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

INTEGRAL
Mission Report

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

No. 019
Week 05

31.01.03

Routine Phase

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LIST OF CONTENTS

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		G. La Rosa – IBIS	1
		S. Brandt – JEM X	1
		E. De Miguel - OMC	1
		W. Hajdas – IREM	1
		JPL / Goldstone	
		D. Holmes	1
		T. Horton	1
		Redu	
		J. Mac Lauchlan	1

1 General

The Flight Control Team at MOC has compiled this report considering a couple of inputs provided by the Flight Dynamics Team.

It addresses the activities from 25.01.03 until 31.01.03 (both dates inclusive) and covers the revolutions 34 to 36.

2 Summary of Activities

The operations were performed from the automatic Timeline. Manual commanding was mainly applied in contingency situations to recover the nominal Timeline. The Timelines of the various revolutions were based on the planning inputs provided by ISOC.

The targets of the revolutions were SN 1987A, the Galactic Plane and the Coma cluster. The observations included a hexagonal dither pattern, a raster dither pattern and a Galactic Plane Survey.

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 / malfunction was identified.

28/01/2003
Following the end of the eclipse season the following changes were made to the On-board configuration:

Select Full charge rate C/26 for both batteries.
FCP_EPS_1273 Select Full Charge Rate (C/13), BCR1
FCP_EPS_1274 Select Full Charge Rate (C/13), BCR2

Load the On-board monitoring list for use outside of the eclipse season.
FCP_DHS_1231 Load OBM Entries for Non-eclipse Season.

3.1.1 AOCS

The AOCS performance was good during this week, but 10 slews were missed due to ground segment problems (9 due to Goldstone problems, 1 due to communications problems with Redu). This amounts to 5% of the total scheduled number.

After the last eclipse of the eclipse season, the AOCS was reconfigured back to the non-eclipse season state. The eclipses went without any problem. The total IMU lifetime spent during this eclipse season was:

IMU-1: 104h41m44s. Total time spent during the mission: 258h00m35s

IMU-2: 1h47m20s. Total time spent during the mission 5h39m36s

The OTF Thresholds were modified (doubled), in order to avoid OTF flickering. The new thresholds are (Roll=120'',Pitch=36'',Yaw=36''). Since the modification, no flickering has occurred due to roll error at the end of slews, and only one case occurred due to simultaneous Pitch and Yaw error. This must have been quite an exotic case, but unfortunately it occurred during a TM outage from Goldstone, so no further investigation is possible.
The fuel consumption over the last 12 days was 0.22 Kg. The remaining propellant is in the order of 179.43 Kg on the 29th of January.

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 OBDH subsystem is working flawlessly. No on-board communications problem identified.

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.

A few RF link measurements have been performed in order to identify the available link margin. The analysis of the data is ongoing.

3.2 Payload

3.2.1 SPI

The status of the instrument is nominal.

After the eclipse season (last rev. was nr 34) it has been operated in photon by photon mode with 59 pkts/cycle of allocation in the PST.

The cryo-cooler performances are nominal. The detector temperature drift is slowly decreasing (<0.02 K/day).

A couple of out of limit, lasting one TM cycle, has been detected in the past revolutions (E2314 indicated PARAM>SPEC, E0358 reported for one cycle -2.652V, limit is -2.4V). No

action was undertaken due to the short duration of the alarm. However discussions are on-going with SPI specialists to set-up special procedures applicable for this kind of alarms, in case they appear more frequently.

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

3.2.2 IBIS

Status Nominal, on going the routine phase.

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

3.2.3 JEM-X

During the reporting period, JEM-X1 was always in SAFE mode and JEM-X2 operations were driven nominally by the automatic timeline.

JEM-X 2 entered Safe Mode when encountering radiation values above the internal thresholds before reaching the defined altitude for the entry of the Perigee Belt (60.000 Km). It was agreed to switch JEM-X off when an altitude of 70.000 Km is reached.

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

3.2.4 OMC

During the reporting period OMC operations were interrupted 3 times due to missing of slews. A total of 10 pointings were missed during this period.

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

3.2.5 IREM

The status of the unit is nominal.

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

4 Ground Facilities

The overall performance of the ground segment was good. The overall performance was above the required 95 %. This concerns the number of executed pointings with respect to the planned pointins and the provision of real-time data to ISDC. The main problems that impacted the operations are addressed in section 6.

4.1 Mission Operations Centre

The performance of the MOC was good in the reporting period. The situation concerning the provision of real-time TM data to ISDC and the consolidation of the archive has improved significantly after a new release of the IMCS has been implemented. The production of CD ROMs is now back to the nominal state.

The main problem concerned the interface to the ISDC, see chapter 6.

4.2 Ground Stations & Network

The performance of the operational network was in general good. However, some anomalies occurred that impacted the operations, see chapter 6.

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

26/01/2003 (DOY 026)

Eclipse passage:
Eclipse #10 of the current eclipse season, this was also the last eclipse of the season.
Total Eclipse Duration: 28m 24s
Umbra Duration: 22m 48s
ECD measured DOD Battery 1 9.54% (2.29Ah)
ECD measured DOD Battery 2 9.46% (2.27Ah)
(Note DOD calculation assumes nominal battery capacity rating of 24Ah)
Recharge time battery 1 1h 20m
Recharge time battery 2 1h 20m
Both the eclipse passage and recharge executed nominally, a small increase in the battery internal temperatures towards the end of the recharge period indicates that both batteries were fully recharged.

6 Anomalies

The main problem of the MOC concerned the real-time link to ISDC. There are still occasionally temporary interruptions of the link. The exact reason for the problems has not been identified. However some upgrades of the system are in preparation.

Besides, there were a few problems with the stations.
The link to the Redu stations was impacted once for a few minutes, which was sufficient to fail one of the pointings.
In addition there were problems during two passes over Goldstone, which caused the loss of a couple of pointings. The problems were mainly due to wrong configurations at Goldstone / JPL.

A list of the pending anomalies since Launch is presented in the Appendix. The following list identifies the new Anomaly Reports introduced into the system.

INT - 002206	2003/01/25	Link lost to ISDC.	Ground	I/F to SGS	Pending
INT - 002204	2003/01/27	Incorrect eclipse times in BCPKT.	Ground	FDS	Pending
INT - 002207	2003/01/27	TM and TC lost due to COMMS problems	Ground	COMMS	Pending
INT - 002208	2003/01/27	Autostack: Commands that fail release do not apply any further interlock.	Ground	IMCS	Pending
INT - 002209	2003/01/27	Loss of TM/TC via DSS-24	Ground	NASA Sta.	Pending

7 Future Milestones

There are planned Instrument Application Software upgrades for the IBIS and SPI instruments, and the Dedicated Front-end Electronics for JEM-X.

In addition it is planned to perform the annealing of the SPI instrument to improve the instrument performance. This means that SPI will not be available for science operations for about two weeks.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 34
The hexagonal dithering observation centred on SN 1987A (RA 05:35:28.32; DEC -69:16:12.0) performed in revolution 33 was continued throughout revolution 34. The TM allocation was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC throughout the science observation and all instruments except for JEM-X1 were in their nominal science modes.

Revolution 35
The hexagonal dithering observation centred on SN 1987A (RA 05:35:28.32; DEC -69:16:12.0) performed in revolutions 33 and 34 was continued throughout revolution 35. The TM allocation was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC throughout the science observation and all instruments except for JEM-X1 were in their nominal science modes.

Revolution 36
The first observation of revolution 36 consisted of 13 pointings of a GPS. Following this a raster dither pattern around RA 12:59:48.72; DEC +27:58:51.6 in the Coma cluster was performed and repeated for the remainder of the revolution, until the slew to the perigee passage attitude (RA 09:26:53.89; DEC -44:50:00.4). The TM allocation was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC during both observations and all instruments except for JEM-X1 were in their nominal science modes.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2003-01-17T05:52:43.000Z     179.6425    F   Automatic TM processing.
2003-01-17T09:03:23.000Z     179.6137    F   Automatic TM processing.
2003-01-18T15:17:02.000Z     179.6016    F   Automatic TM processing.
2003-01-18T19:51:59.000Z     179.5863    F   Automatic TM processing.
2003-01-20T05:38:42.000Z     179.5543    F   Automatic TM processing.
2003-01-21T14:45:25.000Z     179.5423    F   Automatic TM processing.
2003-01-23T05:21:37.000Z     179.5256    F   Automatic TM processing.
2003-01-26T04:42:17.000Z     179.5025    F   Automatic TM processing.
2003-01-27T14:07:41.000Z     179.4836    F   Automatic TM processing.
2003-01-29T03:54:48.000Z     179.4257    F   Automatic TM processing.

This report was generated at  Wed Jan 29 08:00:07 GMT 2003

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 24/12/2002-30/12/2002

AOCS operations were executed from the Automatic Timeline.
During this period, 53 Open Loop Slews, 166 Closed Loop Slews and 7 Momentum Bias were executed. 10 slews were missed due to non-AOCS problems. This is about 5% of losses with respect to the total number of scheduled pointings.
The OTF as reported by the AOCS has flickered in 7 occasions. 1 of them was due to roll error at the end of the slew, and the other 6 to undetected false events in the STR CCD. All these occurrences were before the update of the OTF Threshold, with one exception of a simultaneous Pitch and Yaw Threshold violation that occurred out of coverage, and for this reason can not be investigated further.

24/01/2003 (Day of Year 024, Revolution 34)

Slews missed due to Ground Station problem (Goldstone-DSS16): At 19:32 TM was lost from DSS-16. TM and TC capability was back at 20:45, and the timeline was rejoined using the Recover Schedule tool. The impact of this problem was that slews 00340056, 00340057 and 00340058 were lost.

25/01/2003 (Day of Year 025, Revolution 34)

Nothing to report.

26/01/2003 (Day of Year 026, Revolution 35)
Nothing to report.

27/01/2003 (Day of Year 027, Revolution 35)

Slew missed due to communications problem with Redu: At 08:11 the link to Redu was interrupted, and came back a minute later. Due to this problem, slew 00350041 was missed, and the timeline was rejoined using Recover Schedule.

OTF Threshold Changed: At 09:04 the OTF Thresholds were changed from the default values (R=60'',P=18'',Y=18'') to the double (R=120'',P=36'',Y=36''). This change is to make the problem with the OTF Flickering disappear.

AOCS Reconfigured after the eclipse season: At 11:05 the AOCS was reconfigured for the non-eclipse season. This involved freezing the FDCE eclipse timers in the sunlight state, stopping the ACC Eclipse task, and loading the non-eclipse season AMD thresholds.

Slews missed due to Ground Station problem (Goldstone-DSS24): At 17:22 continuous TM drops started occurring. AOCS timeline operations had to be interrupted. This problem disappeared around 20:00, and Recover Schedule was used to rejoin the timeline. Due to this problem, slews 00350054 to 00350059 were missed. The AOCS subsystem was re-enabled from the timeline at 20:48.

28/01/2003 (Day of Year 028, Revolution 35)

Nothing to report.

29/01/2003 (Day of Year 029, Revolution 36)

Nothing to report.

30/01/2003 (Day of Year 030, Revolution 36)

8.3.2 SPI Operations

SPI Annealing
A meeting was held in CNES-Toulouse to discuss the SPI annealing operations, with the participation of MOC/ISOC/ESA project. It was agreed to start the annealing procedure in rev.38 on 6th February at 08.:00Z. The complete annealing cycle will last the following 4 revolutions until rev.42. When the cryo-cooler will be re-started in rev.41, the stroke will be tuned for a target temperature of 85K instead of 90K CNES/Project provided the necessary qualification status of SPI detector/cryo-cooler assembly at this new operating temperature. The power budget is still in the allocated limits. Detectors will be turned on at 117K at the beginning of rev.42 and by the end of this rev, SPI should be working nominally at 85K.
In rev.43 SPI will be fully ready to start the observation of the Crab.

SPI IASW release 4.2.0/4.1.0
Two new releases of the IASW have been produced by CNES. The necessary patch (release 4.2.0) will be up-linked after the annealing during the passive cooling phase, followed by a series of functional tests (rev.41). The new releases have already successfully gone through the acceptance tests on-ground using the DPE QM and the SPI simulator at CNES.
The following corrections/optimisation are implemented by the new release:
1) Optimisation of the Spectra compression algorithm (less time required)
2) Optimisation of Spectra accumulation start logic (Spectra will start in all cases with the BCP management by POS)
3) Increase of priority in the Spectra TM downlink (Spectra transmission will be quicker, so it can restart in the allocated time) ==> not implemented in release 4.1.0
4) OEM for Spectra start/stop reclassified from exception to event class type.
Release 4.1.0 is a back up version in case the change (3) will not work as expected in-flight.

8.3.3 IBIS Operations

Reported the OEM ID 131 and 133 Class 2 <<IBIS IASW HSL/LSL TRANSFER FAIL REPORT>> with an average rate of 1/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. The fix of this problem it is not included in the IASW patch.

On DOY 2003.26. 06.07Z the sequence GEBENT02 for the instrument configuration at Belt exit failed the release to a Dynamic PTV NO GO for all the TT TC. The problem apparently due to a wrong update of the OBQD task, has been solved sending a report of the pending TT TCs on board. After that the sequence has been correctly up-linked manually.

8.3.4 JEM-X Operations

Nothing to Report.

8.3.5 OMC Operations

24-Jan-2003, DOY 024, Revolution 34

- 19:32:00, Due to loss of TM from Goldstone, slews 00340056 to 00340058 were missed. The schedule was recovered for slew 00340059.

27-Jan-2003, DOY 027, Revolution 35

- 08:11:30, TM/TC loss from Redu caused missing of slew 00350041.
- 17:22:00, TM loss from Goldstone resulted in missing of slews 00350054 to 00350059.

8.3.6 IREM Operations

On DOY 2003.28.22.14 Z the TC U4921 (belonging to ED UEGROF01) failed the completion of execution. The TC was successfully executed on-board but the TM update was received late by the CMD verifier task.

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. Though these Anomaly Reports still have a pending status most of the problems have been analysed and solutions or at least workarounds are already in place.

ARid	Date Occurrence	Subject	Segment	Element	Status
INT - 002003	2002/10/19	Command failure from TCE2 at Redu1.	Ground	ESA Sta.	Pending
INT - 002010	2002/10/22	Time correlation not applied correctly to time parameters in TM type 8 reports.	Ground	IMCS	Pending
INT - 002018	2002/10/22	Loss of TM and TC with Goldstone.	Ground	NASA Sta.	Pending
INT - 002024	2002/10/28	OEM: SPI1 Fixed print overflow	Space	SPI	Pending
INT - 002048	2002/11/08	TM Data Retrieval Jobs not executed	Ground	IMCS	Pending
INT - 002055	2002/11/09	IBIS VETO anomalous count rates.	Space	IBIS	Pending
INT - 002061	2002/11/12	TM Desktop performance collapses when de-selecting super-commutated processing.	Ground	IMCS	Pending
INT - 002062	2002/11/13	Static PTV wrongly handled by IMCS when commands are copied	Ground	IMCS	Pending
INT - 002066	2002/11/13	Data routing to ISDS	Ground	I/F to SGS	Pending
INT - 002082	2002/11/13	TM packet production lower than allocation.	Space	SPI	Pending
INT - 002070	2002/11/14	TDRS: data Retrievals cancelled	Ground	IMCS	Pending
INT - 002079	2002/11/14	Timing Problem with Tele-commands	Ground	ESA Sta.	Pending
INT - 002083	2002/11/16	SPI DPE Crash	Space	SPI	Pending
INT - 002091	2002/11/18	A-Chain Frozen	Ground	IMCS	Pending

INT - 002092	2002/11/19	Load-Dump comparison uses also non-released load commands	Ground	IMCS	Pending
INT - 002094	2002/11/19	TDRS does not work with super-commutated parameters	Ground	IMCS	Pending
INT - 002096	2002/11/19	Retrieval from the stations	Ground	IMCS	Pending
INT - 002097	2002/11/19	Unexpected dithering process when SPI spectra accumulation = 0	Space	SPI	Pending
INT - 002098	2002/11/19	FEE 3 has 2 occurrences of 3 status parameters OOL	Space	SPI	Pending
INT - 002121	2002/11/26	ISGRI count-rates increase up to 8000 counts/sec in one module	Space	IBIS	Pending
INT - 002125	2002/11/29	Data loss between IMCS and ISDC	Ground	I/F to SGS	Pending
INT - 002128	2002/12/01	Wheel Speed monitor crashed	Ground	FDS	Pending
INT - 002122	2002/12/02	IBIS VDM4 HV broke down	Space	IBIS	Pending
INT - 002131	2002/12/04	Lost TC capability via Goldstone(Dss-16)	Ground	NASA Sta.	Pending
INT - 002132	2002/12/05	TM/TC loss via REDU	Ground	ESA Sta.	Pending
INT - 002137	2002/12/08	Handover to DSS-16 delayed due to hardware problems	Ground	NASA Sta.	Pending
INT - 002138	2002/12/09	Command failure	Ground	IMCS	Pending
INT - 002139	2002/12/09	Attitude determination Failed	Ground	FDS	Pending
INT - 002142	2002/12/11	TDRS Time Interval Setting	Ground	IMCS	Pending
INT - 002145	2002/12/15	Commands failing PTV for no reason	Ground	IMCS	Pending
INT - 002152	2002/12/18	NCTRS-A required resetting	Ground	NCTRS	Pending
INT - 002157	2002/12/20	Lost VC-7 from NCTRS	Ground	NCTRS	Pending
INT - 002174	2002/12/29	Wrong GuideStar selected.	Space	Spacecraft	Pending
INT - 002183	2003/01/01	Dyn PTV failure	Ground	IMCS	Pending
INT - 002169	2003/01/03	IREM sw local resets due to SEU (twice)	Space	IREM	Pending
INT - 002191	2003/01/11	FDS not able to update slew parameters	Ground	FDS	Pending

INT - 002194	2003/01/16	Wrong handling of the OTF after Open Loop Slew	Space	Spacecraft	Pending
INT - 002196	2003/01/17	Automatic Stack Needed to be restarted.	Ground	IMCS	Pending
INT - 002199	2003/01/17	Incorrect handling of CLCW wrapparound in CLTU mode	Ground	ESA Sta.	Pending
INT - 002197	2003/01/20	Lost Telecommanding via REDU	Ground	IMCS	Pending
INT - 002200	2003/01/20	TM/TC Link lost via REDU	Ground	ESA Sta.	Pending
INT - 002201	2003/01/21	MRU Timer Circuit - decreasing threshold.	Space	Spacecraft	Pending
INT - 002203	2003/01/21	Telemetry Drops from Goldstone	Ground	NASA Sta.	Pending
INT - 002202	2003/01/22	NCTRS log file writing takes all the CPU making the application fail.	Ground	NCTRS	Pending
INT - 002205	2003/01/24	Telemetry Drops from Goldstone	Ground	NASA Sta.	Pending
INT - 002206	2003/01/25	Link lost to ISDC.	Ground	I/F to SGS	Pending
INT - 002204	2003/01/27	Incorrect eclipse times in BCPKT.	Ground	FDS	Pending
INT - 002207	2003/01/27	TM and TC lost due to COMMS problems	Ground	COMMS	Pending
INT - 002208	2003/01/27	Autostack: Commands that fail release do not apply any further interlock.	Ground	IMCS	Pending
INT - 002209	2003/01/27	Loss of TM/TC via DSS-24	Ground	NASA Sta.	Pending
INT - 002210	2003/01/27	Telemetry loss via DSS-24	Ground	NASA Sta.	Pending
INT - 002211	2003/01/28	Manual Stack crashed on SUN-123	Ground	IMCS	Pending
INT - 002212	2003/01/29	TDRS Interval-by-Interval TM Retrieval Problem	Ground	IMCS	Pending
INT - 002213	2003/01/29	SCOS 2000 Interval-by-Interval TM Retrieval Problem	Ground	IMCS	Pending
INT - 002214	2003/01/29	Drop in telemetry from REDU	Ground	ESA Sta.	Pending