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

INTEGRAL
Mission Report

INT-MOC-SYS-RP-1001-TOS-OF

No. 014
Week 52/2002

13.01.03
PV Phase

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1 General

This report comprises inputs from various teams involved in the operations:
- Flight Control Team,
- Flight Dynamics Team (Fuel book-keeping)

This report addresses the activities from 21.12.02 until 26.12.02 (both dates inclusive). It covers the revolutions 22 (final part), 23, and 24. In general it was a relatively quiet period for operations.

2 Summary of Activities

The operations were performed according to the planning inputs provided by ISOC.

The targets of the revolutions were Cygnus X-1and Empty Field 2. The revolution 22 and 23 consisted of raster type observations in the area of Cygnus, and revolution 24 was a long staring observation of Empty Field 2 over Christmas.

Note: Some further information concerning the activities is provided in the Appendix.

3 Satellite Status

3.1 Platform

The performance of the platform was good, no unexpected behaviour has been observed in the reporting period.

3.1.1 AOCS

The overall performance of the AOCS subsystem was good. Deviations from the timeline operation were always caused by non-AOCS problems. The AOCS has been configured for the eclipse season.
The OTF as reported by the AOCS keeps flickering from time to time due the already known problems (SEU's modifying the detected position of the star, and roll error at the end of open loop slews not been properly processed by the OTF assessment). Occasionally this is reflected in the Broadcast Packet.
The fuel consumption over the last 10 days was 0.16 Kg. The remaining propellant is in the order of 180.5 Kg on 24 December.

Note: Some more information concerning the AOCS operations and the fuel budget is provided in the Appendix.

3.1.2 Power

The power subsystem is working as specified. The available power is in the order of 2380 W as since the beginning of the mission, i.e. no degradation has been identified so far.

3.1.3 Thermal

The thermal control of the satellite is working well. The temperatures are currently all within the specified operational limits.

3.1.4 OBDH

The satellite has reached its nominal configuration, i.e. all nominal units are switched on. The OBDH subsystem is working flawlessly.

3.1.5 RF

The RF subsystem is working properly. The link margin is sufficient to ensure proper TM reception and execution of commands with the ranging channel enabled.

3.2 Payload

No new anomalies have been discovered in the reporting period. Operations are performed from the automatic timeline, with occasional manual commanding to cover change requests.

3.2.1 SPI

Nominal operations performed according to the timeline.

Note: Some more information concerning the SPI operations is provided in the Appendix

3.2.2 IBIS

Nominal operations performed by the timeline.

Note: Some more information concerning the IBIS operations is provided in the Appendix

3.2.3 JEM-X

Nominal operations performed according to the timeline.

Note: Some more information concerning the JEM-X operations is provided in the Appendix.

3.2.4 OMC

The OMC is working nominally. The OMC imaging activities are operated from the automatic Timeline.

Note: Some more information concerning the OMC operations is provided in the Appendix.

3.2.5 IREM

The INTEGRAL Radiation Monitor (IREM) is working nominally. No special operations have been performed.

4 Ground Facilities

The overall performance of the ground segment for the time it was scheduled was good. Problems were mainly in the area of the NCTRS and the link MOC-ISDC.

4.1 Mission Operations Centre

The overall performance of the MOC was good and the configuration was stable.

The main current problem areas are still in the consolidation of the TM archive, the access to the telemetry in retrieval mode after archive splits, and the number of SPR's in the TDRS area (external offline data retrieval).

4.2 Ground Stations & Network

The performance of the operational network and the stations was in general good.

4.3 Science Ground Segment

4.3.1 ISOC

No ISOC Input has been provided

4.3.2 ISDC

No ISDC Input has been provided

5 Special Events

Eclipse season preparation.

6 Anomalies

A list of the pending anomalies is presented in the Appendix.

There were again a few ground problems that impacted the operations. In particular the intermittent disconnection of the MOC-ISDC link has occurred several times.

7 Future Milestones

The next mission milestones are the start of the eclipse season, and the end of the PV phase with the start of the AO-1 observing programme, both occurring in revolution 26 on the 30.12.2002.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Rev22
Revolution 22 consisted of a raster dither pattern centred 7.4degrees off Cygnus-X1, which was repeated throughout the revolution. TM allocation was initially 59 SPI, 122 IBIS, 3 JEM-X1, 6 JEM-X2, 5 OMC, changing to 59 SPI, 122 IBIS, 6 JEM-X1, 3 JEM-X2, 5 OMC. All instruments were commanded into their nominal science modes.

Rev23
The raster dither pattern (7.4deg off Cygnus-X1) performed in revolution 22 was continued into the start of revolution 23, with the TM allocation maintained at 59 SPI, 122 IBIS, 6 JEM-X1, 3 JEM-X2, 5 OMC. Following 9 pointings of this dither pattern, a new raster dither was performed at 9.65deg off Cygnus-X1 and this was repeated until the end of the revolution. The TM allocation at the start of the new raster pattern was 59 SPI, 122 IBIS, 3 JEM-X1, 6 JEM-X2, 5 OMC, changing to 59 SPI, 122 IBIS, 6 JEM-X1, 3 JEM-X2, 5 OMC after approximately 48hrs. All instruments were in their nominal science modes.

Rev24
During this revolution a staring was performed on the Empty Field 2 target (RA 22:15:13.10; DEC -02:03:59.4). The TM allocation for the first ~24hrs of the revolution was 16 SPI, 165 IBIS, 4 JEM-X1, 5 JEM-X2, 5 OMC, allowing IBIS to be in the Photon by Photon mode. During this time, SPI spectra TM was not enabled. A 30min break in the Timeline was then ensured to allow manual reconfiguration of SPI. Staring on the same target was continued for the remainder of the revolution, TM allocation of 59 SPI, 122 IBIS, 5 JEM-X1, 4 JEM-X2, 5 OMC, with IBIS in Standard mode and SPI spectra TM enabled.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
This is an automatic report from the FDS history file for INTEGRAL

2002-12-14T17:36:26.000Z     180.6481    F   Automatic TM processing.
2002-12-14T20:28:27.000Z     180.6330    F   After 0020_0051_M.RWB
2002-12-14T22:08:11.000Z     180.6170    F   After 0020_0054_M.RWB
2002-12-15T06:59:32.000Z     180.6046    F   Automatic TM processing.
2002-12-16T17:26:39.000Z     180.5865    F   Automatic TM processing.
2002-12-18T06:50:43.000Z     180.5699    F   Automatic TM processing.
2002-12-19T16:56:54.000Z     180.5571    F   Automatic TM processing.
2002-12-21T06:39:54.000Z     180.5448    F   Automatic TM processing.
2002-12-22T16:59:33.000Z     180.5254    F   Automatic TM processing.
2002-12-24T06:29:53.000Z     180.4871    F   Automatic TM processing.

This report was generated at  Wed Dec 25 08:00:07 GMT 2002
```

```
Note: The 4.24kg pressurant has now been removed from the
      fuel-book - the above list shows ONLY the remaining
      propellant
```

8.3 Detailed Satellite Information

This section contains some detailed information concerning the various subsystems of the satellite and instruments.

8.3.1 AOCS SUMMARY OPERATIONS REPORT 21/12/2002-26/12/2002

AOCS operations were executed from the Automatic Timeline. During this week the IMU/RMU health check operations in preparation for the eclipse season were perfomed. Also in preparation for the first eclipse, the FDE and FCE eclipse timers were loaded and started, for the first time in the mission (the ACC eclipse timer was already used during the LEOP). During this period, 16 Open Loop Slews, 66 Closed Loop Slews and 4 Momentum Bias were executed.
The OTF as reported by the AOCS has flickered in 3 occasions, 2 due to the incorrect handling of the roll error at the end of the slew for the OTF calculation, and 1 due to undetected false events in the STR CCD.

21/12/2002 (Day of Year 355, Revolution 22-23)

FDS failed to update slew parameters: The parameters for slew 00230011 were not updated by the Flight Dynamics System. Since it was an open loop slew after a close loop slew, it was decided to let the timeline run. No impact.

22/12/2002 (Day of Year 356, Revolution 23)

Slew lost after station H/O: The station H/O from Redu to Goldstone took longer than the time allocated in the timeline. As a consequence the first slew after the H/O was not commanded on time, and recover schedule was needed. Due to this problem, pointings 00230054 and 00230055 were not executed from the timeline.

23/12/2002 (Day of Year 357, Revolution 23)

IMU-1 and 2 pre-eclipse season health check performed. Drift and noise found very low.

Seasonal RMU-B heath check performed. The voltage and temperature were nominal. The drift as seen from the RTU TM (no FCE reconfiguration was performed for this check), had very similar values as the ones seen in LEOP.

24/12/2002 (Day of Year 358, Revolution 23-24)

FDS failed to update slew parameters: The update of the parameters for the first slew of revolution 24 was not produced by the FDS. The update was done manually, and the problem had no impact.

25/12/2002 (Day of Year 359, Revolution 24)

26/12/2002 (Day of Year 360, Revolution 24)

8.3.2 IBIS Operations

- Status Nominal, on going the PV phase.
- The problem of high count rates , lasting for more than 5 minutes, affecting the ISGRI MDUs, did not occur during the week;
- Reported the OEM ID 131 and 133 Class 2 <<IBIS IASW HSL/LSL TRANSFER FAIL REPORT>> with an average rate of 2/day, due to communications problems affecting the DPE/HEPI and the peripherals through the high speed line and low speed line. The problem is known to IBIS team and investigation is on-going in order to fix it.
- The IBIS ECOE was disconnected on DOY 354 due to a problem in the MOC-ISDC link. This did not solved the problem. Software Support requested a re-starting of IFRD task on ISDSA.
- Reported OEM ID 167 Class 2 <<PICsIT NOISY SEMIMODULE>> at 2002.358.0028z : killed pixel (y=0,z=53) in PDM 5 as requested by CR PI-OPS-213 at 2002.358.13.00z.
- The Control of the unit is completely automatic, driven by EDs. Limited manual commanding was requested to set the IBIS configuration for the revolution 24 starting on 2002.358: executed CR PI-OPS-212 in order to set the SCI PPM configuration for the first part of the revolution and the SCI Standard configuration for the last part of the revolution.
- Some TCs of the ED GEPPM-02 were failing on DOY 2002.358 due to a wrong release time in the TC_seq GEPPM-02. The problem had no impact on the instrument configuration because was requested for rev 24 to proceed manually with the special setting.The problem has been fixed.

8.3.3 SPI Operations

- Status Nominal, on going the PV phase.
- Occasionally TM_para E3824 (U PD 5V+DIG L) and E1495 (S PD PROG-ER L) in OOL just for few packets.
- Manual commanding was requested to set the SPI configuration:
  - Rev 22 changed the PSD library configuration (CR PI-OPS-211);
  - Rev 23 changed SPI spectra duration for the following staring observation (CR PI-OPS-209);
  - Rev 24 changed the configuration of the events downloaded, in agreement with the requested PST of 59 pkt foreseen for the following staring observation (CR PI-OPS-209).
- On DOY 2002.359.14:01.22z enabled the CCCF in order to re-establish the SPI configuration because the accumulation of the spectra on board did not start after Belt Exit reconfiguration(requested by ISOC with CR PI-OPS-214). The OEM flagging the building of the spectra was generated at 359.17:49z.

8.3.4 JEM-X Operations

OVERVIEW

During this period all JEM-X operations were driven by the timeline with the exception of uplink and execution of time-tag TCs to set the units to SAFE mode at 90 minutes before the BCP Radiation Belt entry time.

DETAILS

20-Dec-2002, DOY 354, Revolution 22

- 21:55:00, JEMX1 to SAFE by time-tag TC
- 21:55:10, JEMX2 to SAFE by time-tag TC

21-Dec-2002, DOY 355, Revolution 23

- 10:05:00, Time-tag commands were uplinked to put JEMX1 and JEMX2 in SAFE mode at 90 minutes before Rev 23 BCP radiation belt entry time.

23-Dec-2002, DOY 357, Revolution 23

- 21:41:00, JEMX1 to SAFE by time-tag TC
- 21:41:10, JEMX2 to SAFE by time-tag TC

24-Dec-2002, DOY 358, Revolution 24

- 08:46:00, Time-tag commands were uplinked to put JEMX1 and JEMX2 in SAFE mode at 90 minutes before Rev 24 BCP radiation belt entry time.

26-Dec-2002, DOY 360, Revolution 24

- 21:28:00, JEMX1 to SAFE by time-tag TC
- 21:28:10, JEMX2 to SAFE by time-tag TC

8.3.5 OMC Operations

During the reporting period OMC operations were driven nominally by the automatic timeline.

8.4 List of Anomalies since Launch

The following table presents the list of all identified anomalies that have been registered since Launch and that are still pending.

ARid	Date Occurrence	Subject	Segment	Element	Status
INT - 002003	19/10/2002	Command failure from TCE2 at Redu1.	Ground	ESA Sta.	Pending
INT - 002007	22/10/2002	Command sequence TENPE_00 is incorrect.	Space	Procedures	Pending
INT - 002010	22/10/2002	Time correlation not applied correctly to time parameters in TM type 8 reports.	Ground	IMCS	Pending
INT - 002018	22/10/2002	Loss of TM and TC with Goldstone.	Ground	NASA Sta.	Pending
INT - 002024	28/10/2002	OEM: SPI1 Fixed print overflow	Space	SPI	Pending
INT - 002058	06/11/2002	Telemetry Play Back Failed	Ground	NASA Sta.	Pending
INT - 002048	08/11/2002	TM Data Retrieval Jobs not executed	Ground	IMCS	Pending
INT - 002055	09/11/2002	IBIS VETO anomalous count rates.	Space	IBIS	Pending
INT - 002061	12/11/2002	TM Desktop perfomance collapses when de-selecting supercommutated procesing.	Ground	IMCS	Pending
INT - 002062	13/11/2002	Static PTV wrongly handled by IMCS when commands are copied	Ground	IMCS	Pending
INT - 002066	13/11/2002	Data routing to ISDS	Ground	I/F to SGS	Pending
INT - 002082	13/11/2002	TM packet production lower than allocation.	Space	SPI	Pending
INT - 002070	14/11/2002	TDRS: data Rerievals cancelled	Ground	IMCS	Pending
INT - 002078	14/11/2002	Antenna Tracking Problems	Ground	ESA Sta.	Pending
INT - 002079	14/11/2002	Timing Problem with Telecommands	Ground	ESA Sta.	Pending
INT - 002083	16/11/2002	SPI DPE Crash	Space	SPI	Pending
INT - 002091	18/11/2002	A-Chain Frozen	Ground	IMCS	Pending
INT - 002092	19/11/2002	Load-Dump comparison uses also non-released load commands	Ground	IMCS	Pending
INT - 002093	19/11/2002	Incorrect MOUT in POS/EPOS/TSF	Ground	ISOC	Pending
INT - 002094	19/11/2002	TDRS does not work with supercommutated parameters	Ground	IMCS	Pending

INT - 002095	19/11/2002	TDRS incomplete retrievals.	Ground	IMCS	Pending
INT - 002096	19/11/2002	Retrieval from the stations	Ground	IMCS	Pending
INT - 002097	19/11/2002	Unexpected dithering process when SPI spectra accumulation = 0	Space	SPI	Pending
INT - 002098	19/11/2002	FEE 3 has 2 occurences of 3 status parameters OOL	Space	SPI	Pending
INT - 002099	20/11/2002	SPI1 periodic task overun	Space	SPI	Pending
INT - 002107	21/11/2002	TDRS produces gaps in the retrieval, that don't correspond to gaps in the archive	Ground	IMCS	Pending
INT - 002118	25/11/2002	Autostack crashed	Ground	IMCS	Pending
INT - 002121	26/11/2002	ISGRI countrates increase up to 8000 counts/sec in one module	Space	IBIS	Pending
INT - 002116	27/11/2002	SPI Spectra process / cycle stopped	Ground	ISOC	Pending
INT - 002117	27/11/2002	Command releaser failed	Ground	IMCS	Pending
INT - 002124	29/11/2002	Telemetry Drops from GoldStone	Ground	NASA Stat	Pending
INT - 002125	29/11/2002	Data loss between IMCS and ISDC	Ground	I/F to SGS	Pending
INT - 002128	01/12/2002	Wheel Speed monitor crashed	Ground	FDS	Pending
INT - 002122	02/12/2002	IBIS VDM4 HV broke down	Space	IBIS	Pending
INT - 002127	02/12/2002	Telemetry loss from REDU	Ground	ESA Stat	Pending
INT - 002129	03/12/2002	VC-7 data loss	Ground	ESA Stat	Pending
INT - 002130	04/12/2002	Reaction Wheel Task Stopped	Ground	FDS	Pending
INT - 002131	04/12/2002	Lost TC capability via GoldStone(Dss-16)	Ground	NASA Stat	Pending
INT - 002132	05/12/2002	TM/TC loss via REDU	Ground	ESA Stat	Pending
INT - 002133	05/12/2002	Loss of Frames	Ground	IMCS	Pending
INT - 002135	06/12/2002	Inconsistency in Pointing ID vs Slew ID found in POS for revolutions 17 and 18	Ground	ISOC	Pending
INT - 002136	06/12/2002	Invalid PST of SPI in Oper Mode	Ground	ISOC	Pending
INT - 002137	08/12/2002	Handover to DSS-16 delayed due to hardware problems	Ground	NASA Stat	Pending
INT - 002138	09/12/2002	Command failure	Ground	IMCS	Pending
INT - 002139	09/12/2002	Attitude determination Failed	Ground	FDS	Pending
INT - 002141	10/12/2002	TPF failed to load	Ground	IMCS	Pending
INT - 002142	11/12/2002	TDRS Time Interval Setting	Ground	IMCS	Pending
INT - 002144	15/12/2002	Command verifier failed	Ground	IMCS	Pending

INT - 002145	15/12/2002	Commands failing PTV for no reason	Ground	IMCS	Pending
INT - 002143	16/12/2002	Lost commanding via REDU	Ground	ESA Stat	Pending
INT - 002147	16/12/2002	Lost Telecommanding via REDU	Ground	ESA Stat	Pending
INT - 002146	17/12/2002	Late telemetry from REDU	Ground	ESA Stat	Pending
INT - 002149	17/12/2002	OBQD giving wrong results	Ground	IMCS	Pending
INT - 002150	17/12/2002	TM drop via REDU	Ground	ESA Stat	Pending
INT - 002151	17/12/2002	ISDS-ISDC Disconnected	Ground	I/F to SGS	Pending
INT - 002152	18/12/2002	NCTRS-A required resetting	Ground	NCTRS	Pending
INT - 002153	19/12/2002	RWS Plot Stopped	Ground	FDS	Pending
INT - 002154	19/12/2002	Drops in link to ISDC	Ground	I/F to SGS	Pending
INT - 002155	19/12/2002	Star Tracker false events	Ground	Spacecraft	Pending
INT - 002157	20/12/2002	Lost VC-7 from NCTRS	Space	NCTRS	Pending
INT - 002158	20/12/2002	Telemetry drop for both Redu and GoldStone	Ground	Spacecraft	Pending
INT - 002159	21/12/2002	Ranging Failure via REDU	Space	ESA St.	Pending
INT - 002160	21/12/2002	Interruption of TC link	Ground	ESA St.	Pending
INT - 002161	21/12/2002	TPF was not produced	Ground	FDS	Pending
INT - 002162	22/12/2002	Late AOS via GoldStone	Ground	NASA St.	Pending