the DEBPG200 command in the Timeline - add ~ 3 minutes to the time - ask NETWORK to bring the carrier up at that time	
20	Wait for the DEBPG200 to be uplinked and verified	Check parameter D5213 = 'HAND OVER'
30	Inform NETWORK that the last command has been uplinked	
40	Wait for NETWORK to disconnect the TC link	
50	On TC SPACON in the 'Uplink Configuration' panel - Select 'Packet Mode' - Select 'AD' mode - Click on 'Generate Packet'	
60	Load the following commands on the manual stack: - TEST1 (2x)	

Version 1.1
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FCP_GST_0002 – G/S handover to 'non SLE'

Step	Description	Remarks
70	Wait for NETWORK to finish the handover	
80	Verify that all Links have been configured correctly ⇨ VC0 Online Timely PROCESS 10 kb/s ⇨ VC7 Online Complete PROCESS 100 kb/s ⇨ Bad Frames Online Complete PROCESS 0 kb/s	
90	Check that ONLY Transponder 1 is locked	AND: R100 R1004 'TRSP1 RX LOSTAT' = 'LOCKED' R2004 'TRSP2 RX LOSTAT' = 'UNLOCKED'
100	Verify that on both stacks (MS/AS) the LINK-status for TM and TC is displayed 'GREEN'	
110	Wait for NETWORK to 'CLEAR FOR COMMANDING'	
120	Verify on TC SPACON that AD service is initialised	**AD INITIALISED**
130	Send 1st TEST1 ('LINK TEST') command	D5024 'NUM TCPS GND' = increased by 1
140	On TC SPACON in the 'Uplink Configuration' panel - Change the uplink VC ID (0 or 7) - Click on 'Generate Packet' - Click on 'Generate Packet'	

Version 1.1
02/06/09

FCP_GST_0002 – G/S handover to 'non SLE'

Step	Description	Remarks
150	Verify on TC SPACON that AD service is initialised	**AD INITIALISED**
160	Send 2nd TEST1 ('LINK TEST') command	D5024 'NUM TCPS GND' = increased by 1
170	On TC SPACON in the 'Uplink Configuration' panel - Change back the uplink VC ID (0 or 7) - Click on 'Generate Packet'	
180	Inform NETWORK if test commands were successful or failed	

2.6.7 SPACON procedures

2.6.7.1 FCP_SPA_0001 – SPACON shift handover procedure

This section provides a checklist of activities that are to be carried out at each SPACON shift handover.

Version 1.1

Step	Actionee	Description
1	SPACON	On-Shift SPACON will arrive at least 15 minutes before the shift handover is planned.
2	SPACON	Off-Shift SPACON will report details of any nominal and/or special events that have occurred during their shift.
3	SPACON	On-Shift SPACON will examine the digilog to check what activity has occurred since their last shift
4	SPACON	On-Shift SPACON will examine the timeline to make themselves aware of any nominal/special events planned for their upcoming shift
5	SPACON	On-Shift SPACON will assess the operational status of the A and B Chains by running the procedure: “System Status Check” **Note: <u>After the H/O the On-Shift SPACON will check periodically the operational status of the chain not in use to guarantee uninterrupted IMCS redundancy.</u>**
7	SPACON	Handover will be made at a suitable point (i.e. a handover will not be made in the middle of a manual uplink of a command stack).
8	SPACON	Off-Shift will not leave console until their replacement has arrived.
9	SPACON	If the expected replacement has not appeared at the expected time then the Off-Shift SPACON will attempt to contact the planned On-Shift SPACON using the listed contact numbers. If no contact can be made, the Off-Shift SPACON will contact the Analyst who will decide upon the next course of action.
10	SPACON	If, for any reason, the On-Shift SPACON will be unable to arrive at the expected time then they should contact Off-Shift SPACON to inform them. If the On-Shift SPACON is unable to make their shift completely then the Analyst must also be informed.
11	SPACON	Off-Shift SPACON will leave the DCR/Console area in a tidy condition.
12	SPACON	Off-Shift SPACON will check that the printers are in a nominal state with regard to paper and toner.
13	SPACON	On-Shift SPACON will check the mail box, mail tray and mail at the beginning of their shift, and at least one further time during their shift.

Table 1 SPACON Hand-over Procedure

2.6.7.2 FCP_SPA_0002 - Operational Logbook Managing Instructions

Version 1.1

The logbook is an official document that provides the Flight Control Team and other interested parties with a list of activities, events and anomalies. The logbook is important for short- and long-term investigation of events.
The logbook gives an opportunity to document and justify any decision that was taken, rather then trying to remember events, activities or anomalies later.

The operational logbook is written by the SPACON on shift. In some cases other members (e.g. SOE) of the Flight Control Team could enter relevant information into the log book as well.

In order to keep track of all activities, events and anomalies of the entire mission the first logbook is opened on the day of the launch. A closed logbook is archived and available for further investigation.

In May 2008 the handwritten operational logbook was replaced by a digital version of the logbook (‘ESA digital logging system’ – also referred to as ‘digilog’). The digilog uses a web interface to allow the SPACON to create entries. All entries are permanently stored in a database with no possibility to delete them. It is possible to change entries, however the complete history of changes performed to any entry is also permanently stored.
The operational logbook is maintained until the end of the mission.

The general use of an operational logbook is described with the following points:

- The logbook to use is the ESA digital logging system.
- All entries are to be in the official language that is English.
- All entries are in GMT.
- All entries should be short but informative.

Integral mission specific use of the logbook is listed below with examples for the categories: Standard entries, Commanding (TC), Telemetry (TM), Slew Recovery Procedure and System failure.
All examples are without the time indication and the author’s initials.
To use the logbook for further investigation it is necessary to state reasons for any non-standard event or activity.

Standard events are written in the logbook as the following examples. These are just examples and it is not a complete list of all standard events. These examples give a guideline of writing standard events into the logbook.

- AOS at REDU
- LOS at DSS24
- Ground station handover from DSS24 to REDU
- SPACON shift handover from WX to YZ
- ISGRI tables uplink for IBIS started/finished
- OR_0113 restart of W/S sun121, 122, 123
- Eclipse Entry / Exit

Nominal commanding (TC) from ManStk is written in the logbook as the following examples. These are just examples and it is not a complete list of all nominal commanding (TC) activities. These examples give a guideline of writing nominal commanding (TC) into the logbook.

- Sequence from ManStk:
  FCP_AOC_0540 AOCS Daily Maintenance
  FCP_DHS_1220 Enable/Reset On-board Monitoring Task

- Command from ManStk:
  TC A1092 Reset Stored OE FCP_SYS_1100 Step 11.3
  TC K0011 STATE DATA TAKE Parameter:
  L0009-Full Imaging L0010-Restricted

- TPF from ManStk:
  FCP_AOC_1905 RMU Null Bias TPF 0123_0001_M.RMU
  FCP_AOC_0518 Open Loop Slew TPF 0123_0501_M.OSL

- Saved Stacks from ManStk:
  OR_0124 VETO SW Patch saved stack VETO_LOAD_3_1.OBSM.sun121 uplinked in automatic mode

Received telemetry (TM) is written in the logbook as the following examples. These are just examples and it is not a complete list of all telemetry (TM) parameters. These examples give a guideline of writing received telemetry (TM) into the logbook.

- TM Parameter (e.g. requested by OR):
  TM A5004 ACC MODE ACTIVE IPS
  TM A9134 ESA MODE ACTIVE INACTIVE
- OEM on the OBEH (e.g. with class: exception, rejection & anomaly):
  OEM: AIMU ON APID: 640 ID: 44
  OEM: Event MS EVE ECD REACHED APID:129 ID:240
  (Battery 1/2 EOC)

- OOL on the OOL-Display:
  OOL: D9020 DCA F1 FRAM ANA Value: ILLEG X REAS
  OOL: T0107 TCP-4B Value: 128.57 degC

- Anomalies which may occur:
  JEMX-2 to safe mode due to high radiation triggered by IREM
  Reed Solomon Alarms at REDU (incremented) n Units – Bad Frames
  Reed Solomon Alarms from 12:00 to 12:25
  Hit on line - ISDN up from 12:00 to 12:25
  OEM: Rejection SPI1 TC REP APID: 1024 ID:3
  OEM: Anomaly SPI1 CSSW INT ER APID: 1024 ID:3

Log book entries while running the Slew Recovery Procedure with the FDS. These are just examples and it is not a complete list of all entries for a successful slew recovery. These examples give a guideline of writing the steps running the recovery procedure into the logbook.

- Lost TC/TM from DSS24 Track at station stopped DR# G123456
- Recovery Procedure started/finished
- Timeline stopped/started
- AOCS commanding from timeline stopped/started
- Missed slews from timeline: 0123, 0124, 0125
- TPF: 0123_0501_M.CSL from FDS to IMCA and uplinked from ManStk
- TPF: 0123_0502_A.OSL from FDS to IMCA and updated in AutoStk

System events and failure are written in the logbook as the following examples. These are just examples and it is not a complete list of all system failures. These examples give a guideline of writing system failures into the logbook.

- Event logger outputs (e.g. with severity: warning, error & fatal):
  TMDSmain Link ISDS-ISDC disconnected from 12:00 to 12:25
  TMDSmain Link ISDS-ISDC disconnected (12 times)

- MMI Global Status Overview on sun129:
  IDDB status YELLOW – Disk Space Utilization
  Sun128 status YELLOW – Low Swap Space 47MB

- System / Hardware upgrade
  New HDD on IDDA (VC7 on NCTRS-B for maintenance)
  NCTRS-B down (back) for (after) maintenance

- Hardware failures and reaction:
  IDDA all tasks restarted by CCC because of IFTS-failure at 12:00
  IFTS_05/MCS restarted by CCC due TPF transfer problem FDS to IMCA

2.6.8 Satellite Decommissioning

When it is decided to terminate the INTEGRAL mission the MOC will implement the relevant flight procedure to switch off the Satellite. The International Standard concerning the decommissioning of Satellites is not directly applicable to INTEGRAL. However, the appropriate recommendations will be followed.

Since the INTEGRAL orbit is not hazardous to other missions a change of the orbit is not required at the end of the mission.

The operations that need to be considered are as follows.

- Switch off of the transponders: This operation is needed to avoid that INTEGRAL radiates into space in an uncontrolled manner.

- Depletion of fuel: This operation includes the depletion of all fuel that is remaining in the tanks and in the lines. This is to avoid the risk of an explosion.

- Discharge of the batteries: This operation includes the discharge of the batteries. In addition the battery charge automatisms are to be disabled to avoid that the batteries get recharged automatically.

- Disable automatisms: This operation includes the disabling of all on-board automatisms that could cause a reactivation of the satellite in the case that the solar arrays are providing power again when they are pointing to the sun.

2.6.9 Mission Run Down

When it is decided to terminate the INTEGRAL mission the MOC will switch off the satellite and will run down the MOC facilities.

As soon as the date for the mission termination is defined the allocated manpower will be gradually reduced to keep just a minimum team available up to the end of the mission.

The control system will remain operational until the end of the mission. The number of workstations allocated to INTEGRAL will be gradually reduced and only the essential workstations are kept until the end. Other workstations might be released earlier if they are needed for other purposes. It is not foreseen to maintain the INTEGRAL Mission Control System in an operative state after the termination of the mission.

There is no special mechanism foreseen to maintain the flight procedures. In addition it is not envisaged to maintain the know-how on how to operate the satellite once the mission has been terminated.

All TM data that are part of the archive will be stored for a period of 10 years after the end of the mission. It will also be ensured that the data can be retrieved. However, no tools will be maintained to be able to process the data.

The Project Scientist is to organize the mission termination party.

EUROPEAN SPACE AGENCY
DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT
MISSION OPERATIONS DEPARTMENT

INTEGRAL
FLIGHT OPERATIONS PLAN

Volume 2
Mission Support Procedures

Book 7
Operational Support Information

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INTEGRAL FOP Vol. 2 / Book 7
CHANGE RECORD SHEET

DATE	ISSUE / REV. NO.	PAGE / PARA AFFECTED	DESCRIPTION	APPROVAL AUTHORITY
11/09/02	1 / 0	All	New book created to include supplementary information concerning OBM and SECL tasks and IBIS operations	SOM *M. Schmidt*
21/02/03	2 / 0	All	General clean-up post Launch	SOM *M. Schmidt*
11/04/08	2/5	Page 2.7-2	Front Page and Change Record Sheet replaced. Use of On-board Monitoring Function updated to issue 3.1 Added Entries to monitor RMU LCL Statuses Updated use of entries for main Bus CDEs	SOM *M. Schmidt*
02/11/09	2/6	Page 2.7-2	Front Page and Change Record Sheet replaced. Use of On-board Monitoring Function updated to issue 3.2	SOM *R. Southworth*

LIST OF CONTENTS

2 Vol. 2: Mission Support Procedures

2.7 Book 7: Operational Support Information

This book is to collect various types of operational information. It is used to collect Technical Notes that provide operational information and should be put under FOP configuration control.

2.7.1 Use of On-board Monitoring Task

Use of On-board Monitoring Task and RACPs in Orbit (INT-MOC-SYS-TN-1015-TOS-OF)

2.7.2 Use of Spurious Eclipse Task

Use of Spurious Eclipse task (INT-MOC-SYS-TN-1016-TOS-OGI)

2.7.3 IBIS Automatisms and OBT Wrap-around

IBIS automatisms and OBT Wrap-around (VOL02_book7 IBIS_Automatism_OBT)

DOCUMENT

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1st issue	1	0	20/02/2002
Updated following changes to SDB / ODB and experience gained during the first part of the simulations campaign.	2	0	25/07/2002
Updated to remove minor editorial problems.	2	1	9/9/2002
Inclusion of changes post Launch, in particular RCS temperature monitoring OBM and RACP entries.	3	0	5/2/2003
Removal of RACPs from CDE Monitoring entries. Addition of RMU Monitoring Entries	3	1	27/02/2008
Editorial Updates, removal of obsolete information, addition of parameters for RMU Monitoring, display of report packets in TMPH, RACP Entries for battery Reconditioning.	3	2	

CHANGE RECORD

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TABLE OF CONTENTS

1 INTRODUCTION

The OBM (On Board Monitoring) function is an on-board software task, which can be used to monitor some on-board behaviour. In conjunction with RACPs (Recovery Action Command Packets) it can be used to recover S/C safety following certain on-board failures.
Extensive use of these functions is planned for Integral.

It is foreseen that this document will be included in the FOP, to be used as a guideline for management of the OBM / RACP functions during the mission. It is included in the FOP Volume 2, Book 7 "Operational support Information".

This document contains information compliant with the OBM and RACP entries currently in use.

2 REFERENCE DOCUMENTS.

Reference 1: Integral Packet Structure Document (INT-RP-AI-0030).
Reference 2: Integral Users Manual (INT-MA-AI-0001)
Reference 3: SCOS-2000 Database Import ICD (S2K-MCS-ICD-0001-TOS-GCI)

3 DOCUMENT SCOPE

This TN defines the usage in the operational mission of the OBM and RACP tasks, in particular it will:

- Clarify the ground constraints and processing.
- It will enable the user to define new entries, or update existing entries.
- It defines the ODB entries used to control the OBM / RACP tasks.
- It defines the ODB entries used to process the OBM / RACP tasks telemetry.
- It provides a link between OBM entry and applicable CRP, where relevant.

This document assumes that the reader has some familiarity with the functionality of the on-board monitoring task, it is not foreseen to repeat the information contained in the ALENIA Users Manual.

4 CONSTRAINTS

This section attempts to summarise the OBM / RACP tasks constraints which have consequences for operations.

4.1 On-board Constraints

- The on-board Monitoring table is limited to 50 entries.
- It is not possible to differentiate between high and low limit crossings, in both cases the same RACPs are issued. To do this it is necessary to load 2 OBM entries with different sets of limits.

- A Monitored parameter is only written to the Limit / Status Check table after being Out-of-limits for three consecutive acquisitions, similarly RACPs are issued only after the monitored parameter is Out-of-limits for three consecutive acquisitions.
- If the OBM list contains more than one entry with the same PID, any command to enable / disable or delete that PID will act upon all entries with this PID.
- If an entry is deleted from the Monitoring list, the last entry in the table is moved upwards to fill the gap.
- The TC to enable any particular PID will also reset all entries for that PID in the MIN-MAX table and Limit / Status Check table.
- The Monitoring table does not allow valid and empty entries to be interspersed, if an entry is deleted all subsequent entries move down one location. New entries are always loaded at the end of the table. This has the consequence that the ordering and location of parameters within the monitoring list cannot be maintained.
- The ordering and location of parameters in the Monitoring list, Limit / Status Check and MIN / MAX tables is different.
- A monitoring entry can only be loaded after loading any RACPs which it triggers.
- The RACP table is limited to 50 entries.
- The RACP table cannot be reported (the contents of the RACP table can of course be seen via memory dump, this is not however very user-friendly, and no special processing is currently fore seen)..
- The number of RACPs currently on-board cannot be seen in TM
- A total of 3 RACPs can be assigned to each OBM entry.
- Only parameters in the following TM packets can be monitored:

Table 1: Valid Type / Sub-types for On-board Monitoring.

PID_TYPE	PID_STYPE	PID_APID	PID_SPID	PID_DESCR
1	1	129	200000	SVM RTU PKT 1
1	2	129	200001	SVM RTU PKT 2
1	5	129	200500	PLM RTU PKT
1	9	640	110001	ACC ATTITUDE
1	10	640	110002	ACC HOUSEKEEPING

- The report of the MIN / MAX and Limit / Status check tables does not contain the Mask which is defined only in the monitoring table, parameters are identified solely by PID (see 6.1.1and 6.1.2), if the report contains more than one parameter with the same PID, it can be problematic to differentiate between them.
- Once a monitored parameter is Out-of-limits for 3 consecutive TM cycles, the entry is disabled in the monitoring table and must be subsequently re-enabled, this is normally done by ground command, but in some cases a RACP is used.

4.2 On-ground Constraints

- The structure of the Report Packets does not conform to the ESA PUS (Packet Utilisation Standard), this makes processing using standard tools difficult.
- Parameters, which are not 8 bits wide, cannot be displayed – due to the ambiguity in their identification.

- ❖ If a report contains an entry without a corresponding PID (Parameter Identifier) in the ODB, the entire report packet cannot be displayed in interpreted format.
- ❖ The PID must be unique in the ODB.
- ❖ In the OBM report packets – TM(8,5), TM(8,6), TM(8,7) – the Time field is just 2 bytes of coarse time, this has a wraparound of ≈ 18.2 hours. The implication of this is that if the time between report packets is greater than 18.2 hours an ambiguity exists. For the Limit – Status check this can probably be solved by checking the OEM times, however for the MIN / MAX report this possibility does not exist. The consequences of this are that ground will have to report and reset the OBM tables with a frequency of less than 18.2 hours.
  The current proposal is to insert an MOUT in the EPOS every 12 hours, instructing the SPACON to report and then clear the MIN/MAX and Limit / Status check tables.

5 LOADING OBM AND RACP TABLE ENTRIES.

In the SDB dedicated Commands are defined to load each RACP and OBM entry, currently 143 commands are defined. **However since launch these commands are no longer maintained and should not be used.**
This approach has two disadvantages:
- As the commands contents are fixed this approach is very Inflexible, these commands cannot be edited on the Manual Stack of IMCS, hence to change the value of 1 parameter, (limit tuning for instance) a new command must be defined.
- For RACP TCs we rely on ‘Load / Report’ verification, where the contents of a load commands are compared with the contents of the subsequent report TC. To use such a verification, every load TC must have a dedicated report TC, this would imply having to define an extra 40 RACP report commands. As there is no other verification of the RACP TCs load, this ‘load/report’ verification is very important.

To get around these 2 constraints ESOC defined ‘Parameter Value Sets’, a Parameter Value Set is a group of command parameter values, which can be assigned to the editable parameters of a command instance.
For the OBM load TC (TC; D3400) 129 parameters values sets are currently defined.
For the RACP load TC (TC: D3815) 56 parameters values sets are currently defined.

The parameters sets to load OBM entries and their contents are reported in Table 42 on page 35.
The parameters sets to load RACP entries and their contents are reported in Table 43on page 38.

ESOC have pre-defined TC sequences in the ODB, which load different OBM tables, depending on the mission phase. These sequences include all necessary parameters set references, as well as Report and Start (RACP only) TCs. These sequences have been updated since launch, to remain compliant with Change Requests received from Industry / ESTEC as well as ESOC response to the evolving mission scanario.

It is also worth mentioning that at all SVTs, ESOC used and tested only parameter sets, the SDB commands were not validated outside ALENIA.

The FOP currently contains the following FCPs to manage OBM and RACPs:

Table 2: FCPs to Manage OBM and RACPs.

Identifier.	Description.
FCP_DHS_1220	Enable / Reset On- board Monitoring Task.
FCP_DHS_1221	Report / Reset On- board Monitoring List.
FCP_DHS_1222	Disable On- board Monitoring Task.
FCP_DHS_1223	Manipulate Monitoring List Entries.
FCP_DHS_1230	Load OBM Entries for LEOP
FCP_DHS_1231	Load Mandatory OBM Entries for Non- eclipse Season.
FCP_DHS_1232	Load Mandatory OBM Entries for Eclipse Season.
FCP_DHS_1235	Report OBM MIN/ MAX and Limit/ Status Check Tables.
FCP_DHS_1240	Load RACP TC.
FCP_DHS_1245	Load Current Default RACP Table.
CRP_DHS_2300	OBM entry Triggered

Additionally some other procedures load different RACP and OBM entries for specific operations such as SPI Annealing and Battery Reconditioning.

6 PROCESSING OF OBM TM REPORTS.

6.1 Monitoring Table Report – TM(8,5).

The monitoring list can be reported in a TM(8,5) packet, if more than 42 entries are loaded on-board 2 packets are generated.
The Structure of the Packet is defined in Reference 1.

6.1.1 DISPLAY OF MONITORING LIST, VIA VPD TASK.

As the contents of the packets are not fixed, they must be interpreted using the on-board PID (parameters ID). This is defined as a 16 bit word, where the 4 msb are the packet Subtype in which the TM parameter is contained, the 12 lsb are the Offset Byte of the parameter, within the TM Packet, as defined in the SDB (note that the ODB definition of Offset Byte is different, an extra offset of 10 bytes is added in the header).
The IMCS VPD (Variable Packet Display) task is used to display such reports. To do this a number of VPD parameters must be defined, along with a VPD display.

The following PCF extract lists VPD parameters defined in the ODB, used to display TM(8,5) Report packets.

Table 3: VPD parameters to display TM(8,5).

PCF_ NAME	PCF_DESCR	PCF_PTC	PCF_PFC	PCF_ RELATED	PCF_ CATEG	PCF_ NATUR	PCF_ CURTX	PCF_ PARVAL
DUM001	MNT PID	3	12		N	R		
DUM002	MNT MINT	3	4		S	R	2141	

PCF_ NAME	PCF_DESCR	PCF_PTC	PCF_PFC	PCF_ RELATED	PCF_ CATEG	PCF_ NATUR	PCF_ CURTX	PCF_ PARVAL
DUM003	MNT LL	11	0	DUM001	N	R		
DUM004	MNT HL	11	0	DUM001	N	R		
DUM005	MNT POINT 1	3	4		N	R		
DUM006	MNT POINT 2	3	4		N	R		
DUM007	MNT POINT 3	3	4		N	R		
DUM008	MNT STATUS	3	4		S	R	2	
DUM009	MNT MASK	3	4		N	R		
DUM999	EMPTY LOCATION	0		3	4			

The definition of the above fields can be found in reference 3.

The above parameters correspond to one complete 10 byte entry in the TM(8,5) report packet. Parameter DUM001 is the PID, this is the key, which is used to identify each entry in the OBM list report. It must be noted that if a TM(8,5) contains a PID, which is not in the ODB, none of the packets contents can be displayed in the VPD.
DUM003 and DUM004 are related (PCF_RELATED) to DUM001, this means that their interpretation must be that of the parameter identified via DUM001 (PID).

The following VPD extract defines the structure of the VPD, used to display TM(8,5) Report packets.

Table 4: VPD 200, to display TM(8,5) report packets.

VPD_ TPSD	VPD_ POS	VPD_ NAME	VPD_ GRPSIZE	VPD_ FIXREP	VPD_ CHOICE	VPD_ PIDREF	VPD_ DISDESC	VPD_ WIDTH	VPD_ JUSTIFY	VPD_ NEWLINE	VPD_ DCHAR	VPD_ FORM
200	1	DUM001	9	42	N	N		0	L	N	2	H
200	10	DUM001			N	Y	MNT PID	21	L	N	2	H
200	20	DUM002			N	N	MNT MINT	21	L	N	0	N
200	30	DUM003			N	N	MNT LL	21	L	N	2	N
200	40	DUM004			N	N	MNT HL	21	L	N	2	N
200	50	DUM005			N	N	MNT POINT 1	21	L	N	0	D
200	60	DUM006			N	N	MNT POINT 2	21	L	N	0	D
200	70	DUM007			N	N	MNT POINT 3	21	L	N	0	D
200	80	DUM008			N	N	MNT STATUS	21	L	N	0	N
200	90	DUM009			N	N	MNT MASK	21	L	N	0	B

The definition of the above fields can be found in reference 3.

The number of monitoring entries reported in a TM(8,5) report packet is not contained in the packet, rather the total number of entries in the report. Normally the VPD would use this parameter to determine the number of repetitions of the data structure.
As this information is not available, ESOC have assumed that all Report packets contain 42 entries, and fixed the number of repetitions at 42 (VPD_FIXREP). Similarly the number of parameters in each parameters group (VPD_GRPSIZE) is fixed at 9. Any unused entries in the TM(8,5) display simply the ODB parameter with PID = 0 (DUM999) in the VPD.

To view the TM(8,5) OR packet using the VPD task, enter the following options:

DS = 65535, Type = 8, Subtype = 5, APID = 129.

The following table contains an example of a TM(8,5) packet processed via the above VPD definition.

Table 5: VPD display of TM(8,5) report packet.

MNTPID	PCF_DESCR	MNTMINT	MNTLL	MNTHL	MNTPOINT1	MNTPOINT2	MNTPOINT	MNTSTATUS	MNTMASK
A9000	ACCA+5V	ONE TMCYCLE	0,00000 V	4.49641176 V	0 DEC	0 DEC	0 DEC	ENABLED	11111111 BIN
A9950	RMUA X RATE	ONE TMCYCLE	682500000 d/s	-0.70980000 d/s	0 DEC	0 DEC	0 DEC	ENABLED	11111111 BIN
A9951	RMUAYRATE	ONE TMCYCLE	682500000 d/s	-0.70980000 d/s	0 DEC	0 DEC	0 DEC	ENABLED	11111111 BIN
A9952	RMUA Z RATE	ONE TMCYCLE	682500000 d/s	-0.70980000 d/s	0 DEC	0 DEC	0 DEC	ENABLED	11111111 BIN

6.1.2 DISPLAY OF MONITORING LIST, VIA TMPH TASK.

The IMCS TMPH Task can also display OBM Report packets in interpreted Format. The relevant packets can be selected by applying a filter on packet Type and sub-type (8, 5), from the Packet Query Display View for an individual packet the VPD display for that packet can be launched.

6.1.3 PROCESSING OF TM PARAMETERS WITH NON-UNIQUE PID.

To process parameters which are less than 8 bits wide is problematic, as their PID is not unique, and hence is not defined in the ODB. To process such parameters a ‘dummy’ PCF entry must be defined with PID corresponding to the Subtype / Byte of the monitored TM parameter. Currently the ‘dummy’ monitoring parameters defined in the ODB are listed in the table below.

The following table lists all ‘dummy’ PCF entries for the monitoring task in bold text, along with their PID. Below each of these parameters are listed all fixed location ODB parameters with a packet and Offset byte location which would give them the same PID as the dummy monitoring parameter. For such parameters the Offset Bit is also reported, along with the equivalent mask in the OBM list.
If for instance a report of the OBM list displayed in the VPD contains the parameter AM900N, along with mask = 00001000, from the table below it can be seen that the monitored parameter is A9005.

Table 6: OBM parameters with non-unique PID.

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
AM900N	**MON ACC-A RELAYS**	**4157**	**103D**	**200000**	**61**		
A9001	ACC A RELAY 1			200000		0	10000000
A9002	ACC A RELAY 2			200000		1	01000000
A9003	ACC A RELAY 3			200000		2	00100000
A9004	ACC A RELAY 4			200000		3	00010000
A9005	ACC A RELAY 5			200000		4	00001000
A9099	FDE SS OVERRIDE			200000		5	00000100
A9104	CAE A IMU OFF EN			200000		7	00000001
PM1056	**MON WD ST PPDU-A**	**20564**	**5054**	**200500**	**84**		
M9803	COVER TM 1			200500	84	0	10000000

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
P1056	WATCH DOG PPDUA			200500	84	7	00000001
PM1057	**MON WD ST PPDU-B**	**20605**	**507D**	**200500**	**125**		
P1057	WATCH DOG PPDUB			200500	125	7	00000001
PM1058	**MON WD ST SPDU-A**	**4184**	**1058**	**200000**	**88**		
P1058	WATCH DOG SPDUA			200000	88	3	00010000
A9904	RCS LV A STA			200000	88	7	00000001
PM1059	**MON WD ST SPDU-B**	**8211**	**2013**	**200001**	**19**		
R2003	TRSP2 RG STATUS			200001	19	0	10000000
R2009	TRSP2 TX ON/OFF			200001	19	1	01000000
R3000	SWA STAT POS=			200001	19	2	00100000
R3001	SWA STAT POSX			200001	19	3	00010000
P1059	WATCH DOG SPDUB			200001	19	4	00001000
D9112	SRTUB ON/OFF			200001	19	7	00000001
PM1101	**MON LCL LV-A**	**4291**	**10C3**	**200000**	**195**		
P1101	LCL STA LV A			200000	195	0	10000000
P1306	BUSY IND TM W8			200000	195	7	00000001
PM1104	**MON LCL CAE-A**	**4297**	**10C9**	**200000**	**201**		
P1104	LCL STA CAE A			200000	201	0	10000000
P1309	BUSY IND TM W11			200000	201	7	00000001
PM1105	**MON LCL FCV-A**	**4299**	**10CB**	**200000**	**203**		
P1105	LCL STA FCV A			200000	203	0	10000000
P1310	BUSY IND TM W12			200000	203	7	00000001
PM1111	**MON LCL FDE-A**	**4311**	**10D7**	**200000**	**215**		
P1111	LCL STA FDE A			200000	215	0	10000000
P1316	BUSY IND TM W18			200000	215	7	00000001
PM1112	**MON LCL IMU1**	**4313**	**10D9**	**200000**	**217**		
P1112	LCL STA IMU1			200000	217	0	10000000
P1317	BUSY IND TM W19			200000	217	7	00000001
PM1117	**MON LCL RMU-A**	**4323**	**10E3**	**200000**	**227**		
P1117	LCL STA RMUA			200000	227	0	10000000
P1322	BUSY IND TM W24			200000	227	7	00000001
PM1118	**MON LCL FCE(CAE)**	**4325**	**10E5**	**200000**	**229**		
P1118	LCL STA FCE A			200000	229	0	10000000
P1323	BUSY IND TM W25			200000	229	7	00000001
PM1119	**MON LCL STA TX-1**	**4327**	**10E7**	**200000**	**231**		
P1119	LCL STA TX1			200000	231	0	10000000
P1324	BUSY IND TM W26			200000	231	7	00000001
PM1125	**MON SPDU GRP 5A1**	**4339**	**10F3**	**200000**	**243**		
P1125	S HLCL 5A1 STA			200000	243	0	10000000

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
T1009	TSW STA PROPA			200000	243	1	01000000
T1011	PRESTAT SPDU A			200000	243	2	00100000
T1013	TSW3 5A1 SPARE			200000	243	3	00010000
T1014	TSW4 5A1 SPARE			200000	243	4	00001000
T1001	TSW STA SAS +Y A			200000	243	5	00000100
T1002	TSW STASAS-Y+Z A			200000	243	6	00000010
P1330	BUSY IND TM W32			200000	243	7	00000001
PM1145	**MON LCL RMU-B**	**4379**	111B	**200000**	**293**		
P1145	LCL STA RMUB			200000	293	0	10000000
P1350	BUSY IND TM W52			200000	293	7	00000001
PM1147	**MON LCL TX-2**	**4383**	**111F**	**200000**	**287**		
P1147	LCL STA TX2			200000	287	0	10000000
P1352	BUSY IND TM W54			200000	287	7	00000001
PM1151	**MON LCL IMU3**	**4391**	**1127**	**200000**	**295**		
P1151	LCL STA IMU3			200000	295	0	10000000
P1356	BUSY IND TM W58			200000	295	7	00000001
PM1153	**MON SPDU GRP 5B1**	**4395**	**112B**	**200000**	**299**		
P1153	S HLCL 5B1 STA			200000	299	0	10000000
T1033	TSW STA PROPB			200000	299	1	01000000
T1035	PRESTAT SPDU B			200000	299	2	00100000
T1037	TSW3 5B1 SPARE			200000	299	3	00010000
T1038	TSW4 5B1 SPARE			200000	299	4	00001000
T1025	TSW STA SAS +Y B			200000	299	5	00000100
T1026	TSW STASAS-Y+Z B			200000	299	6	00000010
P1358	BUSY IND TM W60			200000	299	7	00000001
PM1166	**MON LCL N CBH-A**	**4301**	**10CD**	**200000**	**205**		
P1166	LCL STANOM CBH A			200000	205	0	10000000
P1311	BUSY IND TM W13			200000	205	7	00000001
PM1174	**MON LCL N CBH-B**	**4357**	**1105**	**200000**	**261**		
P1174	LCL STANOM CBH B			200000	261	0	10000000
P1339	BUSY IND TM W41			200000	261	7	00000001
PM1176	**MON LCL S CBH-A**	**4341**	**10F5**	**200000**	**245**		
P1176	SUR CBH A STA			200000	245	0	10000000
T1056	TSW STA THR2B			200000	245	1	01000000
T1057	TSW STA THR1B			200000	245	2	00100000
T1058	TSW STA THR3B			200000	245	3	00010000
T1059	TSW STA THR4B			200000	245	4	00001000
T1023	TSW STA OMC LNSA			200000	245	5	00000100

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
T1062	TSW STA FCV NOM			200000	245	6	00000010
P1331	BUSY IND TM W33			200000	245	7	00000001
PM1184	**MON LCL S CBH-B**	**4397**	**112D**	**200000**	**301**		
P1184	SUR CBH B STA			200000	301	0	10000000
T1052	TSW STA THR2A			200000	301	1	01000000
T1053	TSW STA THR1A			200000	301	2	00100000
T1054	TSW STA THR3A			200000	301	3	00010000
T1055	TSW STA THR4A			200000	301	4	00001000
T1047	TSW STA OMC LNSB			200000	301	5	00000100
T1063	TSW STA FCV RED			200000	301	6	00000010
P1359	BUSY IND TM W61			200000	301	7	00000001
PM1406	**MON SPDU-A ST**	**4277**	**10B5**	**200000**	**181**		
P1408	SPDUA MLC EXE			200000	181	0	10000000
P1405	SPDUA CMDS STA			200000	181	1	01000000
P1406	SPDUA DNEL STA			200000	181	2	00100000
P1407	SPDUA ECL STA			200000	181	3	00010000
P1412	SPDUA INIT			200000	181	4	00001000
P1409	SPDUA 1ST READ			200000	181	7	00000001
PM1426	**MON SPDU-B ST**	**4401**	**1131**	**200000**	**305**		
P1428	SPDUB MLC EXE			200000	305	0	10000000
P1425	SPDUB CMDS STA			200000	305	1	01000000
P1426	SPDUB DNEL STA			200000	305	2	00100000
P1427	SPDUB ECL STA			200000	305	3	00010000
P1432	SPDUB INIT			200000	305	4	00001000
P1439	SPDUB 1ST READ			200000	305	7	00000001
PM2407	**MON PPDU-A ST**	**20607**	**507F**	**200500**	**127**		
P2405	PPDUA MLC EXE			200500	127	0	10000000
P2406	PPDUA DISC EXE			200500	127	1	01000000
P2407	PPDUA DNEL ST			200500	127	2	00100000
P2408	PPDUA ECL STA			200500	127	3	00010000
P2411	PPDUA INIT			200500	127	4	00001000
P2409	PPDUA ECL DISA			200500	127	5	00000100
P2498	PPDUA 1ST READ			200500	127	7	00000001
PM2427	**MON PPDU-B ST**	**20747**	**510B**	**200500**	**267**		
P2425	PPDUB MLC EXE			200500	267	0	10000000
P2426	PPDUB DISC EXE			200500	267	1	01000000
P2427	PPDUB DNEL ST			200500	267	2	00100000
P2428	PPDUB ECL STA			200500	267	3	00010000

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
P2431	PPDUB INIT			200500	267	4	00001000
P2429	PPDUB ECL DISA			200500	267	5	00000100
P2528	PPDUB 1ST READ			200500	267	7	00000001
PM3046	**MON BDR MODE ST**	**8323**	**2083**	**200001**	**131**		
P3040	BCE2 PROT ENA M			200001	131	0	10000000
P3041	BCE2 PROT ENA R			200001	131	1	01000000
P3042	BCE1 PROT STAT M			200001	131	2	00100000
P3043	BCE1 PROT STAT R			200001	131	3	00010000
P3044	BCE2 PROT STAT M			200001	131	4	00001000
P3045	BCE2 PROT STAT R			200001	131	5	00000100
P3046	BDR MODE STAT M			200001	131	6	00000010
P3047	BDR MODE STAT R			200001	131	7	00000001
PM3053	**MON MRU DNEL**	**8325**	**2085**	**200001**	**133**		
P3048	DNEL BAT1 ENA 1			200001	133	0	10000000
P3050	DNEL BAT1 ENA 2			200001	133	1	01000000
P3051	DNEL BAT2 ENA 1			200001	133	2	00100000
P3052	DNEL BAT2 ENA 2			200001	133	3	00010000
P3053	DNEL BAT1 STAT 1			200001	133	4	00001000
P3054	DNEL BAT1 STAT 2			200001	133	5	00000100
P3055	DNEL BAT2 STAT 1			200001	133	6	00000010
P3056	DNEL BAT2 STAT 2			200001	133	7	00000001
PM3061	**MON MRU ECL-M**	**8327**	**2087**	**200001**	**135**		
P3057	DNEL STAT M			200001	135	0	10000000
P3058	DNEL STAT R			200001	135	1	01000000
P3059	ECL WG1 ENA STA			200001	135	2	00100000
P3060	ECL WG2 ENA STA			200001	135	3	00010000
P3061	ECL STAT M			200001	135	4	00001000
P3062	ECL STAT R			200001	135	5	00000100
P3063	EOC1 ENA/DIS STA			200001	135	6	00000010
P3064	EOC2 ENA/DIS STA			200001	135	7	00000001
PM5102	**MON PRU-A CV ST**	**4144**	**1030**	**200000**	**48**		
P1156	SPDUA ON/OFF STA			200000	48	0	10000000
F9971	CDE1 STBY/OPMODE			200000	48	1	01000000
F9972	CDE1 LAUNCHLOCK			200000	48	2	00100000
P3067	MRU CONVA +5			200000	48	4	00001000
P5102	PRU A AUX STAT			200000	48	7	00000001
PM5109	**MON PRU-B CV ST**	**8241**	**2031**	**200001**	**49**		
P1157	SPDUB ON/OFF STA			200001	49	0	10000000

PCF_NAME	PCF_DESCR	PCF_PID	PCF_PID (hex)	SPID	Byte	bit	Mask
F9991	CDE2 STBY/OPMODE			200001	49	1	01000000
F9992	CDE2 LAUNCHLOCK			200001	49	2	00100000
P3068	MRU CONVB +5			200001	49	4	00001000
P5109	PRU B AUX STAT			200001	49	7	00000001

Display of interpreted Low and High Limit information for such parameters, is also problematic, for 2 reasons:

- Different parameters with the same PID will have a different interpretation.
- Any interpretation is applied to the full 8 bits width of the Low and High Limit values.

For these reasons ESOC defined the following textual interpretation for Low and high limits, to be applied to all such parameters.

The interpretation is as follows:

Table 7: Interpretation of parameters with none unique PID.

TXP_NUMBR	TXP_FROM	TXP_TO	TXP_ALTXT
12	0	0	B00000000B
12	1	1	B00000001B
12	2	2	B00000010B
12	4	4	B00000100B
12	8	8	B00001000B
12	16	16	B00010000B
12	32	32	B00100000B
12	64	64	B01000000B
12	128	128	B10000000B

The definition of the above fields can be found in reference 3.

Currently, all monitored parameters of less than 8 bits width, are single bit parameters, hence only single bit values are contained in the interpretation, the interpretation, simply displays the binary string of the Low or High Limit.

The following table contains an example of a TM(8,5) packet processed via the above VPD definition, containing parameters with none unique PID. To determine the actual parameters identity, take the MNT PID parameters ID and the MNTMASK value and look it up in Table 6 on page 11.

Table 8: VPD diplay of parameters with none unique PID.

MNT PID	PCF_DESCR	MNTMINT	MNTLL	MNTHL	MNTPOINT1	MNTPOINT2	MNTPOINT3	MNTSTATUS	MNTMASK
AM900N	MON ACC-ARELAYS	ONE TMCYCLE	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	ENABLED	10000000 BIN
AM900N	MONACC-ARELAYS	ONE TMCYCLE	B01000000B	B01000000B	0 DEC	0 DEC	0 DEC	ENABLED	01000000 BIN
AM900N	MON ACC-A RELAYS	ONE TMCYCLE	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	ENABLED	00100000 BIN
AM900N	MON ACC-A RELAYS	ONE TMCYCLE	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	ENABLED	00010000 BIN
AM900N	MON ACC-A RELAYS	ONE TMCYCLE	B00001000B	B00001000B	0 DEC	0 DEC	0 DEC	ENABLED	00001000 BIN

Note that there is no restriction on mixing parameters with and without unique PID in the VPD.

6.1.4 DISPLAY OF MONITORING LIST, VIA AND.

The following super-commutated parameters have been defined for display of the raw TM(8,5) packet contents.

Table 9: Super-commutated Parameters for Display of Raw TM(8,5) Contents.

PID_TYPE	PID_STYPE	PID_SPID	PID_DESCR
8	5	211000	REP MON LIST

PCF_NAME	PCF_DESCR	PLF_OFFBY	PLF_OFFBI	PLF_NBOCC	PLF_LGOCC
D8500	MO LIST PAR NUM	10	0	1	0
DUM100	PID	12	0	42	80
DUM101	MINT	14	0	42	80
DUM102	LOW LIMIT	15	0	42	80
DUM103	HIGH LIMIT	16	0	42	80
DUM104	RACP PTR #1	17	0	42	80
DUM105	RACP PTR #2	18	0	42	80
DUM106	RACP PTR #3	19	0	42	80
DUM107	ENTRY STATUS	20	0	42	80
DUM108	ENTRY MASK	21	0	42	80

The parameters with PCF_NAME of the form 'DUM*' are super-commutated parameters.
Each of which occurs 42 times (PLF_NBOCC), in the TM(8,5) packet, this is the maximum no. of entries which can be downlinked in one packet.
Each parameter is repeated every 80 bits (PLF_LGOCC), this is the size of one 10 byte entry in the monitoring list report.
The disadvantage of such displays is that the PID is not interpreted, however it may be useful for debugging purposes, or for display of Monitoring list entries without a corresponding PID in the ODB.
The following ANDs are available for display of these parameters:

Table 10: ANDs for Display of TM(8,5) Contents.

DPF_NUMBE	DPF_TYPE	DPF_HEAD
D4540	3	OB-MNT LIST 1-6, RAW
D4541	3	OB-MNT LIST 7-12, RAW
D4542	3	OB-MNT LIST 13-18, RAW
D4543	3	OB-MNT LIST 19-24, RAW
D4544	3	OB-MNT LIST 25-30, RAW
D4545	3	OB-MNT LIST 31-36, RAW
D4546	3	OB-MNT LIST 37-42, RAW

6.2 Limit / Status Check Table Report – TM(8,6).

The Limit / Status check table can be reported in a TM(8,6) packet.
The Structure of the Packet is defined in Reference 1.

6.2.1 DISPLAY OF LIMIT / STATUS CHECK TABLE, VIA VPD TASK.

As the contents of the packets are not fixed, they must be interpreted using the on-board PID as described in section 6.1.

The IMCS VPD (Variable Packet Display) task is used to display TM(8,6) reports. To do this a number of VPD parameters must be defined, along with a VPD display.

The following PCF extract lists VPD parameters defined in the ODB, used to display TM(8,6) Report packets.

Table 11: VPD parameters to display TM(8,6).

PCF_NAME	PCF_DESCR	PCF_PTC	PCF_PFC	PCF_RELATED	PCF_CATEG	PCF_NATUR	PCF_CURTX
DUM001	MNT PID	3	12		N	R	
DUM020	MNT HI/LO	3	4		S	R	90
DUM021	MNT OOL VALUE	11	0	DUM001	N	R	
DUM022	MNT OOL TIME	9	7		N	R	
DUM999	EMPTY LOCATION	0		3	4		

The definition of the above fields can be found in reference 3.

The above parameters correspond to one complete 6 byte entry in the TM(8,6) report packet. Parameter DUM001 is the PID, this is the key, which is used to identify each entry in the Report. It must be noted that if a TM(8,6) contains a PID, which is not in the ODB, none of the packets contents can be displayed in the VPD.
DUM021 is related (PCF_RELATED) to DUM001, this means that its interpretation is that of the parameter identified via DUM001 (PID).
Note that DUM022 is defined as parameter with PTC = 9, PFC = 7, this allows us to display a real time for the Out-of-limits occurrence time. However due to the wraparound time of 18.2 hours of the 2 Byte time field in this packet, the time is only correctly interpreted for 18.2 hours after the entry is written.

The following VPD extract defines the structure of the VPD, used to display TM(8,6) Report packets.

Table 12: VPD 201, to display TM(8,6) report packets.

VPD_TPSD	VPD_POS	VPD_NAME	VPD_GRPSIZE	VPD_FIXREP	VPD_CHOICE	VPD_PIDREF	VPD_DISDESC	VPD_WIDTH	VPD_JUSTIFY	VPD_NEWLINE	VPD_DCHAR	VPD_FORM
201	1	DUM001	4	50	N	N		0	R	N	0	H
201	10	DUM001			N	Y	MNT PID	21	R	N	2	H
201	20	DUM020			N	N	MNT HI/LO	21	L	N	0	N
201	30	DUM021			N	N	MNT OOL VALUE	21	R	N	2	N
201	40	DUM022			N	N	MNT OOL TIME	21	R	N	0	H

The definition of the above fields can be found in reference 3.

The maximum number of entries in a TM(8,6) report packet is 50 For this reason the number of repetitions of the data structure has been set at 50 (VPD_FIXREP). Similarly the number of parameters in each parameters group (VPD_GRPSIZE) is fixed at 4.

As in the TM(8,5) report, parameters with a non-unique PID are interpreted as their binary string, as defined in Table 7.

Any unused entries in the TM(8,5) display simply the ODB parameter with PID = 0 (DUM999) in the VPD.

To view the TM(8,6) OR packet using the VPD task, enter the following options:
DS = 65535, Type = 8, Subtype = 6, APID = 129.

The following table contains an example of a TM(8,6) packet processed via the above VPD definition.

Table 13: VPD display of TM(8,6) report packet.

MNTPID	PCF_DESCR	MNT HI/LO	MNT OOL VALUE	MNT OOL TIME
PM1166	MON LCL N CBH-A	LOW	B00000000B	2002.014.03.57.22.788
P3115	SA WING 1 CUR 2	HIGH	10.6739683	2002.014.03.57.22.788

6.2.2 DISPLAY OF LIMIT / STATUS CHECK TABLE, VIA TMPH TASK.

The IMCS TMPH Task can also display OBM Limit / Status Check Table Report packets in interpreted Format. The relevant packets can be selected by applying a filter on packet Type and sub-type (8, 6), from the Packet Query Display View for an individual packet the VPD display for that packet can be launched.

6.2.3 DISPLAY OF LIMIT / STATUS CHECK REPORT, VIA AND.

The following super-commutated parameters have been defined for display of the raw TM(8,6) packet contents.

Table 14: Super-commutated Parameters for Display of Raw TM(8,6) Contents.

PID_TYPE	PID_STYPE	PID_SPID	PID_DESCR
8	6	211001	REP LIM ST CHECK

PLF_NAME	PCF_DESCR	PLF_OFFBY	PLF_OFFBI	PLF_NBOCC	PLF_LGOCC
D8500	MO LIST PAR NUM	10	0	1	0
DUM110	PID	12	0	50	48
DUM111	HI/LO FLAG	14	0	50	48
DUM112	OOL VALUE	15	0	50	48
DUM113	OOL TIME CT 2LSB	16	0	50	48

The parameters with PCF_NAME of the form ‘DUM*’ are super-commutated parameters.
Each of which occurs 50 times (PLF_NBOCC), in the TM(8,6) packet, this is the maximum no. of entries which can be downlinked in one packet.

Each parameter is repeated every 48 bits (PLF_LGOCC), this is the size of one 6 byte entry in the monitoring list report.

The disadvantage of such displays is that the PID is not interpreted, however they may be useful for debugging purposes, or for display of Monitoring list entries without a corresponding PID in the ODB.

The following ANDs are available for display of these parameters:

Table 15: ANDs for Display of TM(8,6) Contents.

DPF_NUMBE	DPF_TYPE	DPF_HEAD
D4550	3	OB-MNT LIMIT 1-12, RAW
D4551	3	OB-MNT LIMIT 13-24, RAW
D4552	3	OB-MNT LIMIT 25-36, RAW
D4553	3	OB-MNT LIMIT 37-48, RAW
D4554	3	OB-MNT LIMIT 49-50, RAW

6.3 Min / max Table Report – TM(8,7).

The MIN/MAX table can be reported in a TM(8,7) packet.
The Structure of the Packet is defined in Reference 1.

6.3.1 DISPLAY OF MIN / MAX TABLE, VIA VPD TASK.

As the contents of the packets are not fixed, they must be interpreted using the on-board PID as described in section 6.1.

The IMCS VPD (Variable Packet Display) task is used to display TM(8,7) reports. To do this a number of VPD parameters must be defined, along with a VPD display.

The following PCF extract lists VPD parameters defined in the ODB, used to display TM(8,7) Report packets.

Table 16: VPD parameters to display TM(8,7).

PCF_NAME	PCF_DESCR	PCF_ PTC	PCF_ PFC	PCF_ RELATED	PCF_ CATEG	PCF_ NATUR	PCF_ CURTX
DUM001	MNT PID	3	12		N	R	
DUM030	MNT MAX VAL	11	0	DUM001	N	R	
DUM031	MNT MIN VAL	11	0	DUM001	N	R	
DUM032	MNT MAX TIME	9	7		N	R	
DUM033	MNT MIN TIME	9	7		N	R	
DUM999	EMPTY LOCATION	3	4		N	R	

The definition of the above fields can be found in reference 3.

The above parameters correspond to one complete 8 byte entry in the TM(8,7) report packet.

Parameter DUM001 is the PID, this is the key, which is used to identify each entry in the Report. It must be noted that if a TM(8,7) contains a PID, which is not in the ODB, none of the packets contents can be displayed in the VPD.

DUM030 and DUM031 are related (PCF_RELATED) to DUM001, this means that its interpretation is that of the parameter identified via DUM001 (PID).
Parameters with an ‘inverted’ calibration curve will be shown in reverse, ie the maximum value will be reported in the ‘MNT MIN VAL’ column and the minimum value will be reported in the ‘MNT MAX VAL’ column. This is because the OBM task on-board works on uncalibrated telemetry values only.

Note that DUM032 and DUM033 are defined as parameters with PTC = 9, PFC = 7, this allows us to display a real time for the Out-of-limits occurrence time. However due to the wraparound time of 18.2 hours of the 2 Byte time field in this packet, the time is only correctly interpreted for 18.2 hours after the entry is written.

The following VPD extract defines the structure of the VPD, used to display TM(8,6) Report packets.

Table 17: VPD 202, to display TM(8,7) report packets.

VPD_ TPSD	VPD_ POS	VPD_ NAME	VPD_ GRPSIZE	VPD_ FIXREP	VPD_ CHOICE	VPD_ PIDREF	VPD_ DISDESC	VPD_ WIDTH	VPD_ JUSTIFY	VPD_ NEWLINE	VPD_ DCHAR	VPD_ FORM
202	1	DUM001	5	50	N	N		0	R	N	0	H
202	10	DUM001			N	Y	MNT PID	21	R	N	2	H
202	20	DUM030			N	N	MNT MAX VAL	21	R	N	2	N
202	30	DUM031			N	N	MNT MIN VAL	21	R	N	2	N
202	40	DUM032			N	N	MNT MAX TIME	21	R	N	0	H
202	50	DUM033			N	N	MNT MIN TIME	21	R	N	0	H

The definition of the above fields can be found in reference 3.

The maximum number of entries in a TM(8,7) report packet is 50 For this reason the number of repetitions of the data structure has been set at 50 (VPD_FIXREP). Similarly the number of parameters in each parameters group (VPD_GRPSIZE) is fixed at 5.

As in the TM(8,5) report, parameters with a non-unique PID are interpreted as their binary string, as defined in Table 7.

Any unused entries in the TM(8,5), display simply the ODB parameter with PID = 0 (DUM999) in the VPD.

To view the TM(8,6) OR packet using the VPD task, enter the following options:
DS = 65535,   Type = 8,   Subtype = 7,   APID = 129.

The following table contains an example of a TM(8,6) packet processed via the above VPD definition.

Table 18: VPD display of TM(8,7) report packet.

MNTPID	PCF_DESCR	MNT MAX VAL	MNT MIN VAL	MNT MAX TIME	MNT MIN TIME
PM1166	MON LCL N CBH-A	B00000000B	B00000000B	2002.013.03.06.19.303	2002.014.03.57.22.788
P3115	SA WING 1 CUR 2	14.927684	10.6739683	2002.014.03.57.22.788	2002.013.16.20.11.444

6.3.2 DISPLAY OF MIN / MAX REPORT TABLE, VIA TMPH TASK.

The IMCS TMPH Task can also display the OBM min / max Table Report packets in interpreted Format. The relevant packets can be selected by applying a filter on packet Type and sub-type (8, 7), from the Packet Query Display View for an individual packet the VPD display for that packet can be launched.

6.3.3 DISPLAY OF MIN / MAX REPORT, VIA AND.

The following super-commutated parameters have been defined for display of the raw TM(8,7) packet contents.

Table 19: Super-commutated Parameters for Display of Raw TM(8,7) Contents.

PID_TYPE	PID_STYPE	PID_SPID	PID_DESCR
8	7	211002	REP MIN MAX VAL

PLF_NAME	PCF_DESCR	PLF_OFFBY	PLF_OFFBI	PLF_NBOCC	PLF_LGOCC
D8500	MO LIST PAR NUM	10	0	1	0
DUM120	PID	12	0	50	64
DUM121	MAX VALUE	14	0	50	64
DUM122	MIN VALUE	15	0	50	64
DUM123	MAX TIME	16	0	50	64
DUM124	MIN TIME	16	0	50	64

The parameters with PCF_NAME of the form ‘DUM*’ are super-commutated parameters.
Each of which occurs 50 times (PLF_NBOCC), in the TM(8,6) packet, this is the maximum no. of entries which can be downlinked in one packet.
Each parameter is repeated every 64 bits (PLF_LGOCC), this is the size of one 8 byte entry in the monitoring list report.
The disadvantage of such displays is that the PID is not interpreted, however they may be useful for debugging purposes, or for display of Monitoring list entries without a corresponding PID in the ODB.
The following ANDs are available for display of these parameters:

Table 20: ANDs for Display of TM(8,7) Contents.

DPF_NUMBE	DPF_TYPE	DPF_HEAD
D4560	3	OB-MNT MIN/MAX 1-10, RAW
D4561	3	OB-MNT MIN/MAX 11-20, RAW
D4562	3	OB-MNT MIN/MAX 21-30, RAW

DPF_NUMBE	DPF_TYPE	DPF_HEAD
D4563	3	OB-MNT MIN/MAX 31-40, RAW
D4564	3	OB-MNT MIN/MAX 41-50, RAW

6.4 *On-event Messages associated with OBM Task.*

The following OEMs are associated with the OBM / RACP tasks.

Table 21: OEMs Associated with OBM / RACP Tasks.

TMPK_MESS_CLASS	TMPK_MESS_ID	TMPK_ID_NAME	TMPK_MESS_STR_REF	TMPK_MESS_DESC	TMPK_TMPA_PREF	TMPK_BYTE	TMPK_SBIT	TMPA_PARA_NAME	TMPA_ALI_REF1
					D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
3	21	MO EMPTY	2037	No parameters is currently loaded in the Monitoring Table at the execution of TC (8,5), TC (8,6), TC (8,7)	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
3	23	MO UNDEFINED ACTION	2002	The TC (8,3) contains a not valid (not used or out of range) Pointer to a Corrective Action TCP Buffer slot	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0076	2	0	PTR TO ACTION	2105
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
3	24	MO INVALID ACTION	2002	The Load Corrective Action TCP (TC 5,3) contains a out of range Pointer to a Corrective Action TCP Buffer slot	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0076	2	0	PTR TO ACTION	2105
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
3	25	MO PID NOT FOUND	2037	Monitoring entry PID not found	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
3	26	MO EXEC STILL IN PROGRESS	2037	The previous request for a "Report monitoring List" is still in progress	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0104	3	0	LSB APID129 OEM	
					D0096	4	2	TCP SSC OEM	
1	106	EXCE OBIH DUMP NO SP Q FREE SLOT	2015	The intermediate queue used by the OBDH Bus manages to store the assembled DUMP Packet has not free slot	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0009	3	0	PT ADDRESS	2118
1	144	EXCE MO PARAMETER NOT	2020	During the Monitoring	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	

TMPK_MESS_CLASS	TMPK_MESS_ID	TMPK_ID_NAME	TMPK_MESS_STR_REF	TMPK_MESS_DESC	TMPK_TMPA_PREF	TMPK_BYTE	TMPK_SBIT	TMPA_PARA_NAME	TMPA_ALI_REF1
		FOUND		Management a parameter is not found because the addressed RTU Subtype is not acquired yet or because the parameter offset is outside the packet data field	D0029	2	0	PID	
1	145	EXCE MO CA FIFO PUT FAIL	2021	During the Monitoring Management the attempt to put a commanf into the on_board TCP queue has failed	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
					D0076	5	0	PTR TO ACTION	2105
0	177	EVE MO PARAMETER OUT-OF-RANGE	2020	The Monitoring Management function has detected that a parameter is not within the specified limit. A corrective action will be carried out , if foreseen	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
0	178	EVE MO PAR 3 TIME OUT OF RANGE	2027	Monitoring parameter out of range for the third consecutive time	D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
					D0018	5	0	OEM RACP CTR	

On Event Messages can be viewed on IMCS using the either the OBEH or TMPH tasks, to view just OBDH OEMs apply the following filters:

- OBEH: APID = 129
- TMPH: mnemonic = VPD, APID = 129

From the TMPH task the VPD task can be launched to view the contents of the OEM.
Any parameters containing a PID are also interpreted as described in section 6.1.1, again non-unique PIDs are handled as described in section 6.1.2.

6.4.1 ACTIONS FOLLOWING RECEPTION OF OEM 177 OR 178.

If either of these OEMs are received this means that a monitored parameter has transgressed one of its limits. In this case refer to CRP_DHS_2300.

If only OEM 177 is received, the monitored parameter was Out-of-limit for less than 3 consecutive occurrences. In this case the Out-of-limit value will not be included in the Limit / Status check table. In such a case the SPACON should report the MIN/MAX table only.

If OEM 178 is also received, the monitored parameter was Out-of-limit for 3 or more consecutive occurrences. In this case the Out-of-limit value will be included in the Limit / Status check table. In such a case the SPACON should report the MIN/MAX and Limit / Status Check tables.

From the VPD display of the OEM the monitored parameters identity can be determined.
If the parameter ID is of the form 'PM*', this implies that the parameter was one with a non-unique PID, in this case:

- Use Table 6 to determine the identity of all ODB parameters with the same PID contained in the OEM.
- Check which of these is currently in the On-board monitoring list.

If more than one parameter with the same PID is contained in the OBM list, it may be possible to determine which parameter is OOL by checking the MIN/MAX table in the VPD. Here it may be seen which bit of the monitored parameters changed. If this is still inconclusive then the only alternative is to check carefully the monitored parameters behaviours.

7 APPLICABLE OBM AND RACP ENTRIES FOR DIFFERENT MISSION PHASES.

The following sections define the applicable OBM entries which are planned to be used at different mission phases. It also defines the parameters sets ID and TC ID to be used to load that particular entry. These tables were derived from the tables supplied by ALENIA E-mail, on 11th February 2002.

7.1 Orbits with Eclipses

The following mandatory OBM entries must be loaded during orbits with eclipses.

Table 22: Mandatory OBM Entries for Orbits with Eclipses.

TC Parameter Sets ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.				
PSV_ PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MASK	TCPK_ MF_NO
OBM_050	A9083	ANOM DETECT1		0	0	0 DEC	0 DEC	0 DEC	11111111	D3450
OBM_051	A9084	ANOM DETECT 2		0	0	0 DEC	0 DEC	0 DEC	11111111	D3451
OBM_014	PM1166	MON LCL NCBH-A	P1166	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3414
OBM_073	PM1111	MON LCL FDE-A	P1111	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3473
OBM_074	PM1118	MON LCL FCE(CAE)	P1118	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3474
OBM_021	PM1125	MON SPDUGRP5A1	P1125	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3421
OBM_022	PM1153	MON SPDUGRP5B1	P1153	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3422
OBM_015	PM1176	MON LCL SCBH-A	P1176	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3415
OBM_016	PM1184	MON LCL SCBH-B	P1184	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3416
OBM_121	PM1117	LCL STA RMUA	P1117	B10000000B	B10000000B	35 DEC	36 DEC	0 DEC	10000000	N/a*
OBM_025	P3200	BAT1 VOLT M		30.5V	52V	0 DEC	0 DEC	0 DEC	11111111	D3425
OBM_026	P3202	BAT2 VOLT M		30.5V	52V	0 DEC	0 DEC	0 DEC	11111111	D3426
OBM_064	P3115	SA WING1 CUR2		0.00000A	6.70254 A	7 DEC	0 DEC	0 DEC	11111111	D3464
OBM_065	P3118	SA WING2 CUR2		6.70254A	20.02889 A	8 DEC	0 DEC	0 DEC	11111111	D3465
OBM_057	P3114	SA WING1 CUR1		0.52476A	22.50000 A	21 DEC	22 DEC	9 DEC	11111111	D3457
OBM_058	P3116	SA WING1 CUR3		0.00000A	0.96603 A	23 DEC	24 DEC	10 DEC	11111111	D3458
OBM_059	P3117	SA WING2 CUR1		0.52476A	22.50000 A	25 DEC	26 DEC	11 DEC	11111111	D3459
OBM_060	P3119	SA WING2 CUR3		0.00000A	0.96603 A	27 DEC	28 DEC	12 DEC	11111111	D3460
OBM_094	P3120	BDR1 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111	D3724
OBM_095	P3121	BDR2 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111	D3725
OBM_096	P3122	BDR3 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111	D3726
OBM_097	P3123	BDR4 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111	D3727
OBM_077	PM2407	MON PPDU-A ST	P2411	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3477
OBM_078	PM2427	MON PPDU-B ST	P2431	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3478
OBM_102	PM1406	MON SPDU-A DNEL	P1412	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3732

TC Parameter Sets ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.				
PSV_ PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MASK	TCPK_ MF_NO
OBM_103	PM1426	MON SPDU-B DNEL	P1432	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3733
OBM_036	PM3053	MON MRU DNEL	P3053	B00000000B	B00000000B	29 DEC	0 DEC	0 DEC	00001000	D3436
OBM_037	PM3053	MON MRU DNEL	P3054	B00000000B	B00000000B	29 DEC	0 DEC	0 DEC	00000100	D3437
OBM_038	PM3053	MON MRU DNEL	P3055	B00000000B	B00000000B	29 DEC	0 DEC	0 DEC	00000010	D3438
OBM_039	PM3053	MON MRU DNEL	P3056	B00000000B	B00000000B	29 DEC	0 DEC	0 DEC	00000001	D3439
OBM_079	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	13 DEC	14 DEC	0 DEC	00000001	D3479
OBM_080	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	15 DEC	16 DEC	0 DEC	00000001	D3480
OBM_081	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	17 DEC	18 DEC	4 DEC	00010000	D3481
OBM_082	PM1059	MON WD ST SPDU-B	P1059	B00001000B	B00001000B	19 DEC	20 DEC	4 DEC	00001000	D3482
OBM_098	P1061	CDE1 LCL1 CUR		0.00000A	6.179200A	0 DEC	0 DEC	0 DEC	11111111	D3728
OBM_099	P1063	CDE2 LCL1CUR		0.00000A	5.94857A	0 DEC	0 DEC	0 DEC	11111111	D3729
OBM_107	T6038	TCS TH RCS 1 +Z		200 degC	7.2 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_108	T6040	TCS TH RCS 2		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_109	T6033	TCS TH RCS 3		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_110	T6030	TCS TH RCS 4		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_111	T6042	TCS TH RCS 5 +Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_112	T6039	TCS TH RCS 6		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_113	T6031	TCS TH RCS 7		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_114	T6041	TCS TH RCS 8		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_115	T6053	TCS TH RCS –LV01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_116	T6034	TCS TH RCS LV02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_117	T6036	TCS TH RCS PT02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_118	T6035	TCS TH RCS PT01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_119	T6055	TCS TH RCS 5 –Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_120	T6037	TCS TH RCS PT03		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*

*These entries were defined post launch as Parameter sets only – remember the telecommands are not maintained post launch.

The following alternative OBM entries may also be loaded during orbits with eclipses, if space permits.

Table 23: Alternative OBM Entries for Orbits with Eclipses.

TC Parameter Sets ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.				
PSV_ PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MASK	TCPK_ MF_NO
•OBM_075	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	6 DEC	32 DEC	0 DEC	00000001	D3475
•OBM_076	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	33 DEC	34 DEC	0 DEC	00000001	D3476
•OBM_056	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	1 DEC	2 DEC	4 DEC	00010000	D3456
•OBM_063	PM1059	MON WD ST SPDU-B	P1059	B00001000B	B00001000B	3 DEC	5 DEC	4 DEC	00001000	D3463
OBM_122	P1145	LCL STA RMUB		B10000000B	B10000000B	35 DEC	36 DEC	0 DEC	10000000	N/a*

•Same as OBM_079, OBM_080, OBM_081, OBM_082 with the Redundant RACP (PDU B TC I/F)

7.2 Orbits without eclipses

The following mandatory OBM entries must be loaded during orbits without eclipses.

Table 24: Mandatory OBM Entries for Orbits without Eclipses,

TC Parameter Sets ID	Monitored Parameter	Monitoring Limits	RACP TC Pointers.	

PSV_ PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MASK	TCPK_ MF_NO
OBM_050	A9083	ANOM DETECT1		0	0	0 DEC	0 DEC	0 DEC	11111111	D3450
OBM_051	A9084	ANOM DETECT 2		0	0	0 DEC	0 DEC	0 DEC	11111111	D3451
OBM_014	PM1166	MON LCL NCBH-A	P1166	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3414
OBM_073	PM1111	MON LCL FDE-A	P1111	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3473
OBM_074	PM1118	MON LCL FCE(CAE)	P1118	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3474
OBM_021	PM1125	MON SPDUGRP5A1	P1125	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3421
OBM_022	PM1153	MON SPDUGRP5B1	P1153	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3422
OBM_015	PM1176	MON LCL SCBH-A	P1176	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3415
OBM_016	PM1184	MON LCL SCBH-B	P1184	B10000000B	B10000000B	0 DEC	0 DEC	0 DEC	10000000	D3416
OBM_052	A9207	FCE SAS1 B X		-40.0834mA	41.68670mA	0 DEC	0 DEC	0DEC:	11111111	D3452
OBM_053	A9208	FCE SAS1 B Y		-40.0834mA	41.68670mA	0 DEC	0 DEC	0 DEC	11111111	D3453
OBM_023	P3220	BUS MAIN VOLT M		27.63973 V	28.50000 V	0 DEC	0 DEC	0 DEC	11111111	D3423
OBM_077	PM2407	MON PPDU-A ST	P2411	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3477
OBM_078	PM2427	MON PPDU-B ST	P2431	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3478
OBM_102	PM1406	MON SPDU-A DNEL	P1412	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3732
OBM_103	PM1426	MON SPDU-B DNEL	P1432	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000	D3733
OBM_079	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	13 DEC	14 DEC	0 DEC	00000001	D3479
OBM_080	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	15 DEC	16 DEC	0 DEC	00000001	D3480
OBM_081	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	17 DEC	18 DEC	4 DEC	00010000	D3481
OBM_082	PM1059	MON WD ST SPDU-B	P1059	B00001000B	B00001000B	19 DEC	20 DEC	4 DEC	00001000	D3482
OBM_088	T5107	COLDPLATNSFC1		-200.00degC	113 degC	30 DEC	31 DEC	0 DEC	11111111	D3488
OBM_089	T5114	COLDPLATNSFC2		-200.00degC	113 degC	30DEC	31 DEC	0 DEC:	11111111	D3489
OBM_107	T6038	TCS TH RCS 1 +Z		200 degC	7.2 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_108	T6040	TCS TH RCS 2		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_109	T6033	TCS TH RCS 3		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_110	T6030	TCS TH RCS 4		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_111	T6042	TCS TH RCS 5 +Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_112	T6039	TCS TH RCS 6		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_113	T6031	TCS TH RCS 7		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_114	T6041	TCS TH RCS 8		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_115	T6053	TCS TH RCS –LV01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_116	T6034	TCS TH RCS LV02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_117	T6036	TCS TH RCS PT02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_118	T6035	TCS TH RCS PT01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_119	T6055	TCS TH RCS 5 -Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_120	T6037	TCS TH RCS PT03		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111	N/a*
OBM_121	PM1117	LCL STA RMUA	P1117	B10000000B	B10000000B	35 DEC	36 DEC	0 DEC	10000000	N/a*

*These entries were defined post launch as Parameter sets only – remember the telecommands are not maintained post launch.

The following alternative OBM entries may also be loaded during orbits without eclipses, if necessary.

Table 25: Alternative OBM Entries for Orbits without Eclipses.

TC Parameter Sets ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.				
PSV_ PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MASK	TCPK_ MF_NO
♦OBM_061	P3221	BUS MAIN VOLT R		27.83973V	28.500V	0 DEC	0 DEC	0 DEC	11111111	D3461
♥OBM_075	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	6 DEC	32 DEC	0 DEC	00000001	D3475
♥OBM_076	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	33 DEC	34 DEC	0 DEC	00000001	D3476
♥OBM_056	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	1 DEC	2 DEC	4 DEC	00010000	D3456
♥OBM_063	PM1059	MON WD ST SPDU-B	P1059	B00001000B	B00001000B	3 DEC	5 DEC	4 DEC	00001000	D3463
▿OBM_069	P1047	LCL CUR TX2		0.00000 A	1.4999 A	0 DEC	0 DEC	0 DEC	11111111	D3469
▿OBM_071	T0010	TEMPTRSP2 TX		72.50degC	-17.059degC	0 DEC	0 DEC	0 DEC	11111111	D3471
*OBM_100	T5107	COLDPLATNSFC1		-200.00degC	112 degC	37 DEC	38 DEC	0 DEC	11111111	D3730
*OBM_101	T5114	COLDPLATNSFC2		-200.00degC	112 degC	37 DEC	38 DEC	0 DEC	11111111	D3731
OBM_122	PM1145	LCL STA RMUB	P1145	B10000000B	B10000000B	35 DEC	36 DEC	0 DEC	10000000	N/a*

•Same as OBM_079, OBM_080, OBM_081, OBM_082 with the Redundant RACP (PDU B TC I/F)
∇ To be used only of TX-2 is in use.
*May be used as an alternative to OBM_088 and OBM_089.

7.3 Special Operations

Some groups of OBM entries and RACP table entries are defined to cope with certain events, or failure cases. A more detailed description is given of the following operations from the OBM / RACP point of view:

- SPI Annealing
- Eclipse entry
- Eclipse exit
- PDU Watchdogs Monitoring
- PDU Initialisation - Detection of failed PDU Section.
- RCS Undertemperature

7.3.1 SPI ANNEALING

During the SPI Annealing process the following OBM and RACP entries must be loaded.

Table 26: OBM Entries for SPI Annealing.

TC Parameters Sets ID	Monitored Parameter		Monitoring Limits		RACP TC Pointers.				
PSV_PVSID	MNT PID	PCF_DESCR	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNT STATUS	SDB TC
OBM_088	T5107	COLDPLATNSFC1	-200degC	113 degC	30 DEC	31 DEC	0 DEC	ENABLED	D3488
OBM_089	T5114	COLDPLATNSFC2	-200degC	113 degC	30 DEC	31 DEC	0 DEC:	ENABLED	D3489
OBM_100	T5107	COLD PLA TNSFC1	-200degC	112 degC	37 DEC	38 DEC	0 DEC	ENABLED	D3730
OBM_101	T5114	COLD PLA TNSFC2	-200degC	112 degC	37 DEC	38 DEC	0 DEC	ENABLED	D3731

Table 27: RACP Entries for SPI Annealing.

PSV_PVSID	PSV_DESCR	Description
RACP_030	RACP Entry #030	TC: T5015 TSW ANNEAL-A OFF
RACP_031	RACP Entry #031	TC: T5115 TSW ANNEAL-B OFF
RACP_037	RACP Entry #037	TC: T6015 TSW ANNEAL-A OFF
RACP_038	RACP Entry #038	TC: T6115 TSW ANNEAL-B OFF

These entries are used to detect a possible failure in the SPI Annealing Temperature Control Electronics, which could cause continuous activation of the SPI Annealing Heaters and thereby damage the SPI Detector. If either of the monitored Thermistors exceeds the high temperature limit, both SPI Annealing heaters are switched off.
According to the inputs received from ALENIA on 11/2/2002, OBM entries OBM_088 and OBM_089 will always be loaded in orbits with no eclipses. OBM_100 and OBM_101 will be loaded only during SPI annealing operations.

7.3.2 ECLIPSE ENTRY

At eclipse entry, the following OBM entries are triggered:

Table 28: OBM Entries Triggered at Eclipse Entry.

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_057	P3114	SA WING1 CUR1		0.52476A	22.50000 A	21 DEC	22 DEC	9 DEC:	11111111 BIN
OBM_059	P3117	SA WING2 CUR1		0.52476A	22.50000 A	25 DEC	26 DEC	11 DEC	11111111 BIN
OBM_065	P3118	SA WING 2 CUR2		6.70254 A	20.02889A	8 DEC	0 DEC	0 DEC	11111111 BIN

Following triggering they are disabled automatically, and the following RACPs are issued:

Table 29: RACPs Issued at Eclipse Entry.

PSV_PVSID	Description
RACP_021	Enable OBM for TM: P3120 BDR1 CURRENT (PID = #210B)
RACP_022	Enable OBM for TM: P3121 BDR2 CURRENT (PID = #210D)
RACP_009	Enable OBM for TM: P3116 SA WING 1 CURRENT 3 (PID = #2101)
RACP_025	Enable OBM for TM: P3122 BDR3 CURRENT (PID = #210F)
RACP_026	Enable OBM for TM: P3123 BDR4 CURRENT (PID = #2113)
RACP_011	Enable OBM for TM: P3119 SA WING 2 CURRENT 3 (PID = #2109)
RACP_008	Enable OBM for TM: P3115 SA WING 1 CURRENT 2 (PID = #20FF)

These RACPs enable the following OBM entries for monitoring during eclipse.

Table 30: OBM Entries Enabled at Eclipse Entry.

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_064	P3115	SA WING 1 CUR 2		0.00000 A	6.70254 A	7 DEC	0 DEC	0 DEC	11111111 BIN
OBM_058	P3116	SA WING1 CUR3		0.00000A	0.96603 A	23 DEC	24 DEC	10 DEC	11111111 BIN
OBM_060	P3119	SA WING2 CUR3		0.00000A	0.96603 A	27 DEC	28 DEC	12 DEC	11111111 BIN
OBM_094	P3120	BDR1 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_095	P3121	BDR2 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_096	P3122	BDR3 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_097	P3123	BDR4 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN

OBM entries OBM_094, OBM_095, OBM_096, OBM_097 are loaded to detect DBR over / under-current during eclipse and to record the maximum BDR current passed during eclipse.

OBM entries OBM_064, OBM_058, OBM_060 are used to detect the eclipse exit. Three entries are necessary for this as a total of 7 RACPs are issued at eclipse exit.

7.3.3 ECLIPSE EXIT

At Eclipse exit, the following OBM entries are triggered.

Table 31: OBM entries Triggered at Eclipse Exit.

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_064	P3115	SA WING 1 CUR 2		0.00000 A	6.70254 A	7 DEC	0 DEC	0 DEC	11111111 BIN
OBM_058	P3116	SA WING1 CUR3		0.00000A	0.96603 A	23 DEC	24 DEC	10 DEC	11111111 BIN
OBM_060	P3119	SA WING2 CUR3		0.00000A	0.96603 A	27 DEC	28 DEC	12 DEC	11111111 BIN

Following triggering they are disabled automatically, and the following RACPs are issued:

Table 32: RACPs Issued at Eclipse Exit.

PSV_PVSID	Description
RACP_007	Enable OBM for TM: P3118 SA WING 2 CURRENT 2 (PID = #2107)
RACP_010	Enable OBM for TM: P3114 SA WING 1 CURRENT 1 (PID = #21FD)
RACP_012	Enable OBM for TM: P3119 SA WING 2 CURRENT 1 (PID = #2103)
RACP_023	Disable OBM for TM: P3120 BDR1 CURRENT (PID = #210B)
RACP_024	Disable OBM for TM: P3121 BDR2 CURRENT (PID = #210D)
RACP_027	Disable OBM for TM: P3122 BDR3 CURRENT (PID = #210F)
RACP_028	Disable OBM for TM: P3123 BDR4 CURRENT (PID = #2113)

These RACPs enable the OBM entries for monitoring during Sunlight (OBM_057, OBM_059, OBM_065) and disable the entries for BDRs currents monitoring during eclipse (OBM_094, OBM_095, OBM_096, OBM_097)

Table 33: OBM Entries Enabled / Disabled at Eclipse Exit.

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_057	P3114	SA WING1 CUR1		0.52476A	22.50000 A	21 DEC	22 DEC	9 DEC:	11111111 BIN
OBM_059	P3117	SA WING2 CUR1		0.52476A	22.50000 A	25 DEC	26 DEC	11 DEC	11111111 BIN
OBM_065	P3118	SA WING 2 CUR2		6.70254 A	20.02889A	8 DEC	0 DEC	0 DEC	11111111 BIN
OBM_094	P3120	BDR1 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_095	P3121	BDR2 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_096	P3122	BDR3 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN
OBM_097	P3123	BDR4 OUTPUTCUR		0.53518A	13.02036A	0 DEC	0 DEC	0 DEC	11111111 BIN

OBM Entries OBM_057, OBM_059, OBM_065 are used to detect the next eclipse entry.

7.3.4 PDU WATCHDOGS MONITORING

The following OBM entries are loaded in all mission phases to detect SPDU or PPDU watchdog Triggering.

Table 34: OBM Entries to Detect PDU Watchdog Triggering.

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_056	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	1 DEC	2 DEC	4 DEC:	00010000BIN
OBM_063	PM1059	MON WD ST SPDU-B	P1059	B00001000B	800001000B	3 DEC	5 DEC	4 DEC	00001000BIN
OBM_075	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	6 DEC	32 DEC	0 DEC	00000001BIN
OBM_076	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	33 DEC	34 DEC	0 DEC	00000001BIN
OBM_079	PM1056	MON WD ST PPDU-A	P1056	B00000001B	B00000001B	13 DEC	14 DEC	0 DEC	00000001BIN
OBM_080	PM1057	MON WD ST PPDU-B	P1057	B00000001B	B00000001B	15 DEC	16 DEC	0 DEC	00000001BIN
OBM_081	PM1058	MON WD ST SPDU-A	P1058	B00010000B	B00010000B	17 DEC	18 DEC	4 DEC	00010000BIN
OBM_082	PM1059	MON WD ST SPDU-B	P1059	B00001000B	B00001000B	19 DEC	20 DEC	4 DEC	00001000BIN

If any of the 4 PDU watchdogs are triggered, some of the following RACPs are issued.

If SPDU-A watchdog is triggered, this is detected by OBM entries OBM_056 and OBM_081, in this case the following RACPs are issued.

Table 35: RACPs Issued at SPDU-A watchdog triggered.

PSV_PVSID	Description
RACP_001	TC: P2971 SPDUB ON RTUB
RACP_002	TC: P2960 SPDUA OFF RTUB
RACP_004	TC: D3490 DISABLE MON FUN
RACP_017	TC: P2951 SPDUB ON RTUA
RACP_018	TC: P2940 SPDUB OFF RTUA

These RACPs switch off the failed SPDU-A side using both prime and redundant command. They also ensure that the SPDU-B side is on by issuing the SPDU-B on command, again both prime and Redundant. Lastly the On-board Monitoring function is disabled, to prevent possible erroneous failure detection and issue of RACPs, due to the invalid SPDU telemetry following SPDU-A switch-off.

If SPDU-B watchdog is triggered, this is detected by OBM entries OBM_063 and OBM_082, in this case the following RACPs are issued.

Table 36: RACPs Issued at SPDU-B watchdog triggered.

PSV_PVSID	Description
RACP_003	TC: P2961 SPDUA ON RTUB
RACP_005	TC: P2970 SPDUB OFF RTUB
RACP_019	TC: P2941 SPDUA ON RTUA
RACP_020	TC: P2950 SPDUB OFF RTUA
RACP_004	TC: D3490 DISABLE MON FUN

These RACPs switch off the failed SPDU-B side using both prime and redundant command. They also ensure that the SPDU-A side is on by issuing the SPDU-A on command, again both prime and Redundant. Lastly the On-board Monitoring function is disabled, to prevent possible erroneous failure detection and issue of RACPs, due to the invalid SPDU telemetry following SPDU-B switch-off.

If PPDU-A watchdog is triggered, this is detected by OBM entries OBM_075 and OBM_079, in this case the following RACPs are issued.

Table 37: RACPs Issued at PPDU-A watchdog triggered.

PSV_PVSID	Description
RACP_006	TC: P2471 PPDUB ON RTUB
RACP_032	TC: P2460 PPDUA OFF RTUB
RACP_013	TC: P2451 PPDUB ON RTUA
RACP_014	TC: P2440 PPDUA OFF RTUA

These RACPs switch off the failed PPDU-A side using both prime and redundant command. They also ensure that the PPDU-B side is on by issuing the PPDU-B on command, again both prime and Redundant.

If PPDU-B watchdog is triggered, this is detected by OBM entries OBM_076 and OBM_080, in this case the following RACPs are issued.

Table 38: RACPs Issued at PPDU-B watchdog triggered.

PSV_PVSID	Description
RACP_033	TC: P2461 PPDUA ON RTUB
RACP_034	TC: P2470 PPDUB OFF RTUB
RACP_015	TC: P2441 PPDUA ON RTUA
RACP_016	TC: P2450 PPDUB OFF RTUA

These RACPs switch off the failed PPDU-B side using both prime and redundant command. They also ensure that the PPDU-A side is on by issuing the PPDU-A on command, again both prime and Redundant.

7.3.5 PDU INITIALISATION - DETECTION OF FAILED PDU SECTION.

The following OBM entries are used to detect PDU initialisation, and in particular to differentiate which PDU side initialised, in the case of spurious initialisation.
It is currently foreseen to load these entries only following the first occurrence of spurious initialisation and only for the affected PDU.

Table 39: OBM Entries to detect PDUs Initialisation,

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_077	PM2407	MON PPDU-A ST	P2411	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000BIN
OBM_078	PM2427	MON PPDU-B ST	P2431	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000BIN
OBM_102	PM1406	MON SPDU-A DNEL	P1412	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000BIN
OBM_103	PM1426	MON SPDU-B DNEL	P1432	B00000000B	B00000000B	0 DEC	0 DEC	0 DEC	00001000BIN

When a PDU side initialises, the Initialisation flag is set for one TM Cycle only. For this reason the out-of-limits will not be written to the Limit / Status Check table, however one OEM will be issued, containing the identifier of the OBM dummy parameter (MNT PID) associated with the PDU side which initialised. Using this, ground will be able to detect which PDU side initialised, a little care will be needed to differentiate occurrence of DNEL and initialisation, normally the DNEL status will be set long enough to write the failure to the Limit / Status Check table.

7.3.6 RCS UNDERTEMPERATURE

Following study of the thermal behaviour of the RCS Subsystem the heating concept of the RCS was changed. Propellant Heater B is now permanently OFF, Propellant Heater A only is enabled. The RCS subsystem is protected against under-temperature / Propellant Heater A failure by 14 new OBM entries and 2 new RACP TC. The 14 OBM entries check 14 RCS Thermistors temperatures against a low temperature threshold, if any one of these entries falls below the check threshold the RACPs are issued to switch on Propellant heater B via Nominal and Redundant TC.
To accommodate these 14 new entries the OBM tables for eclipse and Sunlight seasons were updated, the FOP and ODB have also been.

The following OBM entries are used to detect a possible RCS under-temperature.:

Table 40: OBM Entries to detect RCS Under-temperature,

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_107	T6038	TCS TH RCS 1 +Z		200 degC	7.2 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_108	T6040	TCS TH RCS 2		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_109	T6033	TCS TH RCS 3		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_110	T6030	TCS TH RCS 4		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_111	T6042	TCS TH RCS 5 +Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_112	T6039	TCS TH RCS 6		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_113	T6031	TCS TH RCS 7		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_114	T6041	TCS TH RCS 8		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_115	T6053	TCS TH RCS –LV01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111

TC Parameter Set ID	Monitored Parameter			Monitoring Limits		RACP TC Pointers.			
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT LL	MNT HL	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNTMASK
OBM_116	T6034	TCS TH RCS LV02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_117	T6036	TCS TH RCS PT02		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_118	T6035	TCS TH RCS PT01		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_119	T6055	TCS TH RCS 5 -Y		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111
OBM_120	T6037	TCS TH RCS PT03		200 degC	14 degC	41 DEC	42 DEC	0 DEC	11111111

The following RACP are issued if any of the above OBM entries detects a RCS under-temperature.:

Table 41: RACPs issued at RCS Under-temperature detection.

PSV_PVSID	Description
RACP_041	TC: T1331 TSW PROP-B ON (SPDU-A)
RACP_042	TC: T4331 TSW PROP-B ON (SPDU-B)

7.3.7 BATTERY RECONDITIIONING.

Additionally two sets of OBM entries and RACPs have been defined to support battery Reconditioning operations. Details of the use of these entries can be found in a dedicated TN: INT-SYST-HW-PR-1001-TOS-OF

7.4 List of all OBM entries defined in ODB.

The following table contains all OBM entries currently defined in the ODB.

The column PSV_PVSID contains the identifier of the Parameters Values Set which is used to load the particular entry in the OBM table.
The column TCPK_MF_NO, contains the equivalent SDB TC identifier where such a TC exists – note that since launch (SDB3.1) these TCs are no longer maintained.

Table 42: All OBM entries in ODB

TC Parameters Sets ID	Monitored Parameter				Monitoring Limits (raw and interpreted)				RACP TC Pointers.					
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT INT	MNT LL	MNT LL (raw)	MNT HL	MNT HL (raw)	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNT STATUS	MNTMASK	TCPK_MF_NO
OBM_001	A9000	ACCA+5V		ONE TMCYCLE	0,00000 V	0	4.49641 V	150	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3401
OBM_002	AM900N	MON ACC-ARELAYS	A9001	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3402
OBM_003	AM900N	MONACC-ARELAYS	A9002	ONE TMCYCLE	B01000000B	64	B01000000B	64	0 DEC	0 DEC	0 DEC	ENABLED	01000000BIN	D3403
OBM_004	AM900N	MON ACC-A RELAYS	A9003	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00100000BIN	D3404
OBM_005	AM900N	MON ACC-A RELAYS	A9004	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00010000BIN	D3405
OBM_006	AM900N	MON ACC-A RELAYS	A9005	ONE TMCYCLE	B00001000B	8	B00001000B	8	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3406
OBM_007	A9950	RMUA X RATE		ONE TMCYCLE	0.68250d/s	0	-0.709800d/s	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3407
OBM_008	A9951	RMUAYRATE		ONE TMCYCLE	0.68250d/s	0	-0.709800d/s	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3408
OBM_009	A9952	RMUA Z RATE		ONE TMCYCLE	0.68250d/s	0	-0.709800d/s	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3409
OBM_010	PM1105	MON LCL FCV-A	P1105	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3410
OBM_011	PM1101	MON LCL LV-A	P1101	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000 BIN	D3411
OBM_012	PM1112	MON LCL IMU1	P1112	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3412
OBM_013	PM1151	MON LCL IMU3	P1151	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3413
OBM_014	PM1166	MON LCL NCBH-A	P1166	ONETMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3414
OBM_015	PM1176	MON LCL SCBH-A	P1176	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3415
OBM_016	PM1184	MON LCL SCBH-B	P1184	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3416
OBM_017	PM1104	MON LCL CAE-A	P1104	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3417
OBM_018	PM1111	MON LCL FDE-A	P1111	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3418
OBM_019	PM1118	MON LCL FCE(CAE)	P1118	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3419
OBM_020	PM1117	MON LCL RMU-A	P1117	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3420
OBM_021	PM1125	MON SPDUGRP5A1	P1125	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3421
OBM_022	PM1153	MON SPDUGRP5B1	P1153	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3422
OBM_023	P3220	BUS MAIN VOLT M		ONE TMCYCLE	27.63973 V	223	28.50000 V	230	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3423
OBM_024	PM3061	MON MRU ECL-M	P3061	ONE TMCYCLE	B00001000B	8	B00001000B	8	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3424
OBM_025	P3200	BAT1 VOLT M		ONE TMCYCLE	30.5 V	150	52 V	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3425
OBM_026	P3202	BAT2 VOLT M		ONE TMCYCLE	30.5 V	150	52 V	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3426

TC Parameters Sets ID	Monitored Parameter				Monitoring Limits (raw and interpreted)				RACP TC Pointers.					
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_NAME	MNT INT	MNT LL	MNT LL (raw)	MNT HL	MNT HL (raw)	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNT STATUS	MNTMASK	TCPK_MF_NO
OBM_027	P3115	SA WING 1 CUR 2		ONE TMCYCLE	0.00000 A	0	6.70254 A	76	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3427
OBM_028	P3118	SA WING 2 CUR2		ONE TMCYCLE	0.00000A	0	6.70254 A	76	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3428
OBM_029	PM5102	MON PRU-A CV ST	P5102	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00000001BIN	D3429
OBM_030	PM5109	MON PRU-B CVST	P5109	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00000001BIN	D3430
OBM_031	T6000	TCSTHBATTERYC		ONE TMCYCLE	20.00degC	82	-10.000degC	179	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3431
OBM_032	PM1406	MON SPDU-ADNEL	P1406	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00100000BIN	D3432
OBM_033	PM1426	MON SPDU-B DNEL	P1426	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00100000BIN	D3433
OBM_034	PM2407	MON PPDU-A ST	P2407	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00100000BIN	D3434
OBM_035	PM2427	MON PPDU-B ST	P2427	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00100000BIN	D3435
OBM_036	PM3053	MON MRU DNEL	P3053	ONE TMCYCLE	B00000000B	0	B00000000B	0	29 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3436
OBM_037	PM3053	MON MRU DNEL	P3054	ONE TMCYCLE	B00000000B	0	B00000000B	0	29 DEC	0 DEC	0 DEC	ENABLED	00000100BIN	D3437
OBM_038	PM3053	MON MRU DNEL	P3055	ONE TMCYCLE	B00000000B	0	B00000000B	0	29 DEC	0 DEC	0 DEC	ENABLED	00000010BIN	D3438
OBM_039	PM3053	MON MRU DNEL	P3056	ONE TMCYCLE	B00000000B	0	B00000000B	0	29 DEC	0 DEC	0 DEC	ENABLED	00000001BIN	D3439
OBM_040	P1003	FCLCURCDMUA		ONE TMCYCLE	0.14732A	30	0.6521 A	133	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3440
OBM_041	P1031	FCLCURCDMUB		ONE TMCYCLE	0.14732A	30	0.6521 A	133	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3441
OBM_042	This entry is currently not defined / used.													
OBM_043	P1009	FCL CUR RX 1		ONE TMCYCLE	0.00000 A .	0	0.299246 A	61	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3443
OBM_044	P1037	FCL CUR RX2		ONE TMCYCLE	0.00000 A .	0	0.299246 A	61	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3444
OBM_045	P1060	CDE1 LCL2 CUR		ONE TMCYCLE	0.00000 A	0	6.82947 A	147	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3445
OBM_046	P1062	CDE2 LCL2 CUR		ONE TMCYCLE	0.00000A	0	6.91899A	152	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3446
OBM_047	P1061	CDE1 LCL 1 CUR		ONE TMCYCLE	0.00000 A	0	8.214400 A	165	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3447
OBM_048	P1063	CDE2 LCL 1 CUR		ONE TMCYCLE	0.00000 A	0	8.120526 A	175	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3448
OBM_049	A9000	ACC A+5V		ONE TMCYCLE	4.49641V	150	5.995216 V	200	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3449
OBM_050	A9083	ANOM DETECT1		ONE TMCYCLE	0	0	0	0	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3450
OBM_051	A9084	ANOM DETECT 2		ONE TMCYCLE	0	0	0	0	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3451
OBM_052	A9207	FCE SAS1 B X		ONE TMCYCLE	-40.0834mA	0	41.68670mA	255	0 DEC	0 DEC	0DEC:	ENABLED	11111111BIN	D3452
OBM_053	A9208	FCE SAS1 B Y		ONE TMCYCLE	-40.0834mA	0	41.68670mA	255	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3453
OBM_054	P1011	LCLCURFDEA		ONE TMCYCLE	0.06401A	13	0.1228 A	25	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3454
OBM_055	PM1117	MON LCL RMU.A	P1117	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3455
OBM_056	PM1058	MON WD ST SPDU-A	P1058	ONE TMCYCLE	B00010000B	16	B00010000B	16	1 DEC	2 DEC	4 DEC	ENABLED	00010000BIN	D3456
OBM_057	P3114	SA WING1 CUR1		ONE TMCYCLE	0.52476A	6	22.50000 A	255	21 DEC	22 DEC	9 DEC	ENABLED	11111111BIN	D3457
OBM_058	P3116	SA WING1 CUR3		ONE TMCYCLE	0.00000A	0	0.96603 A	11	23 DEC	24 DEC	10 DEC	DISABLED	11111111BIN	D3458
OBM_059	P3117	SA WING2 CUR1		ONE TMCYCLE	0.52476A	6	22.50000 A	255	25 DEC	26 DEC	11 DEC	ENABLED	11111111BIN	D3459
OBM_060	P3119	SA WING2 CUR3		ONE TMCYCLE	0.00000A	0	0.96603 A	11	27 DEC	28 DEC	12 DEC	DISABLED	11111111BIN	D3460
OBM_061	P3221	BUS MAIN VOLT R		ONE TMCYCLE	27.63973V	223	28.500V	230	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3461
OBM_062	PM1119	MONLCLSTA{TX1)	P1119	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3462
OBM_063	PM1059	MON WD STSPDU-B	P1059	ONE TMCYCLE	B00001000B	8	800001000B	8	3 DEC	5 DEC	4 DEC	ENABLED	00001000BIN	D3463
OBM_064	P3115	SA WING1 CUR2		ONE TMCYCLE	0.00000A	0	6.70254 A	76	7 DEC	0 DEC	0 DEC	DISABLED	11111111BIN	D3464
OBM_065	P3118	SA WING2 CUR2		ONE TMCYCLE	6.70254A	76	20.02889 A	227	8 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3465
OBM_066	T6001	TCSTHBATTERY+Y		ONE TMCYCLE	20.00degC	82	-10.00degC	179	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3466

TC Parameters Sets ID	Monitored Parameter				Monitoring Limits (raw and interpreted)				RACP TC Pointers.					
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT INT	MNT LL	MNT LL (raw)	MNT HL	MNT HL (raw)	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNT STATUS	MNTMASK	TCPK_ MF_NO
OBM_067	T6002	TCSTHBATTERY-Y		ONE TMCYCLE	20.00degC	82	-10.00degC	179	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3467
OBM_068	P1019	LCL CUR TX1		ONE TMCYCLE	0.00000 A	0	1.4999 A	102	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3468
OBM_069	P1047	LCL CUR TX2		ONE TMCYCLE	0.00000 A	0	1.4999 A	102	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3469
OBM_070	T0008	TEMPTRSP1 TX		ONE TMCYCLE	72.50degC	16	-17.059degC	204	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3470
OBM_071	T0010	TEMPTRSP2 TX		ONE TMCYCLE	72.50degC	16	-17.059degC	204	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3471
OBM_072	PM1104	MON LCL CAE-A	P1104	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3472
OBM_073	PM1111	MON LCL FDE-A	P1111	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3473
OBM_074	PM1118	MON LCL FCE(CAE)	P1118	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3474
OBM_075	PM1056	MON WD ST PPDU-A	P1056	ONE TMCYCLE	B00000001B	1	B00000001B	1	6 DEC	32 DEC	0 DEC	ENABLED	00000001BIN	D3475
OBM_076	PM1057	MON WD ST PPDU-B	P1057	ONE TMCYCLE	B00000001B	1	B00000001B	1	33 DEC	34 DEC	0 DEC	ENABLED	00000001BIN	D3476
OBM_077	PM2407	MON PPDU-A ST	P2411	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3477
OBM_078	PM2427	MON PPDU-B ST	P2431	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3478
OBM_079	PM1056	MON WD ST PPDU-A	P1056	ONE TMCYCLE	B00000001B	1	B00000001B	1	13 DEC	14 DEC	0 DEC	ENABLED	00000001BIN	D3479
OBM_080	PM1057	MON WD ST PPDU-B	P1057	ONE TMCYCLE	B00000001B	1	B00000001B	1	15 DEC	16 DEC	0 DEC	ENABLED	00000001BIN	D3480
OBM_081	PM1058	MON WD ST SPDU-A	P1058	ONE TMCYCLE	B00010000B	16	B00010000B	16	17 DEC	18 DEC	4 DEC	ENABLED	00010000BIN	D3481
OBM_082	PM1059	MON WD ST SPDU-B	P1059	ONE TMCYCLE	B00001000B	8	B00001000B	8	19 DEC	20 DEC	4 DEC	ENABLED	00001000BIN	D3482
OBM_083	P1046	LCL CUR FDEB		ONE TMCYCLE	0.06401A	13	0.12282A	25	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3483
OBM_084	PM1174	MONLCLNCBH-B	P1174	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3484
OBM_085	PM1174	MONLCLNCBH-B	P1174	ONE TMCYCLE	B10000000B	128	B10000000B	128	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3485
OBM_086	P1018	LCL CUR FCEA		ONE TMCYCLE	0.049603A	5	0.1280A	13	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3486
OBM_087	P1039	LCL CUR FCE B		ONE TMCYCLE	0.049603A	5	0.1280A	13	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3487
OBM_088	T5107	COLDPLATNSFC1		ONE TMCYCLE	-200.00degC	0	113 degC	211	30 DEC	31 DEC	0 DEC	ENABLED	11111111BIN	D3488
OBM_089	T5114	COLDPLATNSFC2		ONE TMCYCLE	-200.00degC	0	113 degC	211	30DEC	31 DEC	0 DEC:	ENABLED	11111111BIN	D3489
OBM_090	PM3053	MON MRU DNEL	P3053	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC:	ENABLED	00001000BIN	D3720
OBM_091	PM3053	MON MRU DNEL	P3054	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC:	ENABLED	00000100BIN	D3721
OBM_092	PM3053	MON MRU DNEL	P3055	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC:	ENABLED	00000010BIN	D3722
OBM_093	PM3053	MON MRU DNEL	P3056	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00000001BIN	D3723
OBM_094	P3120	BDR1 OUTPUTCUR		ONE TMCYCLE	0.53518A	13	13.02036A	186	0 DEC	0 DEC	0 DEC	DISABLED	11111111BIN	D3724
OBM_095	P3121	BDR2 OUTPUTCUR		ONE TMCYCLE	0.53518A	13	13.02036A	186	0 DEC	0 DEC	0 DEC	DISABLED	11111111BIN	D3725
OBM_096	P3122	BDR3 OUTPUTCUR		ONE TMCYCLE	0.53518A	13	13.02036A	186	0 DEC	0 DEC	0 DEC	DISABLED	11111111BIN	D3726
OBM_097	P3123	BDR4 OUTPUTCUR		ONE TMCYCLE	0.53518A	13	13.02036A	186	0 DEC	0 DEC	0 DEC	DISABLED	11111111BIN	D3727
OBM_098	P1061	CDE1 LCL1 CUR		ONE TMCYCLE	0.00000A	0	6.179200A	135	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3728
OBM_099	P1063	CDE2 LCL1CUR		ONE TMCYCLE	0.00000A	0	5.94857A	140	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3729
OBM_100	T5107	COLD PLA TNSFC1		ONE TMCYCLE	-200.00degC	0	112 degC	211	37 DEC	38 DEC	0 DEC	ENABLED	11111111BIN	D3730
OBM_101	T5114	COLD PLA TNSFC2		ONE TMCYCLE	-200.00degC	0	112 degC	211	37 DEC	38 DEC	0 DEC	ENABLED	11111111BIN	D3731
OBM_102	PM1406	MON SPDU-A DNEL	P1412	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3732
OBM_103	PM1426	MON SPDU-B DNEL	P1432	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	00001000BIN	D3733
OBM_104	PM1166	MON LCL N CBH-A	P1166	ONE TMCYCLE	B00000000B	0	B00000000B	0	0 DEC	0 DEC	0 DEC	ENABLED	10000000BIN	D3734
OBM_105	D9007	CDA POWTEMP		ONE TMCYCLE	60.125 degC	63	-20 degC	243	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3735
OBM_106	D9016	CDB POWTEMP		ONE TMCYCLE	60.125 degC	63	-20 degC	243	0 DEC	0 DEC	0 DEC	ENABLED	11111111BIN	D3736

TC Parameters Sets ID	Monitored Parameter				Monitoring Limits (raw and interpreted)				RACP TC Pointers.					
PSV_PVSID	MNT PID	PCF_DESCR	*PCF_ NAME	MNT INT	MNT LL	MNT LL (raw)	MNT HL	MNT HL (raw)	MNT POINT 1	MNT POINT 2	MNT POINT 3	MNT STATUS	MNTMASK	TCPK_ MF_NO
OBM_107	T6038	TCS TH RCS 1 +Z		ONE TMCYCLE	200 degC	0	7.2 degC	119	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_108	T6040	TCS TH RCS 2		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_109	T6033	TCS TH RCS 3		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_110	T6030	TCS TH RCS 4		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_111	T6042	TCS TH RCS 5 +Y		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_112	T6039	TCS TH RCS 6		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_113	T6031	TCS TH RCS 7		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_114	T6041	TCS TH RCS 8		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_115	T6053	TCS TH RCS –LV01		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_116	T6034	TCS TH RCS LV02		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_117	T6036	TCS TH RCS PT02		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_118	T6035	TCS TH RCS PT01		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_119	T6055	TCS TH RCS 5 -Y		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_120	T6037	TCS TH RCS PT03		ONE TMCYCLE	200 degC	0	14 degC	98	41 DEC	42 DEC	0 DEC	ENABLED	11111111	N/a**
OBM_121	PM1117	LCL STA RMUA		ONE TMCYCLE	B10000000B	128	B10000000B	128	35 DEC	36 DEC	0 DEC	ENABLED	10000000	N/a*
OBM_122	PM1145	LCL STA RMUB		ONE TMCYCLE	B10000000B	128	B10000000B	128	35 DEC	36 DEC	0 DEC	ENABLED	10000000	N/a*
OBM_200	P3200	BAT1 VOLT M		ONE TMCYCLE	6.1V	30	52V	255	43	44	0	ENABLED	11111111	N/a*
OBM_201	P3201	BAT1 VOLT R		ONE TMCYCLE	6.1V	30	52V	255	45	46	0	ENABLED	11111111	N/a*
OBM_202	P3400	BAT1 TEMP 1		ONE TMCYCLE	5degC	173	-20 degC	255	47	0	0	ENABLED	11111111	N/a*
OBM_203	P3200	BAT1 VOLT M		ONE TMCYCLE	0V	0	50V	245	47	0	0	ENABLED	11111111	N/a*
OBM_210	P3202	BAT2 VOLT M		ONE TMCYCLE	6.1V	30	52V	255	43	44	0	ENABLED	11111111	N/a*
OBM_211	P3203	BAT2 VOLT R		ONE TMCYCLE	6.1V	30	52V	255	45	46	0	ENABLED	11111111	N/a*
OBM_212	P3403	BAT2 TEMP 1		ONE TMCYCLE	5degC	173	-20 degC	255	47	0	0	ENABLED	11111111	N/a*
OBM_213	P3203	BAT2 VOLT M		ONE TMCYCLE	0V	0	50V	245	47	0	0	ENABLED	11111111	N/a*

*Equivalent ODB TM identifier, obtained by applying the mask to the 8 bit OBM parameters, this field is only populated in the case that MNT MASK ≠ 11111111.

** These entries were defined post launch as Parameter sets only.

7.5 List of all RACP TCs defined in ODB.

Table 43: All RACP TCs in ODB

PSV_PVSID	PSV_DESCR	Description	RACP Table Location	SSC	TCPK_MF_NO

PSV_PVSID	PSV_DESCR	Description	RACP Table Location	SSC	TCPK_MF_NO
RACP_001	RACP Entry #001	TC: P2971 SPDUB ON RTUB	1	8293	D3841
RACP_002	RACP Entry #002	TC: P2960 SPDUA OFF RTUB	2	8294	D3842
RACP_003	RACP Entry #003	TC: P2961 SPDUA ON RTUB	3	8295	D3843
RACP_004	RACP Entry #004	TC: D3490 DISABLE MON FUN	4	8296	D3844
RACP_005	RACP Entry #005	TC: P2970 SPDUB OFF RTUB	5	8297	D3845
RACP_006	RACP Entry #006	TC: P2471 PPDUB ON RTUB	6	8298	D3846
RACP_007	RACP Entry #007	Enable OBM for TM: P3118 SA WING 2 CURRENT 2 (PID = #2107)	7	8299	D3847
RACP_008	RACP Entry #008	Enable OBM for TM: P3115 SA WING 1 CURRENT 2 (PID = #20FF)	8	8300	D3848
RACP_009	RACP Entry #009	Enable OBM for TM: P3116 SA WING 1 CURRENT 3 (PID = #2101)	9	8301	D3849
RACP_010	RACP Entry #010	Enable OBM for TM: P3114 SA WING 1 CURRENT 1 (PID = #21FD)	10	8302	D3850
RACP_011	RACP Entry #011	Enable OBM for TM: P3119 SA WING 2 CURRENT 3 (PID = #2109)	11	8303	D3851
RACP_012	RACP Entry #012	Enable OBM for TM: P3119 SA WING 2 CURRENT 1 (PID = #2103)	12	8304	D3852
RACP_013	RACP Entry #013	TC: P2451 PPDUB ON RTUA	13	8305	D3853
RACP_014	RACP Entry #014	TC: P2440 PPDUA OFF RTUA	14	8306	D3854
RACP_015	RACP Entry #015	TC: P2441 PPDUA ON RTUA	15	8307	D3855
RACP_016	RACP Entry #016	TC: P2450 PPDUB OFF RTUA	16	8308	D3856
RACP_017	RACP Entry #017	TC: P2951 SPDUB ON RTUA	17	8309	D3857
RACP_018	RACP Entry #018	TC: P2940 SPDUB OFF RTUA	18	8310	D3858
RACP_019	RACP Entry #019	TC: P2941 SPDUA ON RTUA	19	8311	D3859
RACP_020	RACP Entry #020	TC: P2950 SPDUB OFF RTUA	20	8312	D3860
RACP_021	RACP Entry #021	Enable OBM for TM: P3120 BDR1 CURRENT (PID = #210B)	21	8313	D3861
RACP_022	RACP Entry #022	Enable OBM for TM: P3121 BDR2 CURRENT (PID = #210D)	22	8314	D3862
RACP_023	RACP Entry #023	Disable OBM for TM: P3120 BDR1 CURRENT (PID = #210B)	23	8315	D3863
RACP_024	RACP Entry #024	Disable OBM for TM: P3121 BDR2 CURRENT (PID = #210D)	24	8316	D3864
RACP_025	RACP Entry #025	Enable OBM for TM: P3122 BDR3 CURRENT (PID = #210F)	25	8317	D3865
RACP_026	RACP Entry #026	Enable OBM for TM: P3123 BDR4 CURRENT (PID = #2113)	26	8318	D3866
RACP_027	RACP Entry #027	Disable OBM for TM: P3122 BDR3 CURRENT (PID = #210F)	27	8319	D3867

PSV_PVSID	PSV_DESCR	Description	RACP Table Location	SSC	TCPK_MF_NO
RACP_028	RACP Entry #028	Disable OBM for TM: P3123 BDR4 CURRENT (PID = #2113)	28	8320	D3868
RACP_029	RACP Entry #029	TC: D4000 DISABLE BCPKT	29	8321	D3869
RACP_030	RACP Entry #030	TC: T5015 TSW ANNEAL-A OFF	30	8322	D3870
RACP_031	RACP Entry #031	TC: T5115 TSW ANNEAL-B OFF	31	8323	D3871
RACP_032	RACP Entry #032	TC: P2460 PPDUA OFF RTUB	32	8324	D3872
RACP_033	RACP Entry #033	TC: P2461 PPDUA ON RTUB	33	8325	D3873
RACP_034	RACP Entry #034	TC: P2470 PPDUB OFF RTUB	34	8326	D3874
RACP_035	RACP Entry #035	TC: P3030 CDE 1 LCL 1 OFF	35	8327	D3875
RACP_036	RACP Entry #036	TC: P3270 CDE 2 LCL 1 OFF	36	8328	D3876
RACP_037	RACP Entry #037	TC: T6015 TSW ANNEAL-A OFF	37	8329	D3877
RACP_038	RACP Entry #038	TC: T6115 TSW ANNEAL-B OFF	38	8330	D3878
RACP_039	RACP Entry #039	TC: P3530 CDE 1 LCL 1 OFF	39	8331	D3879
RACP_040	RACP Entry #040	TC: P3770 CDE 2 LCL 1 OFF	40	8332	D3880
RACP_041	RACP Entry #041	TC: T1331 TSW PROP-B ON (SPDU-A)	41	8333	N/a*
RACP_042	RACP Entry #042	TC: T4331 TSW PROP-B ON (SPDU-B)	42	8334	N/a*
RACP_043	RACP Entry #043	TC: **P3171: LCL RMU-A ON (SPDU-A)**	35	8327	N/a*
RACP_044	RACP Entry #044	TC: **P3671: LCL RMU-A ON (SPDU-B)**	36	8328	N/a*
RACP_045	RACP Entry #045	TC: **P3411: LCL RMU-B ON (SPDU-A)**	35	8327	N/a*
RACP_046	RACP Entry #046	TC: **P3911: LCL RMU-B ON (SPDU-B)**	36	8328	N/a*
RACP_200	RACP Entry #200	TC: P2010 (BAT1 REC K07 OFF)	43	8335	N/a*
RACP_201	RACP Entry #201	TC: P2030 (BAT1 REC K09 OFF)	44	8336	N/a*
RACP_202	RACP Entry #202	TC: P2020 (BAT1 REC K08 OFF)	45	8337	N/a*
RACP_203	RACP Entry #203	TC: P2040 (BAT1 REC K10 OFF)	46	8338	N/a*
RACP_204	RACP Entry #204	TC: P2000 (BAT1 TRICKL CHAR)	47	8339	N/a*
RACP_210	RACP Entry #210	TC: P2060 (BAT2 REC K11 OFF)	43	8335	N/a*
RACP_211	RACP Entry #211	TC: P2080 (BAT2 REC K13 OFF)	44	8336	N/a*

PSV_PVSID	PSV_DESCR	Description	RACP Table Location	SSC	TCPK_MF_NO
RACP_212	RACP Entry #212	TC: P2070 (BAT2 REC K12 OFF)	45	8337	N/a*
RACP_213	RACP Entry #213	TC: P2090 (BAT2 REC K14 OFF)	46	8338	N/a*
RACP_214	RACP Entry #214	TC: P2050 (BAT2 TRICKL CHAR)	47	8339	N/a*

* These entries were defined post launch as Parameter sets only.

8 CREATING NEW RACP AND OBM ENTRIES.

During the course of the mission, it is likely that new Monitoring List or RACP entries will be required. This section gives some guidelines for creating new entries.

- ❖ It is suggested to define new entries using TC parameter sets, for reasons of simplicity and flexibility. New entries should be appended, to the end of the table, and given identifiers of the form ‘OBM_nnn’ or ‘RACP_nnn’, where nnn is the next available number in the parameters sets table.
- ❖ Check whether the new parameter to be monitored has a PID in the ODB, if it doesn’t check whether a dummy PCF entry with the same PID is defined in Table 6 on page 9. If not define a new ‘dummy’ (see section 6.1.2) PCF entry, with representative description and the same PID as the parameter to be monitored.
- ❖ The new PCF entry must have the following settings:
  PCF_CATEG = ‘S’
  PCF_CURTX = ‘12’
  This is necessary to be able to display binary values in the VPD.
- ❖ When defining new entries to monitor a parameter with an ‘inverted’ calibration curve the minimum and maximum values must be reversed, this is because the OBM software works on raw telemetry values.
- ❖ When defining new RACPs, it is necessary to define the complete TC packet, including packet Header and packet data field. The structure, values of fixed fields and meaning of variable fields is defined in R1 page 22.
- ❖ When defining a new RACP, the convention for defining the SSC is:
  SSC = 8292 + ‘RACP number’
  The SSC for the currently defined RACPs is reported in Table 43 on page 38.
- ❖ All new entries should be tested on the simulator before loading on-board. In particular new OBM entries which reference new or existing RACPs **must be thoroughly tested on the simulator**, in a full simulation scenario, this should include at least the following:
  All other OBM entries loaded which would normally be resident on-board concurrently with the new entries.
  SECL table loaded and SECL active.
  Payload on.
  Simulate eclipse passage where relevant.
- ❖ Once the entries have been tested and are to be used, update this document, (including background for generating the new entries) and any affected FOP Procedures.

9 CRP MATRIX.

The following table provides a link between OBM entry and applicable action or Contingency Recovery procedure. The comment field provides additional information to help the operator decide whether the OBM trigger is nominal or whether action needs to be taken.

TC Parameters Sets ID	Monitored Parameter		RACP TC Pointers.			Recovery Action – Where Applicable.	
PSV_PVSID	MNT PID	*PCF_NAME	PTR 1	PTR. 2	PTR. 3	CRP / FCP	Comment
OBM_001	A9000		0	0	0		Separation / activation reporting purposes only.
OBM_002	AM900N	A9001	0	0	0		Separation / activation reporting purposes only
OBM_003	AM900N	A9002	0	0	0		Separation / activation reporting purposes only
OBM_004	AM900N	A9003	0	0	0		Separation / activation reporting purposes only
OBM_005	AM900N	A9004	0	0	0		Separation / activation reporting purposes only
OBM_006	AM900N	A9005	0	0	0		Separation / activation reporting purposes only
OBM_007	A9950		0	0	0		Separation / activation reporting purposes only
OBM_008	A9951		0	0	0		Separation / activation reporting purposes only
OBM_009	A9952		0	0	0		Separation / activation reporting purposes only
OBM_010	PM1105	P1105	0	0	0		Separation / activation reporting purposes only
OBM_011	PM1101	P1101	0	0	0		Separation / activation reporting purposes only
OBM_012	PM1112	P1112	0	0	0		Separation / activation reporting purposes only
OBM_013	PM1151	P1151	0	0	0		Separation / activation reporting purposes only
OBM_014	PM1166	P1166	0	0	0	CRP_SYS_2010 CRP_SYS_2030 FCP_TCS_1200	To detect a cat. Bed heaters A switch-off - if DNEL, or SPDU initialisation occurred, go to the appropriate CRP, call SOM / SOE. In case of spurious trip-off switch it back on.
OBM_015	PM1176	P1176	0	0	0		To detect a cat. Bed Survival heaters A switch-off, this should never occur, if it does call SOM / SOE.
OBM_016	PM1184	P1184	0	0	0		To detect a cat. Bed Survival heaters B switch-off, this should never occur, if it does call SOM / SOE.
OBM_017	PM1104	P1104	0	0	0		Separation / activation reporting purposes only
OBM_018	PM1111	P1111	0	0	0		Separation / activation reporting purposes only
OBM_019	PM1118	P1118	0	0	0		Separation / activation reporting purposes only
OBM_020	PM1117	P1117	0	0	0		Separation / activation reporting purposes only
OBM_021	PM1125	P1125	0	0	0	FCP_EPS_1410	To detect a switch-off of SPDU group 5A-1, this happens at SPDU initialisation only, call SOM / SOE. This is considered critical for SAS temperature, switch it back on asap.
OBM_022	PM1153	P1153	0	0	0	FCP_EPS_1414	To detect a switch-off of SPDU group 5A-1, this happens at SPDU initialisation only, call SOM / SOE. This is considered critical for SAS temperature, switch it back on asap.
OBM_023	P3220		0	0	0		To detect a main Bus Voltage anomaly, check P3220 and P3221, if both are anomalous call SOM / SOE
OBM_024	PM3061	P3061	0	0	0		Separation / activation reporting purposes only
OBM_025	P3200		0	0	0	CRP_EPS_2500	Battery 1 Voltage Anomaly, check for cell undervoltage, call SOM / SOE.
OBM_026	P3202		0	0	0	CRP_EPS_2501	Battery 1 Voltage Anomaly, check for cell undervoltage, call SOM / SOE.
OBM_027	P3115		0	0	0		Separation / activation reporting purposes only

TC Parameters Sets ID	Monitored Parameter		RACP TC Pointers.			Recovery Action – Where Applicable.	
PSV_PVSID	**MNT PID**	***PCF_NAME**	**PTR 1**	**PTR. 2**	**PTR. 3**	**CRP / FCP**	**Comment**
OBM_028	P3118		0	0	0		Separation / activation reporting purposes only
OBM_029	PM5102	P5102	0	0	0		Separation / activation reporting purposes only
OBM_030	PM5109	P5109	0	0	0		Separation / activation reporting purposes only
OBM_031	T6000		0	0	0	CRP_EPS_2510 CRP_EPS_2511 FCP_TCS_1220 FCP_TCS_1220	Battery temperature anomaly. In case of over-temperature, execute whichever of the 2 CRPs is applicable. In case of under-temperature, check the heater status, see whichever of the 2 FCPs is applicable..
OBM_032	PM1406	P1406	0	0	0	CRP_SYS_2010 CRP_EPS_2622 CRP_EPS_2633	The DNEL bit has been set in SPDU-A Telemetry. Check that this is also set in SPDU-B, MRU and PPDU TM, in this case a real DNEL has occurred – CRP_SYS_2010. If this is only set in SPDU-A TM, it is possible that a 'spurious DNEL' has occurred at SPDU-A level – CRP_EPS_2622, or CRP_EPS_2623.
OBM_033	PM1426	P1426	0	0	0	CRP_SYS_2010 CRP_EPS_2622 CRP_EPS_2633	The DNEL bit has been set in SPDU-B Telemetry. Check that this is also set in SPDU-A, MRU and PPDU TM, in this case a real DNEL has occurred – CRP_SYS_2010. If this is only set in SPDU-B TM, it is possible that a 'spurious DNEL' has occurred at SPDU-B level – CRP_EPS_2622, or CRP_EPS_2623
OBM_034	PM2407	P2407	0	0	0	CRP_SYS_2010 CRP_EPS_2722 CRP_EPS_2733	The DNEL bit has been set in PPDU-A Telemetry. Check that this is also set in PPDU-B, MRU and SPDU TM, in this case a real DNEL has occurred – CRP_SYS_2010. If this is only set in PPDU-A TM, it is possible that a 'spurious DNEL' has occurred at PPDU-A level – CRP_EPS_2722, or CRP_EPS_2723
OBM_035	PM2427	P2427	0	0	0	CRP_SYS_2010 CRP_EPS_2722 CRP_EPS_2733	The DNEL bit has been set in PPDU-B Telemetry. Check that this is also set in PPDU-A, MRU and SPDU TM, in this case a real DNEL has occurred – CRP_SYS_2010. If this is only set in PPDU-B TM, it is possible that a 'spurious DNEL' has occurred at PPDU-A level – CRP_EPS_2722, or CRP_EPS_2723
OBM_036	PM3053	P3053	29	0	0	CRP_SYS_2010	A DNEL has occurred, Check that BCPKT distribution is stopped by RACP.
OBM_037	PM3053	P3054	29	0	0	CRP_SYS_2010	A DNEL has occurred, Check that BCPKT distribution is stopped by RACP.
OBM_038	PM3053	P3055	29	0	0	CRP_SYS_2010	A DNEL has occurred, Check that BCPKT distribution is stopped by RACP.
OBM_039	PM3053	P3056	29	0	0	CRP_SYS_2010	A DNEL has occurred, Check that BCPKT distribution is stopped by RACP.
OBM_040	P1003		0	0	0		Possible CDMU-A hardware problem, check CTU temperature evolution and behaviour.
OBM_041	P1031		0	0	0		Possible CDMU-B hardware problem, check CTU temperature evolution and behaviour.
OBM_042							Not used
OBM_043	P1009		0	0	0	CRP_RFS_2020	Possible RX-1 hardware problem, check RX-1 temperature evolution and behaviour (if RX-1 is in use).
OBM_044	P1037		0	0	0	CRP_RFS_2021	Possible RX-2 hardware problem, check RX-2 temperature evolution and behaviour (if RX-2 is in use).
OBM_045	P1060		0	0	0		Possible CDE1 power over-consumption, call SOM / SOE.
OBM_046	P1062		0	0	0		Possible CDE2 power over-consumption, call SOM / SOE.
OBM_047	P1061		0	0	0		Possible CDE1 power over-consumption, call SOM / SOE.
OBM_048	P1063		0	0	0		Possible CDE2 power over-consumption, call SOM / SOE.
OBM_049	A9000		0	0	0	CRP_AOC_xxxx	Possible ACC-A H/W failure, check temperature and CV Voltages, call SOM / SOE
OBM_050	A9083		0	0	0	CRP_AOC_0500	ESAM Entry, check that ESAM has really occurred, call SOM / SOE.
OBM_051	A9084		0	0	0	CRP_AOC_0500	ESAM Entry, check that ESAM has really occurred, call SOM / SOE
OBM_052	A9207		0	0	0		Used for recording purposes only.

TC Parameters Sets ID	Monitored Parameter		RACP TC Pointers.			Recovery Action – Where Applicable.	
PSV_PVSID	**MNT PID**	***PCF_ NAME**	**PTR 1**	**PTR. 2**	**PTR. 3**	**CRP / FCP**	**Comment**
OBM_053	A9208		0	0	0		Used for recording purposes only.
OBM_054	P1011		0	0	0	CRP_AOC_xxx	Possible FDE H/W Anomaly, check FDE-B LCL Current for corresponding change in opposite direction, check FDE temperature and CV Voltages..
OBM_055	PM1117	P1117	0	0	0	FCP_AOC_1905	Spurious RMU-A LCL switch-off.E
OBM_056	PM1058	P1058	1	2	4	CRP_EPS_2610	SPDU-A Watchdog circuit has detected an error, check that SPDU-A is switched OFF by RACP.
OBM_057	P3114		21	22	9		Triggered nominally at **eclipse entry only**.
OBM_058	P3116		23	24	10		Triggered nominally at **eclipse exit only**.
OBM_059	P3117		25	26	11		Triggered nominally at **eclipse entry only**.
OBM_060	P3119		27	28	12		Triggered nominally at **eclipse exit only**.
OBM_061	P3221		0	0	0		To detect a main Bus Voltage anomaly, check P3220 and P3221, if both are anomalous call SOM / SOE
OBM_062	PM1119	P1119	0	0	0		Separation / activation reporting purposes only
OBM_063	PM1059	P1059	3	5	4	CRP_EPS_2611	SPDU-B Watchdog circuit has detected an error, check that SPDU-B is switched OFF by RACP
OBM_064	P3115		7	0	0		Triggered nominally at **eclipse exit only**.
OBM_065	P3118		8	0	0		Triggered nominally at **eclipse entry only**.
OBM_066	T6001		0	0	0	CRP_EPS_2510 FCP_TCS_1220 FCP_TCS_1220	Battery 1 temperature anomaly. In case of over-temperature, go to CRP_2510. In case of under-temperature, check the heater status, see FCP_TCS_1220, FCP_TCS_1221..
OBM_067	T6002		0	0	0	CRP_EPS_2511 FCP_TCS_1220 FCP_TCS_1220	Battery 2 temperature anomaly. In case of over-temperature, go to CRP_2510. In case of under-temperature, check the heater status, see FCP_TCS_1220, FCP_TCS_1221..
OBM_068	P1019		0	0	0	CRP_RFS_2010	TX-1 Over-current, check for TX-1 H/W failure.
OBM_069	P1047		0	0	0	CRP_RFS_2011	TX-2 Over-current, check for TX-2 H/W failure.
OBM_070	T0008		0	0	0	CRP_RFS_2010	TX-1 temperature anomaly, check for TX-1 H/W failure.
OBM_071	T0010		0	0	0	CRP_RFS_2011	TX-2 temperature anomaly, check for TX-2 H/W failure.
OBM_072	PM1104	P1104	0	0	0	CRP_AOC_1505	Spurious CAE-A LCL switch-off.
OBM_073	PM1111	P1111	0	0	0		Spurious FDE-A LCL switch-off, call SOM / SOE.
OBM_074	PM1118	P1118	0	0	0		Spurious FCE-A LCL switch-off, call SOM / SOE
OBM_075	PM1056	P1056	6	32	0	CRP_EPS_2710	PPDU-A Watchdog circuit has detected an error, check that PPDU-A is switched OFF by RACP.
OBM_076	PM1057	P1057	33	34	0	CRP_EPS_2711	PPDU-A Watchdog circuit has detected an error, check that PPDU-A is switched OFF by RACP.
OBM_077	PM2407	P2411	0	0	0	CRP_SYS_2040	PPDU-A initialisation, note only detected for one TM cycle, only one OEM (177) will be issued.
OBM_078	PM2427	P2431	0	0	0	CRP_SYS_2040	PPDU-A initialisation, note only detected for one TM cycle, only one OEM (177) will be issued.
OBM_079	PM1056	P1056	13	14	0	CRP_EPS_2710	PPDU-A Watchdog circuit has detected an error, check that PPDU-A is switched OFF by RACP.
OBM_080	PM1057	P1057	15	16	0	CRP_EPS_2711	PPDU-A Watchdog circuit has detected an error, check that PPDU-A is switched OFF by RACP.
OBM_081	PM1058	P1058	17	18	4	CRP_EPS_2610	SPDU-A Watchdog circuit has detected an error, check that SPDU-A is switched OFF by RACP.
OBM_082	PM1059	P1059	19	20	4	CRP_EPS_2611	SPDU-B Watchdog circuit has detected an error, check that SPDU-B is switched OFF by RACP.
OBM_083	P1046		0	0	0		FDE-B power consumption anomaly, call SOM / SOE.
OBM_084	PM1174	P1174	0	0	0		Separation / activation reporting purposes only
OBM_085	PM1174	P1174	0	0	0	CRP_SYS_2010 CRP_SYS_2030 FCP_TCS_1201	To detect a cat. Bed heaters B switch-off - if DNEL, or SPDU initialisation occurred, go to the appropriate CRP, call SOM / SOE. In case of spurious trip-off switch it back on.

TC Parameters Sets ID	Monitored Parameter		RACP TC Pointers.			Recovery Action – Where Applicable.	
PSV_PVSID	**MNT PID**	***PCF_ NAME**	**PTR 1**	**PTR. 2**	**PTR. 3**	**CRP / FCP**	**Comment**
OBM_086	P1018		0	0	0		FCE-A current anomaly, check for the corresponding opposite change in FCE-B current, call SOM / SOE.
OBM_087	P1039		0	0	0		FCE-A current anomaly, check for the corresponding opposite change in FCE-B current, call SOM / SOE.
OBM_088	T5107		30	31	0	CRP_SPI_xxxx	Over-temperature Detected during SPI Annealing. Check that SPI Annealing Heaters 1 and 2 are switched off via RACP 30, 31
OBM_089	T5114		30	31	0:	CRP_SPI_xxxx	Over-temperature Detected during SPI Annealing. Check that SPI Annealing Heaters 1 and 2 are switched off via RACP 30, 31
OBM_090	PM3053	P3053	0	0	0:	CRP_SYS_2550	A DNEL has occurred, during ascent phase.
OBM_091	PM3053	P3054	0	0	0:	CRP_SYS_2550	A DNEL has occurred, during ascent phase.
OBM_092	PM3053	P3055	0	0	0:	CRP_SYS_2550	A DNEL has occurred, during ascent phase.
OBM_093	PM3053	P3056	0	0	0	CRP_SYS_2550	A DNEL has occurred, during ascent phase.
OBM_094	P3120		0	0	0	CRP_EPS_2400	Possible BDR1 failure, check CRP entry conditions, call SOM / SOE.
OBM_095	P3121		0	0	0	CRP_EPS_2400	Possible BDR2 failure, check CRP entry conditions, call SOM / SOE.
OBM_096	P3122		0	0	0	CRP_EPS_2400	Possible BDR3 failure, check CRP entry conditions, call SOM / SOE.
OBM_097	P3123		0	0	0	CRP_EPS_2400	Possible BDR4 failure, check CRP entry conditions, call SOM / SOE.
OBM_098	P1061		0	0	0		CDE1 LCL1 power-consumption anomaly, call SOM / SOE.
OBM_099	P1063		0	0	0		CDE2 LCL1 power-consumption anomaly, call SOM / SOE.
OBM_100	T5107		37	38	0	CRP_SPI_xxxx	Over-temperature Detected during SPI Annealing. Check that SPI Annealing Heaters 1 and 2 are switched off via RACP 37, 38
OBM_101	T5114		37	38	0	CRP_SPI_xxxx	Over-temperature Detected during SPI Annealing. Check that SPI Annealing Heaters 1 and 2 are switched off via RACP 37, 38
OBM_102	PM1406	P1412	0	0	0	CRP_SYS_2030	SPDU-A initialisation, note only detected for one TM cycle, only one OEM (177) will be issued.
OBM_103	PM1426	P1432	0	0	0	CRP_SYS_2030	SPDU-B initialisation, note only detected for one TM cycle, only one OEM (177) will be issued.
OBM_104	PM1166	P1166	0	0	0		
OBM_105	D9007		0	0	0		CDMU-A power supply temperature anomaly, check power consumption and behaviour of unit, call SOM / SOE.
OBM_106	D9016		0	0	0		CDMU-A power supply temperature anomaly, check power consumption and behaviour of unit, call SOM / SOE
OBM_107	T6038		41	42	0		Possible RCS Heater A Failure, check temperature evolution and Heater A power consumption. Try to correlate a possible failure with the other RCS temperatures. Check also for cold cases at certain SAA. **If the A Heater is failed (or suspected to be) – leave the B Heater ON.** In no circumstances should the RCS OBM entries be disabled or deleted.
BM_108	T6040		41	42	0		
OBM_109	T6033		41	42	0		
OBM_110	T6030		41	42	0		
OBM_111	T6042		41	42	0		
OBM_112	T6039		41	42	0		
OBM_113	T6031		41	42	0		
OBM_114	T6041		41	42	0		
OBM_115	T6053		41	42	0		
OBM_116	T6034		41	42	0		
OBM_117	T6036		41	42	0		
OBM_118	T6035		41	42	0		
OBM_119	T6055		41	42	0		
OBM_120	T6037		41	42	0		
OBM_121	P1117		35	36	0		Verify that RMU-A has switched on correctly, using FCP_AOC_1900, steps 3.1 to 3.2
OBM_122	P1145		35	36	0		Verify that RMU-A has switched on correctly, using FCP_AOC_1902, steps 3.1 to 3.2

DOCUMENT

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Update Introduction post launch	4	1
Added extra constraint	5	4.1
ESOC now responsible for maintaining TC parameters sets	6	5
Updated Nominal Heater table	11	7.1

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1 INTRODUCTION

The SECL (‘Spurious Eclipse’) function is an on-board software task, which can be used to monitor some on-board Thermistors temperatures and take action following detection of Thermistor under-temperature, by issuing up to 3 telecommands for each monitored Thermistor. The selection of monitored Thermistor and ‘recovery telecommands is under ground control. This task is designed to ensure spacecraft safety following certain on-board failures, for more information refer to RD4, extensive use of this functions is planned for Integral.

It is foreseen that this document will be included in the FOP, to be used as a guideline for management of the SECL functions during the mission. It is included in the FOP Volume 2, Book 7 “Operations Support information”.

This document contains information compliant with the SECL entries currently in use.

2 REFERENCE DOCUMENTS.

RD1: Integral Packet Structure Document (INT-RP-AI-0030).
RD2: Integral Users Manual (INT-MA-AI-0001)
RD3: SCOS-2000 Database Import ICD (S2K-MCS-ICD-0001-TOS-GCI)
RD4: Operational Analysis on ECL, DNEL and Initialisation Sequences in PDU PROMs (INT-TN-AI-0139)

3 DOCUMENT SCOPE

This TN defines the usage in the operational mission of the SECL task, in particular it will:
- Clarify the ground constraints and processing.
- It will enable the user to define new entries, or update existing entries.
- It defines the ODB entries used to control the SECL tasks.
- It defines the ODB entries used to process the SECL task telemetry.
- It provides a link between SECL entry and applicable CRP, where relevant.

This document assumes that the reader has some familiarity with the functionality of the SECL task, it is not foreseen to repeat the information contained in the ALENIA Users Manual (RD2).

4 CONSTRAINTS

This section attempts to summarise those SECL task constraints which have consequences for operations.

4.1 On-board Constraints

- The SECL Heater Table is limited to 45 entries.
- The type of parameters which can be monitored is restricted to parameters which are:
  8 bits wide.

Start at Bit_Offset = 0

- Only parameters in the following TM packets can be monitored:

Table 1: Valid Type / Sub-types for SECL Heater Table.

PID_TYPE	PID_STYPE	PID_APID	PID_SPID	PID_DESCR
1	1	129	200000	SVM RTU PKT 1
1	2	129	200001	SVM RTU PKT 2
1	5	129	200500	PLM RTU PKT
1	9	640	110001	ACC ATTITUDE
1	10	640	110002	ACC HOUSEKEEPING

- Each entry in the Heater Table is limited to a maximum of 3 'recovery' commands. In practice, this constraint can be overcome by repeating entries in the Heater table and assigning a different set of commands to them.
- The SECL task only issues recovery commands if a monitored thermistor is out-of-limits for three consecutive acquisitions on 3 consecutive TM cycle.
- If an entry is deleted from the Heater table, this location remains empty, subsequent entries are not shifted up to fill the gap.
- The type of commands which can be loaded into the Heater table is restricted to Type = 2, Stype=2.
- When SECL issues a command, the source (bit 2 of Packet Sequence Control in Packet Sequence header – see RD1) is set to 1, which indicates 'command from On-board source'. The SSC in Packet sequence control (see RD1) is set to:

  3i + 1 + (Command Index)

  Where **'i'** = Heater number in Heater table (1 to 45).

  Command Index, is the ordinate position of the commands, associated with each entry (1 to 3)

  For instance if Heater number 23, with 2 recovery commands assigned is below threshold temperature, 2 commands will be issued with the following SSC:

  1^{st} TC: 3 * 23 + 1 + 1 = 71

  2^{nd} TC: 3 * 23 + 1 + 2 = 71
- Use of the SECL task to detect Thermistor under-temperature detection is restricted to those Thermistors with 'inverted' calibration curves. In fact in CDMU S/W as the SECL task operates only on acquired raw RTU TM the check is in fact a 'greater than' test..
- Once a monitored parameter is Out-of-limits for 3 consecutive TM cycles, and recovery commands are issued issue of further commands (and OEMs) by this Heater table entry is inhibited until it goes back within limits.
- When loading heater table entries it is <u>not</u> necessary to send a 'start' command after each load command, once all new entries have been loaded into the 'load' buffer a single start command is sufficient to transfer all TCs to the 'in-use' buffer.

4.2 On-ground Constraints

- If a report contains an entry without a corresponding PID (Parameter Identifier) in the ODB, the entire report packet cannot be displayed in interpreted format, using the VPD.

- The PID (Parameter Identifier) must be unique in the ODB.

5 LOADING SUNLIGHT AND HEATER TABLE ENTRIES.

In the SDB dedicated telecommand parameter value sets are defined to load each SECL Heater table entry, currently (SDB3.1) 126 such parameter value sets are defined. A Parameter Value Set is a group of command parameter values, which can be assigned to the editable parameters of a command instance.
Use of parameters sets has two advantages:

- As the commands contents are not fixed this approach is very flexible, commands can be edited on the Manual Stack of IMCS after applying the parameter values sets. Hence to change the value of 1 parameter, (limit tuning for instance) a new command need not be defined.
- For load verification of Heater table entries we rely on 'Load / Report' verification, where the contents of a load commands are compared with the contents of the subsequent report TC. To use such a verification, every load TC must have a dedicated report TC, this would imply having to define an extra 126 SECL report commands. Using parameter sets the same single load / report command combination can always be used.

The parameter value sets were originally generated in ESOC and made available to ALS and incorporated in the SDB, they were maintained by ALS until launch, since launch ESOC have taken responsibility for maintaining these parameters sets.

The parameters sets to load the heater tables are reported in:
Table 8: Nominal Heater Table.
Table 9: Redundant SPDU Heater Table.
Table 10: Redundant PPDU Heater Table.

ESOC have pre-defined TC sequences in the ODB, which load different Heater tables. These sequences include all necessary parameters set references, as well as Report and Start TCs.

Sunlight table entries are loaded using dedicated commands defined in the SDB / ODB.

The FOP currently contains the following FCPs to manage SECL:

Table 2: FCPs to Manage OBM and RACPs.

Identifier.	Description.
FCP_DHS_1360	Use of SECL software.
FCP_DHS_1365	Disable SECL.
FCP_DHS_1366	Enable SECL
FCP_DHS_1367	SECL: Disable Sunlight Conditions
FCP_DHS_1368	SECL: Enable Sunlight Conditions
FCP_DHS_1370	SECL: Load Sunlit Conditions
FCP_DHS_1371	SECL: Load Heater Table Entry.
FCP_DHS_1372	SECL: Delete Heater Table Entry.

Identifier.	Description.
FCP_DHS_1373	SECL: Load Default Tables*
FCP_DHS_1374	SECL: Load Redundant Heater Tables
FCP_DHS_1375	SECL: Start SECL First Time.**
CRP_TCS_2010	SECL: Under Temperature Detected

*Updated post launch.
**LEOP procedure only, not maintained.

6 PROCESSING OF SECL TM REPORTS.

6.1 Heater Table Report – TM(5,4).

The Heater table can be reported in 2 TM(5,4) packets, 2 commands are necessary to do this. The Structure of the Packet is defined in RD2 and the SDB / ODB. Heater Table entries 1 to 25 are reported in SPID 252002, entries 26 to 45 are reported in SPID 252003.

6.1.1 DISPLAY OF HEATER TABLE, USING VPD TASK.

As the contents of the packets are not fixed, they must be interpreted using the on-board PID (Parameter ID). This is defined as a 16 bit word, where the 4 msb are the packet Subtype in which the TM parameter is contained, the 12 lsb are the Offset Byte of the parameter, within the TM Packet, as defined in the SDB (note that the ODB definition of Offset Byte is different, an extra offset of 10 bytes is added in the header).
The IMCS VPD (Variable Packet Display) task is used to display such reports. To do this a number of VPD parameters must be defined, along with a VPD display.

The following PCF extract lists VPD parameters defined in the ODB, used to display Heater table Report packets. Note that the VPD only interprets the part of the packet containing the monitored thermistors PID, Threshold and recovery commands, the Sunlit conditions are not interpreted.

Table 3: VPD parameters to display Heater Table report packets.

PCF_NAME	PCF_DESCR	PCF_PTC	PCF_PFC	PCF_ RELATED	PCF_ CATEG	PCF_ NATUR	PCF_ CURTX	PCF_ PARVAL
DUS001	SECL PID	3	12		N	R		
DUS010	SECL THRES	11	0	DUS001	N	R		
DUS020	SECL STAT	2	8		S	R	2301	
DUS030	TC1 RLA	3	12		N	R		
DUS031	TC1 RLD	3	12		N	R		
DUS040	TC2 RLA	3	12		N	R		
DUS041	TC2 RLD	3	12		N	R		
DUS050	TC3 RLA	3	12		N	R		
DUS051	TC3 RLD	3	12		N	R		

The definition of the above fields can be found in RD3.

The above parameters correspond to one complete 16 byte entry in the Heater table report packets. Parameter DUS001 is the PID, this is the key, which is used to identify each entry in the OBM list report. It must be noted that if a Heater table report packet contains a PID, which is not in the ODB, none of the packets contents can be displayed in the VPD.
DUS010 is related (PCF_RELATED) to DUS001, this means that its interpretation must be that of the parameter identified via DUS001 (PID).

The following VPD extract defines the structure of the VPDs, used to display Heater table Report packets.

Table 4: VPD 200, to display Heater table part 1 (SPID=252002) report packet.

VPD_ TPSD	VPD_ POS	VPD_ NAME	VPD_ GRPSIZE	VPD_ FIXREP	VPD_ CHOICE	VPD_ PIDREF	VPD_ DISDESC	VPD_ WIDTH	VPD_ JUSTIFY	VPD_ NEWLINE	VPD_ DCHAR	VPD_ FORM
210	1	DUS001	9	25	N	N		0	R	N	0	N
210	10	DUS001			N	Y	SECL PID	21	R	N	2	N
210	20	DUS010			N	N	SECL THRES	21	R	N	2	N
210	30	DUS020			N	N	SECL STAT	21	L	N	1	N
210	40	DUS030			N	N	TC1 RLA	21	R	N	0	H
210	50	DUS031			N	N	TC1 RLD	21	R	N	0	H
210	60	DUS040			N	N	TC2 RLA	21	R	N	0	H
210	70	DUS041			N	N	TC2 RLD	21	R	N	0	H
210	80	DUS050			N	N	TC3 RLA	21	R	N	0	H
210	90	DUS051			N	N	TC3 RLD	21	R	N	0	H

To display Heater table part 2 (SPID=252003) report packet, VPD_TPSD 211 has been defined, which is identical to the above apart from the FVP_TPSD number and the VPD_FIXREP (20) fields.

The definition of the above fields can be found in reference 3.

The number of Heater table entries reported in a TM(8,5) report packet is not contained in the packet. Normally the VPD would use this parameter to determine the number of repetitions of the data structure.
As this information is not available, ESOC have assumed that all Heater table part 1 report packets contain 25 entries and all Heater table part 2 report packets contain 20 entries, and fixed the number of repetitions at 25 and 20 (VPD_FIXREP) respectively. Similarly the number of parameters in each parameters group (VPD_GRPSIZE) is fixed at 9. Any unused entries in the VPD display simply the ODB parameter with PID = 0 (DUM999) in the VPD.

To view the TM(8,5) OR packet using the VPD task, enter the following options:
DS = 65535, Type = 5, Subtype = 4, APID = 130.

The following table contains an example of a Heater table report packet processed via the above VPD definition.

Table 5: VPD display of TM(8,5) report packet.

SECL PID	PCF_DESCR	SECL THRES	SECL STAT	TC1 RLA	TC1 RLD	TC2 RLA	TC2 RLD	TC3 RLA	TC3 RLD
T5010	TH SPI AFEE1	-15.00degC	CMD ENABLE	41 HEX	6441 HEX	0 HEX	0 HEX	0 HEX	0 HEX
T5011	TH SPI AFEE2	-15.00degC	CMD ENABLE	41 HEX	4420 HEX	41 HEX	4BC1 HEX	0 HEX	0 HEX
T5012	TH SPI DFEE M+R	-20.00degC	CMD ENABLE	41 HEX	6441 HEX	0 HEX	0 HEX	0 HEX	0 HEX
T5013	TH SPI PSD	-23.125degC	CMD ENABLE	41 HEX	6441 HEX	41 HEX	4BC1 HEX	41 HEX	CCC1 HEX

6.2 Pending Sunlight Conditions Report – TM(5,4).

The pending sunlit conditions table is not currently defined as a VPD, it is not anticipated that this table will change as frequently as the Heater table, also as it is a relatively small number of parameters it is easy to check via a 'normal' AND. This data is displayed on AND D4400.

6.2.1 DISPLAY OF SECL TM, VIA AND.

Dedicated telemetry parameters for the display of SECL TM have been defined in the SDB / ODB. The disadvantage of displaying SECL TM via AND is that the parameter identifier (PID) cannot be interpreted, also less information can be displayed on one display – Heater table part 1 report for instance requires 5 ANDs to display everything.
The following ANDs are available for display of these parameters:

Table 6: ANDs for Display of SECL TM.

DPF_NUMBE	DPF_TYPE	DPF_HEAD
D4400	1	SECL + LOAD / REPORT
D4410	3	SECL REP HTR 1 to 5
D4411	3	SECL REP HTR 6 to 11
D4412	3	SECL REP HTR 12 to 17
D4413	3	SECL REP HTR 18 to 23
D4414	3	SECL REP HTR 24 & 25
D4415	3	SECL REP HTR 26 to 30
D4416	3	SECL REP HTR 31 to 36
D4417	3	SECL REP HTR 37 to 42
D4418	3	SECL REP HTR 43 to 45

6.3 On-event Messages associated with SECL Task.

The following OEMs are associated with the SECL task.

Table 7: OEMs Associated with SECL Task.

TMPK_MESS_CLASS	TMPK_MESS_ID	TMPK_ID_NAME	TMPK_MESS_STR_REF	TMPK_MESS_DESC	TMPK_TMPA_PREF	TMPK_BYTE	TMPK_SBIT	TMPA_PARA_NAME	TMPA_ALI_REF1
1	230	MS EXCE SECL PARAMETER NOT FOUND	2036	The parameter could not be found because: RTU subtype not acquired or offset is illegal for the given subtype	FIX6	0	0	FIX 6	
					D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
					FIX8	4	0	FIX 8	
					D5555	5	0	CURRENT HTR ID	
0	241	MS EVE SECL OEM1	2036	The temperature of the heater under check is less than the threshold for the 3rd consecutive time and commanding is enabled	FIX6	0	0	FIX 6	
					D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
					FIX8	4	0	FIX 8	
					D5555	5	0	CURRENT HTR ID	
0	242	MS EVE SECL OEM2	2036	The temperature of the heater under check is less than the threshold for the 3rd consecutive time and commanding is disabled	FIX6	0	0	FIX 6	
					D0006	0	6	MESS CLASS	
					D0008	1	0	MESS ID	
					D0029	2	0	PID	
					FIX8	4	0	FIX 8	
					D5555	5	0	CURRENT HTR ID	

On Event Messages can be viewed on IMCS using the RED task, this is however a summary view, which does not interpret any OEM parameters. Using the VPD task the contents of individual OEMs can be seen in an interpreted form. Any parameters containing a PID are also interpreted as described in section 6.1.1,.
To view the SECL OEM 230 using the VPD task, enter the following options:
DS = 65535, Type = 98, Subtype = *, APID = 129.
To view the SECL OEMs 241, 242 using the VPD task, enter the following options:
DS = 65535, Type = 97, Subtype = *, APID = 129.

Note that it is not possible to filter on OEM by identifier, the lowest filter available is APID / class (Type) combination.

6.3.1 ACTIONS FOLLOWING RECEPTION OF OEM 240 OR 241.

If either of these OEMs are received this means that a monitored thermistor temperature has fallen below its limit. In this case refer to CRP_TCS_2010.
From the VPD display of the OEM the monitored thermistors identity can be determined.
If more than one parameter with the same PID is contained in the heater table, the heater table index number can be used to identify the exact test which failed, and the commands which were issued (if any).

7 APPLICABLE HEATER TABLE ENTRIES FOR DIFFERENT MISSION PHASES.

The following sections define the applicable Heater table entries, which are planned to be used n different mission phases. It also defines the parameters value sets ID to be used to load that particular entry. These tables were derived from the SDB / ODB3.1.

7.1 Nominal Heater Table Entries.

The following Heater Table entries are currently in use.

Table 8: Nominal Heater Table.

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_001	1	5	109	20589	T5072	IBIS MAINFRA TH1	225	-23.5	Enable	41	1541	P4101 P HLCL 5A1 ON(A)	45	1541	P4601 P HLCL 5A1 ON(B)	41	D41	P4105 P HLCL 6A2 ON(A)
SECL_002	2	5	109	20589	T5072	IBIS MAINFRA TH1	225	-23.5	Enable	45	D41	P4605 P HLCL 6A2 ON(B)	0	0	0	0	0	0
SECL_003	3	5	109	20589	T5072	IBIS MAINFRA TH1	225	-23.5	Enable	41	F540	T5511 TSW CDTE HR1A ON	45	F540	T6511 TSW CDTE HR1A ON	41	ED40	T5516 TSW CDTE HR2A ON
SECL_004	4	5	109	20589	T5072	IBIS MAINFRA TH1	225	-23.5	Enable	45	ED40	T6516 TSW CDTE HR2A ON	41	6D41	P4205 TSW IBISDET A ON	45	6D41	P4705 TSW IBISDET A ON
SECL_005	5	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	41	340	P4113 P HLCL 7A2 ON(A)	45	340	P4613 P HLCL 7A2 ON(B)	41	CC1	P4363 P HLCL 7B2 ON(A)
SECL_006	6	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	45	CC1	P4863 P HLCL 7B2 ON(B)	41	4CC0	T5641 TSW PEB1 HTRB ON	45	4CC0	T6641 TSW PEB1 HTRB ON
SECL_007	7	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	41	CCC1	T5646 TSW PEB2 HTRB ON	45	CCC1	T6646 TSW PEB2 HTRB ON	41	2341	T5551 TSW IEB1 HTRA ON
SECL_008	8	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	45	2341	T6551 TSW IEB1 HTRA ON	41	A340	T5556 TSW JDPE1 HTA ON	45	A340	T6556 TSW JDPE1 HTA ON
SECL_009	9	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	41	1941	P4093 P HLCL 4A1 ON(A)	45	1941	P4593 P HLCL 4A1 ON(B)	41	1D40	P4109 P HLCL 6A1 ON(A)

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_010	10	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	45	1D40	P4609 P HLCL 6A1 ON(B)	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)
SECL_011	11	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	41	F940	T5501 TSW IEB2 HTRA ON	45	F940	T6501 TSW IEB2 HTRA ON	41	BD40	T5536 TSW VEB HTRA ON
SECL_012	12	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	45	BD40	T6536 TSW VEB HTRA ON	41	3D41	T5531 TSW JDPE2 HTA ON	45	3D41	T6531 TSW JDPE2 HTA ON
SECL_013	13	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	41	D341	T5566 TSW IDPE1 HTA ON	45	D341	T6566 TSW IDPE1 HTA ON	0	0	N/a
SECL_014	14	5	70	20550	T5058	TCS TH ODPE	179	-10	Enable	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)	41	5340	T5561 TSW ODPE HTRA ON
SECL_015	15	5	70	20550	T5058	TCS TH ODPE	179	-10	Enable	45	5340	T6561 TSW ODPE HTRA ON	41	3340	T5571 TSW SDPE2 HTA ON	45	3340	T6571 TSW SDPE2 HTA ON
SECL_016	16	5	22	20502	T5003	TH SPI STRUC3	193	-13.9	Enable	41	E941	T5036 TSW ACS MSK-A ON	45	E941	T6036 TSW ACS MSK-A ON	0	0	N/a
SECL_017	17	5	29	20509	T5010	TH SPI AFEE1	197	-14.7	Enable	41	6441	T5006 LCL CAMER H-A ON	45	6441	T6006 LCL CAMER H-A ON	0	0	N/a
SECL_018	18	5	28	20508	T5009	TH SPICMP+RAD O1	230	-24.7	Enable	41	4420	T5000 LCL COMP H A OFF	41	4BC1	T5101 LCL COMP H B ON	45	4BC1	T6101 LCL COMP H B ON
SECL_019	19	5	19	20499	T5042	TCS TH SPI CDE1	172	-8	Enable	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)	0	0	N/a
SECL_020	20	5	19	20499	T5042	TCS TH SPI CDE1	172	-8	Enable	41	B341	T5576 TSW CDE HTRA ON	45	B341	T6576 TSW CDE HTRA ON	0	0	N/a
SECL_021	21	5	44	20524	T5049	TCS TH SPI TRP	172	-8	Enable	41	1D40	P4109 P HLCL 6A1 ON(A)	45	1D40	P4609 P HLCL 6A1 ON(B)	0	0	N/a
SECL_022	22	5	44	20524	T5049	TCS TH SPI TRP	172	-8	Enable	41	5D41	T5521 TSW SPI IF HA ON	45	5D41	T6521 TSW SPI IF HA ON	0	0	N/a
SECL_023	23	5	118	20598	T5070	TH IBIS CDM1	130	-30	Enable	41	1D40	P4109 P HLCL 6A1 ON(A)	45	1D40	P4609 P HLCL 6A1 ON(B)	0	0	N/a
SECL_024	24	5	118	20598	T5070	TH IBIS CDM1	130	-30	Enable	41	DD40	T5528 TSW IBISCUH AONA	45	DD40	T6528 TSW IBISCUH AONA	0	0	N/a
SECL_025	25	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	41	CC1	P4363 P HLCL 7B2 ON(A)	45	CC1	P4863 P HLCL 7B2 ON(B)	41	16C0	P4393 P HLCL 4B1 ON(A)

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_026	26	5	55	20535	T5051	TCS TH IBIS PEB2	179	-10	Enable	45	16C0	P4843 P HLCL 4B1 ON(B)	41	2CC0	T5651 TSW IEB1 HTRB ON	45	2CC0	T6651 TSW IEB1 HTRB ON
SECL_027	27	5	54	20534	T5050	TCS TH IBIS IEB2	179	-10	Enable	41	F6C1	T5601 TSW IEB2 HTRB ON	45	F6C1	T6601 TSW IEB2 HTRB ON	0	0	N/a
SECL_028	28	5	112	20592	T5075	IBIS MAINFRA TH2	225	-23.5	Enable	41	1AC0	P4351 P HLCL 5B1 ON(A)	45	1AC0	P4851 P HLCL 5B1 ON(B)	0	0	N/a
SECL_029	29	5	112	20592	T5075	IBIS MAINFRA TH2	225	-23.5	Enable	41	2C0	P4355 P HLCL 6B2 ON(A)	45	2C0	P4855 P HLCL 6B2 ON(B	0	0	N/a
SECL_030	30	5	112	20589	T5075	IBIS MAINFRA TH2	225	-23.5	Enable	41	FAC1	T5611 TSW CDTE HR1B ON	45	FAC1	T6611 TSW CDTE HR1B ON	0	0	
SECL_031	31	5	112	20589	T5075	IBIS MAINFRA TH2	225	-23.5	Enable	41	E2C1	T5616 TSW CDTE HR2B ON	45	E2C1	T6616 TSW CDTE HR2B ON	0	0	
SECL_032	32	5	112	20589	T5075	IBIS MAINFRA TH2	225	-23.5	Enable	41	7AC0	P4435 TSW IBISDET B ON	45	7AC0	P4935 TSW IBISDET B ON	0	0	
SECL_033	33	1	36	4132	T6078	TCS TH TANK4 BOT	87	18	Enable	23	940	T1481 S HLCL 5A2 ON(A)	2B	940	T4481 S HLCL 5A2 ON(B)	2B	6C1	T4521 S HLCL 5B2 ON(B)
SECL_034	34	1	35	4131	T6075	TCS TH TANK2 BOT	87	18	Enable	23	6C1	T1521 S HLCL 5B2 ON(A)	2B	6C1	T4521 S HLCL 5B2 ON(B)	23	940	T1481 S HLCL 5A2 ON(A)
SECL_035	35	2	31	8223	T6000	TCS TH BATTERY C	172	-8	Enable	23	940	T1481 S HLCL 5A2 ON(A)	2B	940	T4481 S HLCL 5A2 ON(B)	23	6C1	T1521 S HLCL 5B2 ON(A)
SECL_036	36	2	31	8223	T6000	TCS TH BATTERY C	172	-8	Enable	2B	6C1	T4521 S HLCL 5B2 ON(B)	23	66C1	T1361 TSW BAT B ON	2B	66C1	T4361 TSW BAT B ON
SECL_037	37	2	31	8223	T6000	TCS TH BATTERY C	172	-8	Enable	23	6940	T1121 TSW BAT A ON	2B	6940	T4121 TSW BAT A ON	0	0	N/a
SECL_038	38	1	103	4199	T0054	TCS TH STRH1	190	-13	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	0	0	N/a
SECL_039	39	5	35	20515	T5016	OMC LENS TEMP1	179	-10	Enable	23	6540	T1231 TSW OMC LNSA ON	2B	6540	T4231 TSW OMC LNSA ON	0	0	N/a
SECL_040	40	1	37	4133	T6011	TCS TH IMUH	77	22	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	23	1AC0	T1551 S HLCL 6B1 ON(A)
SECL_041	41	1	37	4133	T6011	TCS TH IMUH	77	22	Enable	2B	1AC0	T4551 S HLCL 6B1 ON(B)	23	B541	T1581 TSW IMUE A ON	0	0	N/a

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_042	42	1	37	4133	T6011	TCS TH IMUH	77	22	Enable	2B	B541	T4581 TSW IMUE A ON	23	BAC0	T1591 TSW IMUE B ON	2B	BAC0	T4591 TSW IMUE B ON
SECL_043	43	1	64	4160	T0025	TEMP RWA2	163	3	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	23	1AC0	T1551 S HLCL 6B1 ON(A)
SECL_044	44	1	64	4160	T0025	TEMP RWA2	163	3	Enable	2B	1AC0	T4551 S HLCL 6B1 ON(B)	23	7541	T1171 TSW RWA A ON	0	0	N/a
SECL_045	45	1	64	4160	T0025	TEMP RWA2	163	3	Enable	2B	7541	T4171 TSW RWA A ON	23	7AC0	T1411 TSW RWA B ON	2B	7AC0	T4411 TSW RWA B ON

7.2 *Redundant SPDU Entries.*

The following Heater Table entries contain commands to PPDU-A and B and SPDU-B only, they will be loaded only following loss of the SPDU-A commanding capability.
These entries have not been updated since launch, when inputs are received from Industry this table and the relevant FCPs will be updated.

Table 9: Redundant SPDU Heater Table.

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_101	1	5	109	20589	T5072	IBIS MAINFRA TH1	214	-20	Enable	41	1541	P4101 P HLCL 5A1 ON(A)	45	1541	P4601 P HLCL 5A1 ON(B)	41	D41	P4105 P HLCL 6A2 ON(A)
SECL_102	2	5	109	20589	T5072	IBIS MAINFRA TH1	214	-20	Enable	45	D41	P4605 P HLCL 6A2 ON(B)	0	0	N/a	0	0	N/a
SECL_103	3	5	109	20589	T5072	IBIS MAINFRA TH1	217	-20.9	Enable	41	F540	T5511 TSW CDTE HR1A ON	45	F540	T6511 TSW CDTE HR1A ON	41	ED40	T5516 TSW CDTE HR2A ON

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_104	4	5	109	20589	T5072	IBIS MAINFRA TH1	217	-20.9	Enable	45	ED40	T6516 TSW CDTE HR2A ON	41	6D41	P4205 TSW IBISDET A ON	45	6D41	P4705 TSW IBISDET A ON
SECL_105	5	5	55	20535	T5051	TCS TH IBIS PEB2	168	-6.9	Enable	41	340	P4113 P HLCL 7A2 ON(A)	45	340	P4613 P HLCL 7A2 ON(B)	0	0	N/a
SECL_106	6	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	41	4341	T5541 TSW PEB1 HTRA ON	45	4341	T6541 TSW PEB1 HTRA ON	0	0	N/a
SECL_107	7	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	41	C340	T5546 TSW PEB2 HTRA ON	45	C340	T6546 TSW PEB2 HTRA ON	41	2341	T5551 TSW IEB1 HTRA ON
SECL_108	8	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	45	2341	T6551 TSW IEB1 HTRA ON	41	A340	T5556 TSW JDPE1 HTA ON	45	A340	T6556 TSW JDPE1 HTA ON
SECL_109	9	5	54	20534	T5050	TCS TH IBIS IEB2	168	-6.9	Enable	41	1941	P4093 P HLCL 4A1 ON(A)	45	1941	P4593 P HLCL 4A1 ON(B)	41	1D40	P4109 P HLCL 6A1 ON(A)
SECL_110	10	5	54	20534	T5050	TCS TH IBIS IEB2	168	-6.9	Enable	45	1D40	P4609 P HLCL 6A1 ON(B)	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)
SECL_111	11	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	41	F940	T5501 TSW IEB2 HTRA ON	45	F940	T6501 TSW IEB2 HTRA ON	41	BD40	T5536 TSW VEB HTRA ON
SECL_112	12	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	45	BD40	T6536 TSW VEB HTRA ON	41	3D41	T5531 TSW JDPE2 HTA ON	45	3D41	T6531 TSW JDPE2 HTA ON
SECL_113	13	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	41	D341	T5566 TSW IDPE1 HTA ON	45	D341	T6566 TSW IDPE1 HTA ON	0	0	N/a
SECL_114	14	5	70	20550	T5058	TCS TH ODPE	172	-8	Enable	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)	41	5340	T5561 TSW ODPE HTRA ON
SECL_115	15	5	70	20550	T5058	TCS TH ODPE	172	-8	Enable	45	5340	T6561 TSW ODPE HTRA ON	41	3340	T5571 TSW SDPE2 HTA ON	45	3340	T6571 TSW SDPE2 HTA ON
SECL_116	16	5	22	20502	T5003	TH SPI STRUC3	193	-13.9	Enable	41	E941	T5036 TSW ACS MSK-A ON	45	E941	T6036 TSW ACS MSK-A ON	0	0	N/a
SECL_117	17	5	29	20509	T5010	TH SPI AFEE1	196	-14.7	Enable	41	6441	T5006 LCL CAMER H-A ON	45	6441	T6006 LCL CAMER H-A ON	0	0	N/a
SECL_118	18	5	28	20508	T5009	TH SPICMP+RAD O1	229	-24.7	Enable	41	4420	T5000 LCL COMP H A OFF	41	4BC1	T5101 LCL COMP H B ON	45	4BC1	T6101 LCL COMP H B ON
SECL_119	19	5	19	20499	T5042	TCS TH SPI CDE1	168	-6.9	Enable	41	1341	P4117 P HLCL 7A1 ON(A)	45	1341	P4617 P HLCL 7A1 ON(B)	0	0	N/a

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_120	20	5	19	20499	T5042	TCS TH SPI CDE1	172	-8	Enable	41	B341	T5576 TSW CDE HTRA ON	45	B341	T6576 TSW CDE HTRA ON	0	0	N/a
SECL_121	21	5	44	20524	T5049	TCS TH SPI TRP	168	-6.9	Enable	41	1D40	P4109 P HLCL 6A1 ON(A)	45	1D40	P4609	0	0	N/a
SECL_122	22	5	44	20524	T5049	TCS TH SPI TRP	172	-8	Enable	41	5D41	T5521 TSW SPI IF HA ON	45	5D41	T6521 TSW SPI IF HA ON	0	0	N/a
SECL_123	23	5	118	20598	T5070	TH IBIS CDM1	125	-28.8	Enable	41	1D40	P4109 P HLCL 6A1 ON(A)	45	1D40	P4609 P HLCL 6A1 ON(B)	0	0	N/a
SECL_124	24	5	118	20598	T5070	TH IBIS CDM1	129	-29.8	Enable	41	DD40	T5528 TSW IBISCUH AONA	45	DD40	T6528 TSW IBISCUH AONA	0	0	N/a
SECL_125	25	5	55	20535	T5051	TCS TH IBIS PEB2	168	-6.9	Enable	41	CC1	P4363 P HLCL 7B2 ON(A)	45	CC1	P4863 P HLCL 7B2 ON(B)	41	16C0	P4343 P HLCL 4B1 ON(A)
SECL_126	26	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	45	16C0	P4843 P HLCL 4B1 ON(B)	41	2CC0	T5651 TSW IEB1 HTRB ON	45	2CC0	T6651 TSW IEB1 HTRB ON
SECL_127	27	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	41	F6C1	T5601 TSW IEB2 HTRB ON	45	F6C1	T6601 TSW IEB2 HTRB ON	0	0	N/a
SECL_128	28	5	112	20592	T5075	IBIS MAINFRA TH2	214	-20	Enable	41	1AC0	P4351 P HLCL 5B1 ON(A)	45	1AC0	P4851 P HLCL 5B1 ON(B)	0	0	N/a
SECL_129	29	5	112	20592	T5075	IBIS MAINFRA TH2	214	-20	Enable	41	2C0	P4355 P HLCL 6B2 ON(A)	45	2C0	P4855 P HLCL 6B2 ON(B)	0	0	N/a
SECL_130	30	5	112	20592	T5075	IBIS MAINFRA TH2	217	-20.9	Enable	41	FAC1	T5611 TSW CDTE HR1B ON	45	FAC1	T6611 TSW CDTE HR1B ON	0	0	N/a
SECL_131	31	5	112	20592	T5075	IBIS MAINFRA TH2	217	-20.9	Enable	41	E2C1	T5616 TSW CDTE HR2B ON	45	E2C1	T6616 TSW CDTE HR2B ON	0	0	N/a
SECL_132	32	5	112	20592	T5075	IBIS MAINFRA TH2	221	-22.2	Enable	41	7AC0	P4435 TSW IBISDET B ON	45	7AC0	P4935 TSW IBISDET B ON	0	0	N/a
SECL_133	33	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	41	4CC0	T5641 TSW PEB1 HTRB ON	45	4CC0	T6641 TSW PEB1 HTRB ON	0	0	N/a
SECL_134	34	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	41	CCC1	T5646 TSW PEB2 HTRB ON	45	CCC1	T6646 TSW PEB2 HTRB ON	0	0	N/a
SECL_135	35	2	74	8266	T6076	TCS TH TANK3 TOP	82	20	Enable	2B	940	T4481 S HLCL 5A2 ON(B)	2B	6C1	T4521 S HLCL 5B2 ON(B)	0	0	N/a

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_136	36	2	73	8265	T6072	TCS TH TANK1 TOP	82	20	Enable	2B	6C1	T4521 S HLCL 5B2 ON(B)	0	0	N/a	0	0	N/a
SECL_137	37	2	31	8223	T6000	TCS TH BATTERY C	160	-4.7	Enable	2B	940	T4481 S HLCL 5A2 ON(B)	2B	6C1	T4521 S HLCL 5B2 ON(B)	0	0	N/a
SECL_138	38	2	31	8223	T6000	TCS TH BATTERY C	160	-4.7	Enable	2B	66C1	T4361 TSW BAT B ON	2B	6940	T4121 TSW BAT A ON	0	0	N/a
SECL_139	39	1	103	4199	T0054	TCS TH STRH1	179	-10	Enable	2B	1541	T4511 S HLCL 6A1 ON(B)	0	0	N/a	0	0	N/a
SECL_140	40	5	35	20515	T5016	OMC LENS TEMP1	160	-4.7	Enable	2B	6540	T4231 TSW OMC LNSA ON	0	0	N/a	0	0	N/a
SECL_141	41	1	37	4133	T6011	TCS TH IMUH	125	5.3	Enable	2B	1541	T4511 S HLCL 6A1 ON(B)	2B	1AC0	T4551 S HLCL 6B1 ON(B)	0	0	N/a
SECL_142	42	1	37	4133	T6011	TCS TH IMUH	125	5.3	Enable	2B	B541	T4581 TSW IMUE A ON	2B	BAC0	T4591 TSW IMUE B ON	0	0	N/a
SECL_143	43	1	50	4146	T0022	TEMP RWA1	157	4.8	Enable	2B	1541	T4511 S HLCL 6A1 ON(B)	2B	1AC0	T4551 S HLCL 6B1 ON(B)	0	0	N/a
SECL_144	44	1	50	4146	T0022	TEMP RWA1	157	4.8	Enable	2B	7541	T4171 TSW RWA A ON	2B	7AC0	T4411 TSW RWA B ON	0	0	N/a

7.3 Redundant PPDU Entries.

The following Heater Table entries contain commands to SPDU-A and B and PPDU-B only, they will be loaded only following loss of the PPDU-A commanding capability.
These entries have not been updated since launch, when inputs are received from Industry this table and the relevant FCPs will be updated.

Table 10: Redundant PPDU Heater Table.

PVS_ID	Htr.	Monitored Thermistor	Threshold		TC1	TC2	TC3

		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)			RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_201	1	5	109	20589	T5072	IBIS MAINFRA TH1	214	-20	Enable	45	1541	P4601 P HLCL 5A1 ON(B)	45	D41	P4605 P HLCL 6A2 ON(B)	0	0	
SECL_202	2	5	109	20589	T5072	IBIS MAINFRA TH1	217	-20.9	Enable	45	F540	T6511 TSW CDTE HR1A ON	45	ED40	T6516 TSW CDTE HR2A ON	45	6D41	P4705 TSW IBISDET A ON
SECL_203	3	5	55	20535	T5051	TCS TH IBIS PEB2	168	-6.9	Enable	45	340	P4613 P HLCL 7A2 ON(B)	0	0	N/a	0	0	N/a
SECL_204	4	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	45	4341	T6541 TSW PEB1 HTRA ON	45	C340	T6546 TSW PEB2 HTRA ON	0	0	N/a
SECL_205	5	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	45	2341	T6551 TSW IEB1 HTRA ON	45	A340	T6556 TSW JDPE1 HTA ON	0	0	N/a
SECL_206	6	5	54	20534	T5050	TCS TH IBIS IEB2	168	-6.9	Enable	45	1941	P4593 P HLCL 4A1 ON(B)	45	1D40	P4609 P HLCL 6A1 ON(B)	45	1341	P4617 P HLCL 7A1 ON(B)
SECL_207	7	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	45	F940	T6501 TSW IEB2 HTRA ON	45	BD40	T6536 TSW VEB HTRA ON	0	0	N/a
SECL_208	8	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	45	3D41	T6531 TSW JDPE2 HTA ON	45	D341	T6566 TSW IDPE1 HTA ON	0	0	N/a
SECL_209	9	5	70	20550	T5058	TCS TH ODPE	172	-8	Enable	45	1341	P4617 P HLCL 7A1 ON(B)	45	5340	T6561 TSW ODPE HTRA ON	45	3340	T6571 TSW SDPE2 HTA ON
SECL_210	10	5	22	20502	T5003	TH SPI STRUC3	193	-13.9	Enable	45	E941	T6036 TSW ACS MSK-A ON	0	0	N/a	0	0	N/a
SECL_211	11	5	29	20509	T5010	TH SPI AFEE1	196	-14.7	Enable	45	6441	T6006 LCL CAMER H-A ON	0	0	N/a	0	0	N/a
SECL_212	12	5	28	20508	T5009	TH SPICMP+RAD O1	229	-24.7	Enable	45	4BC1	T6101 LCL COMP H B ON	0	0	N/a	0	0	N/a
SECL_213	13	5	19	20499	T5042	TCS TH SPI CDE1	168	-6.9	Enable	45	1341	P4617 P HLCL 7A1 ON(B)	0	0	N/a	0	0	N/a
SECL_214	14	5	19	20499	T5042	TCS TH SPI CDE1	172	-8	Enable	45	B341	T6576 TSW CDE HTRA ON	0	0	N/a	0	0	N/a
SECL_215	15	5	44	20524	T5049	TCS TH SPI TRP	168	-6.9	Enable	45	1D40	P4609 P HLCL 6A1 ON(B)	0	0	N/a	0	0	N/a
SECL_216	16	5	44	20524	T5049	TCS TH SPI TRP	172	-8	Enable	45	5D41	T6521 TSW SPI IF HA ON	0	0	N/a	0	0	N/a
SECL_217	17	5	118	20598	T5070	TH IBIS CDM1	125	-28.8	Enable	45	1D40	P4609 P HLCL 6A1 ON(B)	0	0	N/a	0	0	N/a

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_218	18	5	118	20598	T5070	TH IBIS CDM1	129	-28.8	Enable	45	DD40	T6528 TSW IBISCUH AONB	0	0	N/a	0	0	N/a
SECL_219	19	5	55	20535	T5051	TCS TH IBIS PEB2	168	-6.9	Enable	45	CC1	P4863 P HLCL 7B2 ON(B)	45	16C0	P4843 P HLCL 4B1 ON(B)	0	0	N/a
SECL_220	20	5	54	20534	T5050	TCS TH IBIS IEB2	172	-8	Enable	45	2CC0	T6651 TSW IEB1 HTRB ON	45	F6C1	T6601 TSW IEB2 HTRB ON	0	0	N/a
SECL_221	21	5	112	20592	T5075	IBIS MAINFRA TH2	214	-20	Enable	45	1AC0	P4851 P HLCL 5B1 ON(B)	45	2C0	P4855 P HLCL 6B2 ON(B)	0	0	N/a
SECL_222	22	5	112	20592	T5075	IBIS MAINFRA TH2	217	-20.9	Enable	45	FAC1	T6611 TSW CDTE HR1B ON	45	E2C1	T6616 TSW CDTE HR2B ON	0	0	N/a
SECL_223	23	5	112	20592	T5075	IBIS MAINFRA TH2	221	-22.2	Enable	45	7AC0	P4935 TSW IBISDET B ON	0	0	N/a	0	0	N/a
SECL_224	24	5	55	20535	T5051	TCS TH IBIS PEB2	172	-8	Enable	45	4CC0	T6641 TSW PEB1 HTRB ON	45	CCC1	T6646 TSW PEB2 HTRB ON	0	0	N/a
SECL_225	25	2	74	8266	T6076	TCS TH TANK3 TOP	82	20	Enable	23	940	T1481 S HLCL 5A2 ON(A)	2B	940	T4481 S HLCL 5A2 ON(B)	2B	6C1	T4521 S HLCL 5B2 ON(B)
SECL_226	26	2	73	8265	T6072	TCS TH TANK1 TOP	82	20	Enable	23	6C1	T1521 S HLCL 5B2 ON(A)	2B	6C1	T4521 S HLCL 5B2 ON(B)	23	940	T1481 S HLCL 5A2 ON(A)
SECL_227	27	2	31	8223	T6000	TCS TH BATTERY C	160	-4.7	Enable	23	940	T1481 S HLCL 5A2 ON(A)	2B	940	T4481 S HLCL 5A2 ON(B)	23	6C1	T1521 S HLCL 5B2 ON(A)
SECL_228	28	2	31	8223	T6000	TCS TH BATTERY C	160	-4.7	Enable	2B	6C1	T4521 S HLCL 5B2 ON(B)	23	66C1	T1361 TSW BAT B ON	2B	66C1	T4361 TSW BAT B ON
SECL_229	29	2	31	8223	T6000	TCS TH BATTERY C	160	-4.7	Enable	23	6940	T1121 TSW BAT A ON	2B	6940	T4121 TSW BAT A ON	0	0	N/a
SECL_230	30	1	103	4199	T0054	TCS TH STRH1	179	-10	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	0	0	N/a
SECL_231	31	5	35	20515	T5016	OMC LENS TEMP1	160	-4.7	Enable	23	6540	T1231 TSW OMC LNSA ON	2B	6540	T4231 TSW OMC LNSA ON	0	0	N/a
SECL_232	32	1	37	4133	T6011	TCS TH IMUH	125	5.3	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	23	1AC0	T1551 S HLCL 6B1 ON(A)
SECL_233	33	1	37	4133	T6011	TCS TH IMUH	125	5.3	Enable	2B	1AC0	T4551 S HLCL 6B1 ON(B)	23	B541	T1581 TSW IMUE A ON	0	0	N/a

PVS_ID	Htr. Nr.	Monitored Thermistor					Threshold		Enable / Disable	TC1			TC2			TC3		
		Packet SType	Offs. Byte	PID (Dec)	PCF_ NAME	PCF_DESCR	dec	Eng. (degC)		RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR	RLA	RLD	ODB PCF_NAME PCF_DESCR
SECL_234	34	1	37	4133	T6011	TCS TH IMUH	125	5.3	Enable	2B	B541	T4581 TSW IMUE A ON	23	BAC0	T1591 TSW IMUE B ON	2B	BAC0	T4591 TSW IMUE B ON
SECL_235	35	1	50	4146	T0022	TEMP RWA1	157	4.8	Enable	23	1541	T1511 S HLCL 6A1 ON(A)	2B	1541	T4511 S HLCL 6A1 ON(B)	23	1AC0	T1551 S HLCL 6B1 ON(A)
SECL_236	36	1	50	4146	T0022	TEMP RWA1	157	4.8	Enable	2B	1AC0	T4551 S HLCL 6B1 ON(B)	23	7541	T1171 TSW RWA A ON	0	0	N/a
SECL_237	37	1	50	4146	T0022	TEMP RWA1	157	4.8	Enable	2B	7541	T4171 TSW RWA A ON	23	7AC0	T1411 TSW RWA B ON	2B	7AC0	T4411 TSW RWA B ON

8 SUNLIT CONDITIONS.

The default Sunlit conditions as defined in the SDB (TC D4414) and at CDMU Boot-up are are:

Sunlit Condition 1
Packet Subtype 2
Offset Byte 255
Threshold 85
This corresponds to
P3115 SA WING 1 CUR 2 > 7.5A

Sunlit Condition 2
Packet Subtype 2
Offset Byte 263
Threshold 85
This corresponds to
P3118 SA WING 2 CUR 2 > 7.5A

Sunlit Condition 3
Packet Subtype 1
Offset Byte 62
Bit 4
This corresponds to
A9190 CSPAAD EXCDED = 0 (NOT EXCEED)

However this is not the Sunlit conditions set which will be used during the nominal mission. Due to modifications in the AOCS, the CSPAAD (AAD-2) threshold is now set to 33 degrees. Therefore in order to detect the sun presence up to 40 degrees it is necessary to use the FSPAAD (AAD-1).
A new TC packet D4415 has been defined in the database to load the new FSPAAD criteria. The changed Sunlit condition is as follows:

Sunlit Condition 3
Packet Subtype 1
Offset Byte 62
Bit 5
This corresponds to
A9191 FSPAAD EXCDED = 0 (NOT EXCEED)

The other Sunlight conditions remain unchanged. FCP_DHS_1370 will load the new criteria.

9 CREATING NEW SECL ENTRIES.

During the course of the mission, it is likely that new SECL entries will be required. This section gives some guidelines for creating new entries.

- It is suggested to define new entries using TC parameter sets, for reasons of simplicity and flexibility. New entries should be given identifiers of the form 'SECL_nnn', the current (pre-launch) naming convention is
  SECL_0nn: nominal Heater table entries which contain commands to SPPDU-A and B and PPDU-A and B as required.
  SECL_1nn: Heater table entries which do not contain commands to SPDU-A.
  SECL_2nn: Heater table entries which do not contain commands to PPDU-A.
  Check whether the new Thermistor parameter to be monitored has a PID in the ODB, this is necessary to be able to display reports of the heater table in the IMCS VPD task.
- The SECL task only works with Thermistors with 'inverted' calibration curves, check that the parameter to be monitored has such a calibration curve.
- When defining recovery action commands, it is necessary to define only the 3 bytes of TC data, as defined in the SDB TC_PKT_STRUCT table, the TC packet structure is generated automatically be the SECL task when it issues commands.
- All new entries should be tested thoroughly on the simulator before loading on-board, in a full simulation scenario, this should include at least the following:
  All other SECL entries loaded which would normally be resident on-board concurrently with the new entries.
  SECL table loaded and SECL active.
  Payload on.
  Simulate eclipse passage where relevant.
  Trigger issue of any recovery commands to be issued and verify their functionality.
- Once the entries have been tested and are to be used, update this document, (including background for generating the new entries) and any affected FOP Procedures.

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TABLE OF CONTENTS

1 INTRODUCTION

IBIS the Gamma ray Imager on-board the Integral Satellite is designed to be a gamma-ray telescope with imaging and spectroscopic capabilities. It will be able to localise sources at low energy with few arcminutes accuracy. *IBIS* will cover the energy range from soft gamma-rays to several MeV g-rays, and will be able to localise sources with 12' angular resolution.
The Imager makes use of the regular broadcast packets in order to manage autonomously the instrument status.
Every SW automatism is indicated in the periodic or non periodic housekeeping TM or as On Event Message to permit the reconstruction on ground of every action executed on board.

1.1 On Board Automatism

In case of necessity any on-board automatism can be disabled, and the instrument operated from ground via telecommands. Any SW automatism (with the exception of ESAM automatism always active) can be enabled/disabled by TLC. Follows below a table with the SW automatism on-board the IBIS instrument:

- Pointing/Slew Automatism
- Eclipse Automatism
- Radiation Belt Automatism
- PICSIT Noisy Pixel Automatism
- Emergency OFF Automatism
- HEPI Resynch Automatism
- Radiation Monitor Automatism
- ISGRI Noisy Pixel Automatism
- ESAM automatism

1.1.1 POINTING/SLEW AUTOMATISM

This automatism is by default active in any science mode and could be switched off by ground TC.

REASON: the automatic transition from slew to pointing (and vice-versa) is performed by the IASW based on the BCPKT information [TM D5233 (PID) & A5004 (AOCS Mode) & D5217 (OTF)]. At the moment of the transition a dedicated non-periodic HK packet H2 (APID=1281) will be generated.

ACTION: TC (G/H0807 – TC_parameter G/H8604)

TM VERIFIC: TM G8051 (AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: further to the automatic transition following the BCPKT information the transition from pointing to slew sub-mode can be achieved by following the procedures reported in the FOP related to the SCI mode point/slew . Prior to do this the automatism shall be deactivated via the configuration TC indicated above. This mechanism can be used for diagnostic / troubleshooting activities. As per default this automatism is enabled at activation.

1.1.2 ECLIPSE AUTOMATISM

This automatism is by default active in any science mode and could be switched off by ground TC.

REASON: according to BCPKT, IASW perform a transition to stand by at eclipse start time (stop data acquisition) from any mode; IASW generates additional HK TM(1,1) (exit scientific mode).
ISGRI and VETO will be switched into stand by mode; PICSiT will be switched into maintenance mode;
The ISGRI bias will be switched off;
IASW save peripheral context autonomously (except HEPI, because DPE is the master of HEPI tables).

ACTION: TC (G/H0808 – TC_parameter G/H8605)

TM VERIFIC: TM G8052(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: during the eclipse the DPE and HEPI stay powered ON and all other periphery units are powered OFF. The DPE keeps a full copy in its RAM of all parameters and tables used in the periphery. The eclipse times will be taken from Broadcast Packet (BCPCK). As per default the automatism are enabled at activation.

1.1.3 RADIATION BELT AUTOMATISM

This automatism is by default active in any science mode and could be switched off by ground TC.

REASON: at BCPCK time radiation belt entry IASW change to stand by from each mode. IASW generate HK TM(1,1) packet (exit scientific mode); IASW will switch off Veto HV by changing into stand by mode, ISGRI will be set to stand-by mode and bias will be switched off; PICSIT pixel monitoring is switched off (because not active when IASW is in Stand-By);

ACTION: TC (G/H0809 – TC_parameter G/H8606)

TM VERIFIC: TM G8053(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: as per default the automatism are enabled at activation.

1.1.4 PICSIT NOISY PIXEL AUTOMATISM

This automatism is by default active in any science mode and could be switched off by ground TC.

REASON: If one of the semi-module[1] counters (in H1 HK packet G/H) exceeds the programmed threshold (parameter G/H5650 settable with TC G/H0520), an OEM (class 2, msg. 167) with the information of the semi-module number is generated by PICSiT.

This OEM is passed together with the standard HK to IASW. IASW monitors the OEM from PICSIT. In case this OEM occurs only in one semi-module and IASW is in any scientific mode then IASW reads the PICSIT rate meters on HEPI according the semi-module number and looks for a noisy pixel. If only one noisy pixel exceeds the programmable threshold (parameter G/H 8603 settable with TC G/H806), IASW generates a command to switch off the relevant pixel. After the reception of the Kill-Pix command from IASW, PICSIT S/W generates an OEM (class 0, msg. 175 with pixel co-ordinates) to inform ground about the switched off pixel.

ACTION TC: TC (G/H0881 – TC_parameter G/H8744)

TM VERIFIC: TM G8054(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: If more than a pixel exceed the threshold no automatic operation will be executed because this is understood as an increment of the count-rate due to external causes (GRB / Solar Flare). The ground segment will possibly receive in this case one OEM maximum per semi-module. **Not all semi-modules may have this condition simultaneously.**

1.1.5 EMERGENCY SWITCH OFF AUTOMATISM

If not disabled the imminent switch off automatism is active in any mode.

REASON: IASW monitors the imminent switch off field in BCPCK (TM D5212). If flag is set, IASW goes to stand- by mode from any other mode, VETO HV will be switched off by change to stand by mode and ISGRI will set set to stand-by mode and bias will be switched off.

ACTION: TC (G/H0811 – TC_parameter G/H8607)

TM VERIFIC: TM G8055(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: as per default the automatism are enabled at activation.

1.1.6 HEPI RESYNCH AUTOMATISM

If not disabled by TC from ground this automatism is active in any of the IBIS mode.

REASON: in science mode HEPI and the detectors will be re-synchronised under the following conditions:

- Event rate of valid events is less or equal than valid events rate threshold;
- Invalid event rate is higher than invalid event rate threshold.

Both thresholds are configurable at activation (TC G0886/887– set threshold valid / invalid). All values are measured on DPE HBR A I/F.

ACTION: TC (G/H0812 – TC_parameter G/H8608)

TM VERIFIC: TM G8056(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK:

1.1.7 RADIATION MONITOR AUTOMATISM

If not disabled by TC from ground or by checking the validity flag in the BCPKT the IREM automatism is active in any of the IBIS mode.

REASON: The IASW monitors the count rates of 3 IREM channels (TM U9919-20-21) in the BCPKT (D5214-15-16), after exceeding thresholds (settable at activation phase with TC G/H0318 – parameter G/H 8692/93/94) IASW switch immediately to stand by mode from each mode.VETO HV will be switched off by change to stand by mode; ISGRI will set set to stand-by mode and bias will be switched off;

ACTION: TC (G/H0823 – TC_parameter G/H8800)

TM VERIFIC: TM G8040(AND G0047)

PROCEDURE: FCP_IBIS1_0075 (IASW SET-UP)

REMARK: if the DRMC flag (TM D5204) is set to DISREGARD in the BCPKT, the information from the IREM counters is not considered by the instruments. As per default the automatism are enabled at activation.

1.1.8 ISGRI NOISY PIXEL AUTOMATISM

If not disabled by TC from ground this automatism is active in any of the IBIS mode.

REASON: The ISGRI Noisy Pixel Handling System is able to do the following:

- automatic switch-off of pixels that become noisy;
- automatic switch-on of the noisy pixels after a time interval.

The parameters that rules the noisy pixel switch off (Module and Pixel Max Counts Switch On Period) are part of the ISGRI Context Table.

ACTION: TC (G/H0216/217 – MCE0 NP ON/OFF)
(G/H0251/252 – MCE1 NP ON/OFF)
(G/H0286/287 – MCE2 NP ON/OFF)
(G/H0321/322 – MCE3 NP ON/OFF)
(G/H0356/357 – MCE4 NP ON/OFF)
(G/H0391/392 – MCE5 NP ON/OFF)
(G/H0426/427 – MCE6 NP ON/OFF)
(G/H0461/462 – MCE7 NP ON/OFF)

TM VERIFIC: TM G2003(MCE0 OPM)-
G2017(MCE1 OPM)
G2031(MCE2 OPM)
G2045(MCE3 OPM)
G2059(MCE4 OPM)
G2073(MCE5 OPM)
G2087(MCE6 OPM)
G2101(MCE7 OPM)

PROCEDURE: GEISCL02 (ISGRI CALIBRATION)

REMARK: the activation of this automatism is always performed after a proper calibration of the ISGRI detector (executed nominally below the Radiation belts). The information about the pixels statuses is downloaded to ground by HK3 TM: the first 256 bytes of the HK3.* packet are reporting the current statuses of the pixels in each ISGRI module*

1.1.9 ESAM AUTOMATISM

This automatism is always active in any of the IBIS mode and **CANNOT** be disabled by ground.

REASON: IASW monitors the ESAM field in BCPCK If the flag is set than IASW goes to stand by mode from any other mode, VETO will HV will be switched off by change to stand by mode and ISGRI will set set to stand-by mode and bias will be switched off.

ACTION: none

TM VERIFIC: TM A9134(AOCS) D5219(BCPKT)

PROCEDURE: none

REMARK:

1.2 IASW reaction to DPE OBT wrap around

The OBT is used as a timing tool for the IBIS histogram generation, i.e.,when an histogram is integrated (and read), is checked also with the OBT by comparing the expected end time with the current time. So the histogram integration stops when current time is greater than the end time. If there is not sufficient time until the start of slew also the histogramming will not start
But this will lead to a problem when the histogram end time or slew time wrap around and this occurs during the mission every 194.18 days (due to the 24 bits counter on board DPE):

- if the pointing/slew automatism is ON no further histograms are integrated if the start of slew time wrapped around;

- if the pointing/slew automatism is OFF, histograms will be stopped immediately after started because the computed end time wrapped around and is less than the current time.

This also is applicable for the reading of histograms because the reading rate must be evenly distributed for a given time. If the desired end time of reading histograms is before the current time, a reading (transmission on ground) of histograms will be performed as fast as possible.

If IBIS IASW is left in science mode the following consequences will appear:

- No histogram integrations will start or will immediately stop after start (-> empty histogram);

- Reading of histograms will be performed as fast as possible.

Operational constraints:

In conclusion to perform a safe control of the IBIS IASW, the following points must be taken into account:

1) While integration of histograms is running the time must not wrap around. This means in particular that

- the integration time of a histogram plus the start time must not wrap around;

- the calculated stop of pointing mode (that is: switch to pointing time plus pointing duration) must not wrap around.

2) One of the following precautions must be performed facing a wrap around:

a.) the pointing duration must be shortened so it will not cross the wrap around time or for this cycle the IBIS IASW must skip processing histograms;

b.) IBIS IASW should be switched into standby mode at a time T_Wraparound - max(Integration Times), by scheduling (by ISOC) a proper calibration window and executing the ED GESTBY02. It will be responsibility of the MOC to inform in advance (~1 months before) ISOC in order to schedule that calibration activity for IBIS [this is the current official agreement]

c.) disable histogramming S5-S7 when crossing the wrap-around condition.

Remark: the PPM mode or other functions (e.g. radiation belt/eclipse passage) are not affected.