

**INTEGRAL**  
**Mission Report**  
**INT-MOC-SYS-RP-1001-TOS-OF**  
**No. 012**  
**Week 50**  
**13.12.02**  
**Commissioning-PV Phase**

Prepared by: J. Piñeiro (TOS-OF)

## LIST OF CONTENTS

|       |                                                            |    |
|-------|------------------------------------------------------------|----|
| 1     | General .....                                              | 1  |
| 2     | Summary of Activities .....                                | 1  |
| 3     | Satellite Status.....                                      | 1  |
| 3.1   | Platform .....                                             | 1  |
| 3.1.1 | AOCS .....                                                 | 1  |
| 3.1.2 | Power .....                                                | 2  |
| 3.1.3 | Thermal .....                                              | 2  |
| 3.1.4 | OBDH.....                                                  | 2  |
| 3.1.5 | RF .....                                                   | 2  |
| 3.2   | Payload .....                                              | 2  |
| 3.2.1 | SPI .....                                                  | 2  |
| 3.2.2 | IBIS .....                                                 | 2  |
| 3.2.3 | JEM-X.....                                                 | 2  |
| 3.2.4 | OMC.....                                                   | 3  |
| 3.2.5 | IREM .....                                                 | 3  |
| 4     | Ground Facilities .....                                    | 3  |
| 4.1   | Mission Operations Centre .....                            | 3  |
| 4.2   | Ground Stations & Network .....                            | 4  |
| 4.3   | Science Ground Segment .....                               | 4  |
| 4.3.1 | ISOC .....                                                 | 4  |
| 4.3.2 | ISDC.....                                                  | 4  |
| 5     | Special Events.....                                        | 4  |
| 6     | Anomalies .....                                            | 4  |
| 7     | Future Milestones .....                                    | 4  |
| 8     | Appendix .....                                             | 5  |
| 8.1   | Overview of Revolutions .....                              | 5  |
| 8.2   | Consumables .....                                          | 5  |
| 8.2.1 | Detailed Fuel Book-keeping.....                            | 5  |
| 8.3   | Detailed Satellite Information.....                        | 6  |
| 8.3.1 | AOCS SUMMARY OPERATIONS REPORT 06/12/2002-12/12/2002 ..... | 6  |
| 8.3.2 | IBIS Operations .....                                      | 9  |
| 8.3.3 | JEM-X Operations .....                                     | 11 |
| 8.3.4 | OMC Operations.....                                        | 14 |
| 8.4   | List of Anomalies since Launch .....                       | 17 |

## DISTRIBUTION LIST

| Addressees           | Copy | Addressees              | Copy |
|----------------------|------|-------------------------|------|
| D/TOS                |      | ESA HQ                  |      |
| G. Winters D/TOS     | 1    | D. Southwood D/SCI      | 1    |
| W. Frank TOS-O       | 1    |                         |      |
| A. Smith TOS-OF      | 1    | ESTEC                   |      |
| J. F. Kaufeler TOS-G | 1    | J. Credland SCI-P       | 1    |
| N. Bobrinsky TOS-ON  | 1    | A. Gimenez-Canete SCI-S | 1    |
| R. Münch TOS-GF      | 1    |                         |      |
| P. Maldari           | 1    | ESTEC / PG              |      |
| W. Wimmer            | 1    | K. Clausen              | 1    |
| M. Schmidt           | 1    | P. Jensen               | 1    |
| J. Pineiro           | 1    | P. Strada               | 1    |
| R. Southworth        | 1    | G. Sarri                | 1    |
| F. Di Marco          | 1    | R. Carli                | 1    |
| F. Cordero           | 1    |                         |      |
| M. Walker            | 1    | ESTEC/RSSD              |      |
| M. Rezazad           | 1    | M. Kessler SCI-SD       | 1    |
| J. Houser            | 1    | C. Winkler              | 1    |
| P. Lippi             | 1    | A. Parmar               | 1    |
| SPACONS              | 1    | R. Much                 | 1    |
| S. Fahmy             | 1    | L. Hansson              | 1    |
|                      |      | R. Kuulkers             | 1    |
| B. Komasa            | 1    | Nicola Rando            | 1    |
| G. Di Girolamo       | 1    |                         |      |
| D. Guerucci          | 1    | ISDC                    |      |
| F. Dreger            | 1    | T. Courvoisier          | 1    |
| G. Gienger           | 1    | R. Walter               | 1    |
| S. Pallaschke        | 1    | N. Mowlavi              | 1    |
| W. Hell              | 1    | ISDC Shift Team         | 1    |
| K. Capelle           | 1    | D. Texier               | 1    |
| M. Butkovic          | 1    |                         |      |
| D. Heinzer           | 1    | ALENIA                  |      |
| A. Pena              | 1    | C. Cassi                | 1    |
| Shift - Coord        | 1    | F. Ravera               | 1    |
| Scheduling Office    | 1    |                         |      |
| T. Beck              | 1    | PI / Instrument Teams   |      |
| B. Smeds             | 1    | C. Larigauderie – SPI   | 1    |
|                      |      | G. La Rosa – IBIS       | 1    |
| S. Scaglioni         | 1    | S. Brandt – JEM X       | 1    |
|                      |      | E. De Miguel - OMC      | 1    |
| J. Wardill           | 1    | W. Hajdas – IREM        | 1    |
|                      |      |                         |      |
|                      |      | JPL / Goldstone         |      |
|                      |      | D. Holmes               | 1    |
|                      |      | T. Horton               | 1    |
|                      |      |                         |      |
|                      |      | Redu                    |      |
|                      |      | J. Mac Lauchlan         | 1    |

## 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 06.12.02 until 12.12.02 (both dates inclusive). It covers the revolutions 17 (final part), 18, 19 and 20 (initial part).

## 2 Summary of Activities

This period can be considered already as part of the Performance Verification Phase. The operations were mostly performed according to the planning inputs provided by ISOC. Several change requests have been implemented to modify the configurations of the instruments and the timing of activities to fulfil the requirements of the instrument teams.

The target of the revolutions was Cygnus-X1. The revolution 18 consisted basically of a staring observation for the entire revolution. The revolutions 19 and 20 were a raster type observation still in the area of Cygnus, with 30 minutes dwelling time. The time since the start of revolution 19 has been the longest period of intensive timeline commanding up to now in the mission, and as a consequence the most representative of the future routine phase operations.

*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. Operations in the last days of the period reached the nominal intensity expected for the routine phase (slews every 30 minutes). The timeline operations were interrupted a number of times due to ground problems of different nature (communication lines, Flight Dynamics System, Mission Planning), and the schedule was recovered. For the problems related with Mission Planning and Flight Dynamics System the corrective actions are being implemented. During this week a total of 8 pointings were lost, over a total of 139. This gives a 6% losses.

The fuel consumption over the last 15 days was 0.15 Kg. The remaining propellant is in the order of 180.7 Kg on 10 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 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**

The functions and performances of the various instruments are currently being assessed. The instruments work mostly as expected, with the exception of JEM-X, for which the operational baseline is being re-assessed in order to minimise the degradation of the unit (see section 8.3.3).

### **3.2.1 SPI**

Nominal operations performed according to the timeline.

### **3.2.2 IBIS**

Nominal operations performed by the timeline.

The configuration requested by the IBIS PI for the perigee passage (PDM's 3 and 5 remaining on to improve the thermal stability of PICsIT) has been maintained as in the previous week.

An alarm On Event Message for the VETO Counter occurred shortly before the Radiation Belt entry in revolution 18. There is no indication of this being an anomalous behaviour, it rather seems due to real radiation. See section 8.3.2 for details.

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

### **3.2.3 JEM-X**

The operational strategy to better handle the two JEM-X units in view of the degradation problems is being discussed and refined. Currently MOC is working on the implementation of

the new JEM-X operations concept, which requires the operation of only one JEM-X unit at a time, starting from revolution 26.

The latest IODB updates contain corrections to two JEM-X TM parameters and the HV setting command CEVs as well as the new default values for the Low Level Discriminator setting TC and JEM-X1 reduced HV setting.

On 8 December 2002 (DOY 342) at a descending altitude of about 79000km JEM-X trigger rates increased above the S/W HV switch OFF threshold and both units were set to SAFE mode by the internal S/W ratemeters.

Both JEMX units are being switched to SAFE mode at 90 minutes before the BCP radiation belt entry time.

*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.

During the reporting period OMC operations were interrupted 3 times. Once because the PTV NO-GO condition did not clear, the second time because AOCS commands failed release and two slews were missed and the third time was due to loss of TC link, which also resulted in missing of slews.

A test of OMC remote commanding through IBAS was performed on 10 December 2002.

*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.

During this week several requests of modification for the DSS-16 coverage were received from JPL due to LEOP changes in other missions supported by this station. Apart from the direct impact in terms of science coverage reduction, the implementation of these modifications is involving a big effort from all parties involved in the Integral Mission Planning, both at MOC and at ISOC.

### **4.1 Mission Operations Centre**

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

On the 9<sup>th</sup> of December the IMCS release 8.5 was installed on the prime server. This release closes 28 SPR's.

The main current problem areas are in the occasional incorrect failure of the telecommand Pre-Transmission Validation and Execution Verification, 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. See comment above for the impacts of DSS-16 re-scheduling.

A hit in the communications line with Redu caused the loss of 3 pointings.

## **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**

None

## **6 Anomalies**

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

There were again a few problems at the MOC that impacted the operations, most of them re-occurrences of known problems. For details see the detailed sections of the Appendix.

A new problem in the area of the Mission Planning that has affected the operations during the reporting period is that there is currently no proper way to implement an LOS period outside perigee passage. The changes needed in the PSF in order to handle this type of LOS in an adequate way have uncovered additional problems also in the ISOC side of the Mission Planning. Intensive work is in progress in order to fix this issue.

## **7 Future Milestones**

The next mission milestone is the end of the PV phase, and the start of the AO-1 observing programme, planned for revolution 26 on the 30.12.2002.

## 8 Appendix

The appendix includes various detailed information.

### 8.1 Overview of Revolutions

Revolution 18 was similar to revolution 16 in that it consisted of a Cygnus-X1 on-axis staring for the full revolution. The TM allocation at the start of the revolution was 59 SPI, 122 IBIS, 6 JEM-X1, 3 JEM-X2, 5 OMC, with JEM-X1 in Full Imaging Data Taking and JEM-X2 in Restricted Data Taking. The TM share and Full Imaging/Restricted were interchanged between JEM-X1 and JEM-X2 after the wheel bias close to apogee. All instruments, including SPI, which had spectra TM enabled, were commanded to their science modes via the automatic Timeline.

Revolution 19 contained the first raster dither pattern. The raster pattern was centred 2.67deg off Cygnus-X1 and was repeated throughout the entire revolution. The TM allocation was initially 59 SPI, 122 IBIS, 3 JEM-X1, 6 JEM-X2, 5 OMC and was changed to 59 SPI, 122 IBIS, 6 JEM-X1, 3 JEM-X2, 5 OMC for the last day of the revolution (likewise Restricted vs. Full Imaging for JEM-X). All instruments were commanded into their respective science modes via the Timeline.

### 8.2 Consumables

#### 8.2.1 Detailed Fuel Book-keeping

|                          |          |   |                          |
|--------------------------|----------|---|--------------------------|
| 2002-11-27T08:00:56.000Z | 185.0970 | F | Automatic TM processing. |
| 2002-11-28T18:14:28.000Z | 185.0830 | F | Automatic TM processing. |
| 2002-11-30T07:55:43.000Z | 185.0697 | F | Automatic TM processing. |
| 2002-12-01T18:00:51.000Z | 185.0610 | F | Automatic TM processing. |
| 2002-12-03T07:46:06.000Z | 185.0377 | F | Automatic TM processing. |
| 2002-12-04T17:49:06.000Z | 185.0153 | F | Automatic TM processing. |
| 2002-12-06T07:32:54.000Z | 185.0010 | F | After 0018_0001_M.RWB*   |
| 2002-12-07T17:35:29.000Z | 184.9826 | F | Automatic TM processing. |
| 2002-12-09T07:20:21.000Z | 184.9570 | F | Automatic TM processing. |
| 2002-12-10T17:42:32.000Z | 184.9452 | F | Automatic TM processing. |

This report was generated at Wed Dec 11 08:00:08 GMT 2002

Note: fuel-book initial value included 4.24kg pressurant  
which will not be exhausted - thus when the fuel  
book reaches a value of 4.24kg this represents the  
ZERO PROPELLANT value

\* The first RWB of revolution 18 was not performed manually, as this record could lead to believe. The production of the TPF was needed just for Flight Dynamics fuel Book-Keeping purposes, due to the fact that at the time the RWB was executed by the timeline there was no TM flowing into the FDS.

## **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 06/12/2002-12/12/2002**

AOCS operations were executed from the Automatic Timeline. The reporting period started with a staring pointing to Cygnus, and continued from revolution 19 with a raster type observation. Revolutions 19 and 20 can in fact be considered as representative for the routine phase AOCS operation, and in the reporting period 19 Open Loop Slews and 120 Offset Slews were performed. Unfortunately 8 slews that were planned in the timeline could not be executed as scheduled due to different problems.

#### **06/12/2002 (Day of Year 340, Revolution 17-18)**

Nominal AOCS operations executed from the Automatic Timeline.

#### **On Target Flag set to False (jitter at the end of slew)**

At the end of the Open Loop Slew to the perigee passage attitude, the ACC issued the On Event Message:

00:49:12.121 ACC ROLL ERROR OOL

This message is issued when the threshold for the OTF in roll (1 arcminute) is exceeded. This problem already happened for the last slew of revolution 16, and it is due to a combination of problems in the Flight Dynamics System and in the ACC logic. For an explanation see the INTEGRAL Mission Report #11, page 7, report for day 03/12/2002.

In this case the jitter was not seen in the Broadcast Packet.

This problem will disappear once the update of the Sun Steering Law coefficients every 3 hours of static pointing is introduced in the timeline. It is expected that this functionality is in place before the start of the routine phase.

#### **Automatic Update of a TPF failed**

The update of the first Open Loop Slew in the Automatic Timeline was not performed at the due time by the Flight Dynamics System. This was realised by the Spacon, and FD support called in. The reason was that during the Perigee Passage the control system was re-started in order to perform some scheduled software maintenance activities. At a re-start of the control system the FDS does not reconnect automatically, manual intervention is needed. In this case FD had not been informed about the planned activity.

Once on site, FD reconnected the FDS to the control system. This was done still on time to update the Open Loop Slew. The problem had no impact on the operations. Corrective measures have been taken to add FD to the appropriate distribution list.

#### **Automatic Generation of the RMU Drift TPF failed**

After the RMU calibration started from the timeline at 13:43, no TPF was produced by the FDS with the calibration results. This turned out to be a side effect remaining from the problem reported above. FD produced the TPF manually.

**07/12/2002 (Day of Year 341, Revolution 18)**

Nominal AOCS operations executed from the Automatic Timeline.

**08/12/2002 (Day of Year 342, Revolution 18)**

Nominal AOCS operations executed from the Automatic Timeline.

**09/12/2002 (Day of Year 343, Revolution 18-19)**

Nominal AOCS operations executed from the Automatic Timeline.

**On Target Flag set to False (jitter at the end of slew)**

At the end of the Open Loop Slew to the perigee passage attitude, the ACC issued the On Event Message:

00:34:13.779 ACC ROLL ERROR OOL

This message is issued when the threshold for the OTF in roll (1 arcminute) is exceeded. This problem already happened for the last slew of revolutions 16 and 17, and it is due to a combination of problems in the Flight Dynamics System and in the ACC logic. For an explanation see the INTEGRAL Mission Report #11, page 7, report for day 03/12/2002. In this case the jitter was also not seen in the Broadcast Packet. This problem will disappear once the update of the Sun Steering Law coefficients every 3 hours of static pointing is introduced in the timeline. It is expected that this functionality is in place before the start of the routine phase.

**Slew parameters not updated (attitude determination failed)**

The parameters for the Offset Slew ID 00190008 at 13:38 were not updated at the due time, because the corresponding TPF (Task Parameter File), was not generated by the Flight Dynamics System. The reason was a misidentification of one of the stars present in the mapping. Due to this misidentification the calculated attitude was slightly shifted with respect to the real one, and when checking again the stars coordinates against the catalogue with the determined attitude, the mean error exceeded the maximum error criteria that the FDS applies to consider the attitude determination as valid. Flight Dynamics were called and performed a manual determination and update of the offset. The manual attitude determination performed by the recover schedule software uses a reduced number of stars, and in this case the offending star was not used, and consequently did not corrupt the results of the determination. The problem had no impact in the operations.

**Command Verification not performed by the Control System.**

At 20.28 the Command Execution Verification of command A3169 (TC to start an Offset Slew) was considered by the control system with status "Unknown". This status should normally only happen when the TM parameter used for CEV is not updated, i.e. no new packet containing the parameter is received. This was not the case, since the TM properly reflected the start of the offset. This is a known and open SPR on the control system, that makes occasionally some tasks "forget" the update of a particular TM parameter. Once this happens, the solution is to restart the relevant task.

In this particular case, there is no interlock defined in the DB on the CEV of the "start offset" command, i.e. its failure does not block subsequent AOCS commands. This is for timing reasons in the command sequence used (note that the next command is the report of the current offset parameters, and there is an interlock defined with the CEV of this one). Due to this the timeline could continue. Although this command was showing the explained behaviour during the whole night, the successful execution of the slews could be clearly verified via other means, and the Spacon decided to wait for the day personnel to arrive

before taking any action. In the morning the Verifier task of the control system was re-started and the problem was fixed (actually all the telecommand tasks were re-started, for procedural reasons).  
This problem did not impact the operations.

#### **10/12/2002 (Day of Year 344, Revolution 19)**

Nominal AOCS operations executed from the Automatic Timeline.

##### **On Target Flag set to False**

After AOS, the ACC generated the message:

11.43.55.299 ACC YAW ERROR OOL

The star data at the time were:

| Time         | Mag  | CCDY   | CCDZ  |
|--------------|------|--------|-------|
| 11.43.54.603 | 7.55 | -27394 | -6620 |
| 11.43.55.103 | 7.50 | -27426 | -6727 |
| 11.43.55.603 | 7.55 | -27392 | -6618 |

In this case, the change in the STR Z coordinate was of 107 CCD units, or 26". This is above the OTF threshold for yaw (18").

The ACC Pointing Bit (OTF) was set to FALSE for 0.5 seconds. It was not reflected in the Broadcast Packet.

The height in the orbit at the moment of the event was  $\approx 150450$  Km.

#### **11/12/2002 (Day of Year 345, Revolution 19)**

Nominal AOCS operations executed from the Automatic Timeline.

##### **Automatic uplink of Offset Slew failed**

In this revolution there was a foreseen and pre-planned outage of the Goldstone station, that ended at 01:55:14. Unfortunately there was no margin inserted in the timeline between the time when the service was expected to be back and the first commands. Due to the normal time needed to re-acquire the telecommand capability once the station was available again, the uplink of these commands (first one scheduled at 01:55:14) was not possible. The affected commands were the first ones for the sequence to start the offset 00190072, and due to the failure in the uplink the AOCS timeline operations were stopped.

Flight Dynamics on call was activated, and once on site they performed the recover schedule. The first slew performed from the timeline again in a nominal way was the offset 00190075, which started uplink as scheduled at 03:30.

This problem highlighted a Mission Planning problem in the way outages in the middle of a revolution are handled. It is obvious that some LOS/AOS windows have to be inserted before/after the outage to allow a proper way to stop and resume operations.

##### **Uplink of Offset Slew failed (guide star not found)**

At 08:18 the command to perform the change of guide star that is part of the Offset Slew sequence to start the slew 00190084 failed Pre-Transmission Validation. The reason was that the previous STR Search/Track operation did not find the intended star, and for this reason at the moment of the change there was only one star been tracked.

The suspected reason for the failure in finding the star is that there was a nearby neighbour that was not taken into account by the Flight Dynamics System due to its dim magnitude, but was detected by the STR and made the proximity criteria fail. The expected magnitude of the intended guide star was 7.6, and the magnitude of the neighbour was 9.3. The guide star was

classified as a "last choice" one in the Flight Dynamics catalogue, and was only selected since there was nothing better available. It has to be mentioned nevertheless that the same star had been successfully used in three previous pointings of the same revolution (00190018, 00190033 and 00190067).

Flight Dynamics were called and performed the recover schedule activities. The first slew to be executed again nominally from the Automatic Timeline was 00190086.

### **12/12/2002 (Day of Year 346, Revolution 19-20)**

Nominal AOCS operations executed from the Automatic Timeline.

#### **OTF Flickering at the end of a slew**

After the completion of the open loop slew to pointing ID 00200001, the ACC issued the message:

09:01:36.826      ACC ROLL ERROR OOL

This means that the OTF threshold was exceeded for roll. In fact the OTF was set at the end of this slew, but lost again. The reason was that the resume of the SSL introduced a step in the roll demand of 4.64 arcminutes. This error was propagated from the beginning of the slew, and it points to a reproduction of the problem in updating slews after non-inertial pointing periods that was reported for day 18/11/2002 (see Mission Report # 9). This problem was fixed by an update of the Flight Dynamics System, as reported for day 03/12/2002 (see Mission Report #11), and successfully tested. Unfortunately the fix was only of temporary nature, at requires some manual intervention at Flight Dynamics Mission Planning level, which in this occasion was overlooked.

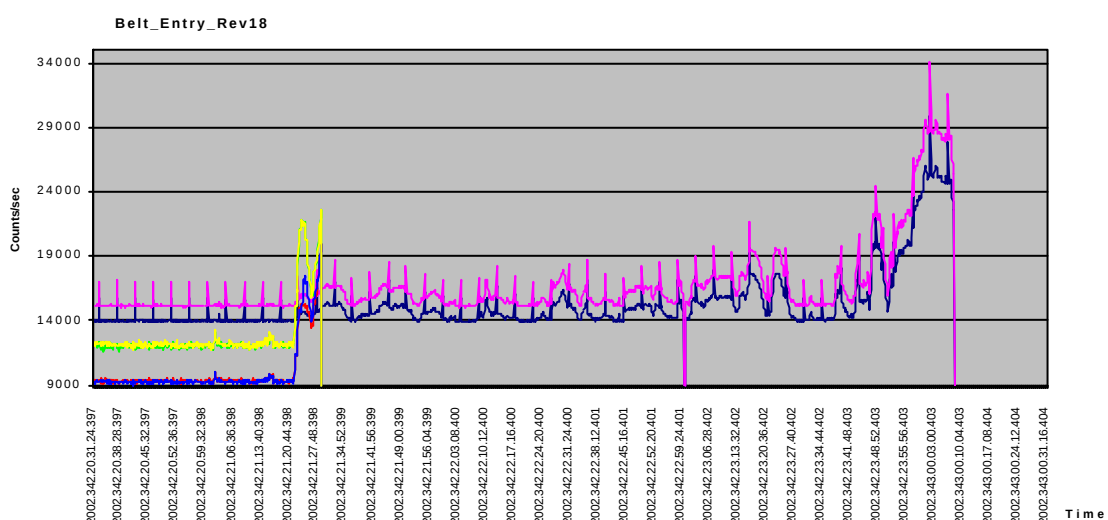
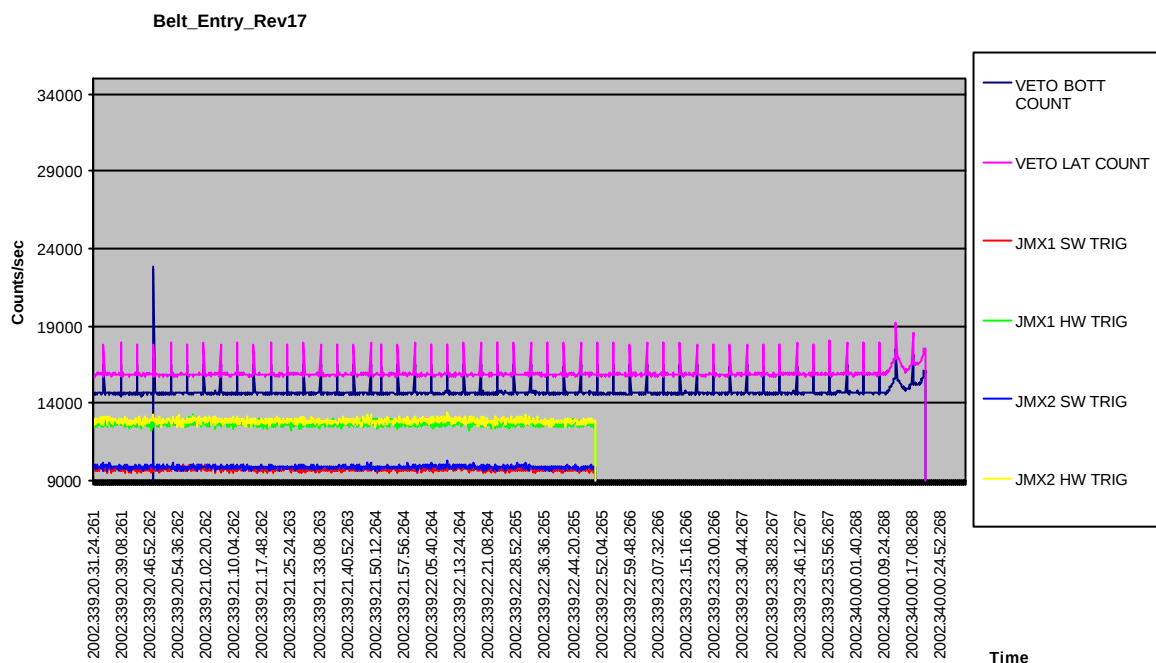
#### **AOCS Operations Interrupted by communication link problem**

At 12:21:20 there was a hit (short drop) in the communication line with Redu. This caused an immediate disconnection of the TM/TC links to the station. At the moment of the disconnection the uplink of the commands for the Offset Slew 00200007 was taking place, and was interrupted before the offset actually started. At 12:24 the command capability was restored, and the recover schedule operations could start. The timeline operations were re-joined at 13:31, and the first pointing performed nominally again was 00200010. Note that during the complete duration of pointing 00200009 the attitude was already the correct one for this pointing, but it was not acquired in the way expected by the timeline. For this reason the timing of the OTF setting with respect to the Broadcast Packet was not as planned and the pointing 00200009 can not be considered nominal.

### **8.3.2 IBIS Operations**

- Status Nominal, PV phase ongoing.
- The problem of high count rate lasting for more than 5 minutes that affects the ISGRI MDUs never occurred during the week; periodically it has been noticed a high count rate for period less than 5 minutes.
- The Configuration of the unit is completely automatic, driven by EDs. Limited manual commanding is requested occasionally.
- The anomalies noticed in the past for VETO VDM # 4 and 12 did not occur again: on going analyses in way to clarify whether the problem could be related to combination of temperature effect and outgassing from the unit.

- The problem reported in the ARTS 2013 occurred again in the last revolutions. As reported in the ARTS the problem is still under investigation at IAAT and University of Warsaw.
- Reported OEM ID 180 Class 2: <<IBIS1 VETO Counter for VETO lateral Exceeds Alert Value>> during Rev #18 at 342.22.30. The analysis performed a posteriori does not evidence a particular problem for the VETO unit. The generation of the OEM looks to be in coincidence with the a possible modification of the Radiation Belt Entry time (induced by Solar Activity on that day) as shown by the plots below for Rev 17 and 18, comparing the Belt Entry as seen by VETO counters:



- Implemented modification of the automatic configuration at Belt Entry: the PDM # 3 and 5 are kept switched ON (with PDM status ENABLED) at the radiation Belt entry in order to guarantee for the PICsIT detectors a more stable thermal environment during the perigee passage.

### **8.3.3 JEM-X Operations**

#### **OVERVIEW**

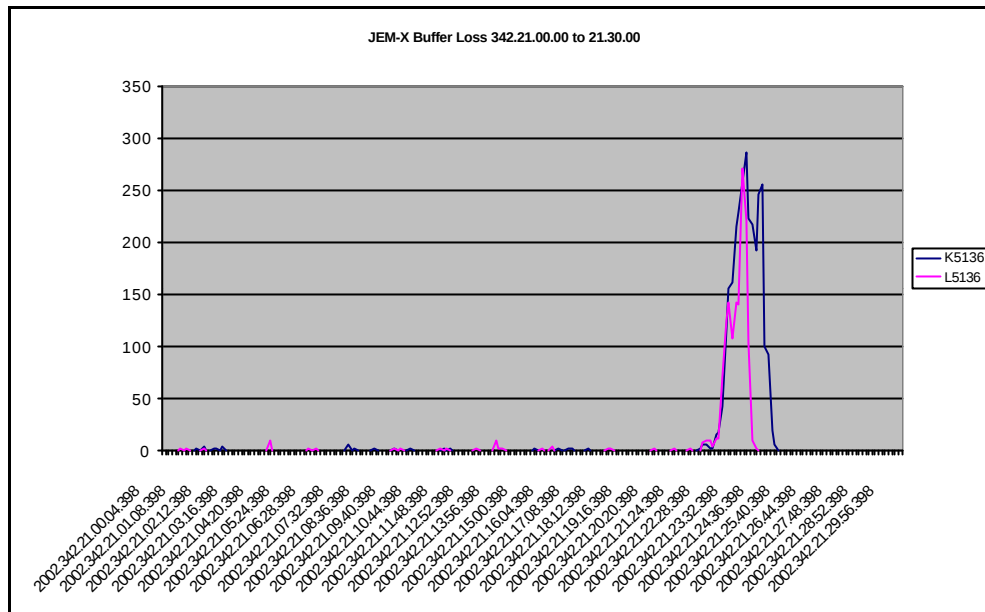
It is decided to operate only one JEM-X unit at a time during the routine operation phase. The concept is to keep the DPE and DFEE of the dormant JEM-X unit ON, but not to activate its high voltages and allocate only one TM window from the PST to it. Starting from revolution 26, JEM-X1 will not be operated any more and JEM-X2 will be active. MOC is working on the implementation of this concept, which will be presented in a technical note.

#### **6-Dec-2002, DOY 340, Revolution 18**

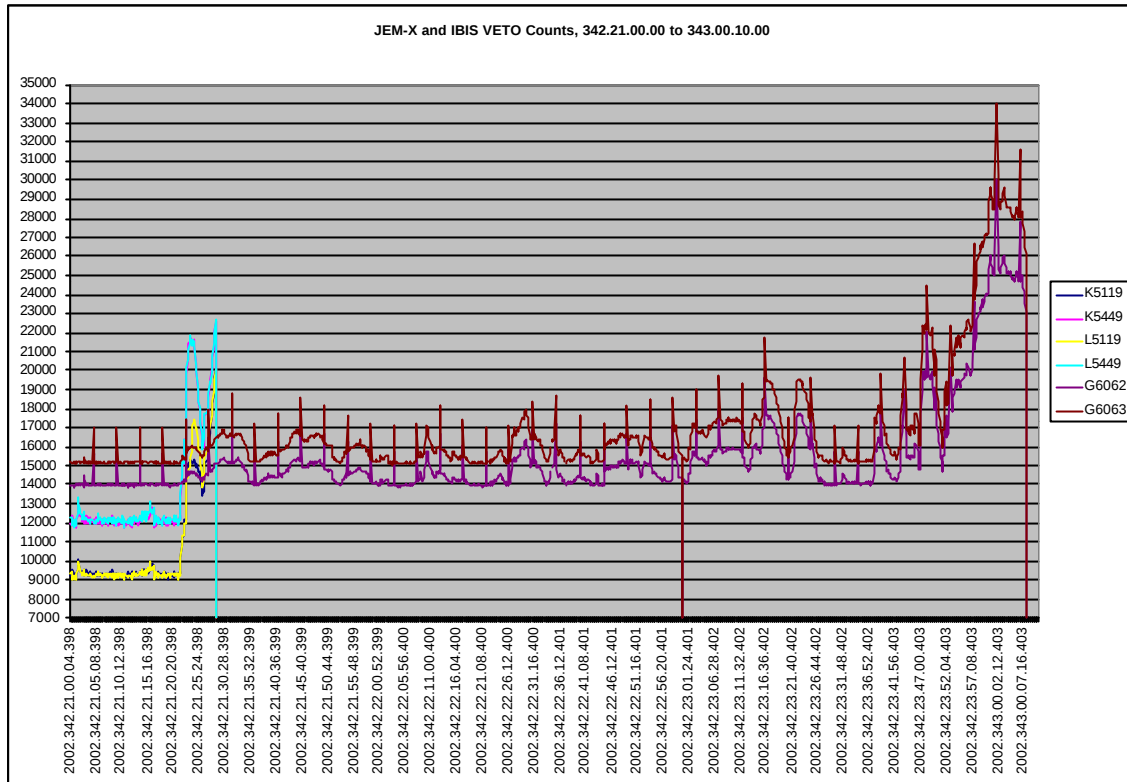
- The new ODB release (IODB 3.1\_0012\_05-12-02), which was propagated during the REV 18 perigee, contained the following JEMX updates:
  - The definition of parameters TM K/L5305 (DFEE parameter update time) was corrected. These parameters contain 6 bytes long absolute time values with 3 bytes coarse time and 3 bytes fine time. The previous DB definition for them was 4 bytes coarse time and 2 bytes fine time.
  - CEV definitions of JEMX HV setting commands (K/LU0004, K/LU0003A and K/LU0004A) were incorrect. The CEV definitions contained different CEV IDs with the same verification stage. The definitions were corrected to a single CEV ID with different CEV parameters for each command. Since this fix was made, the failing of JEM-X2 HV setting commands (failing of Dynamic PTV) that were previously reported, have not occurred. These TCs are sent after radiation belt exit by EDs K/LEHVON01 and K/LEHVAJ01 to set the high voltages.
  - Definition of new PTVs for JEMX HV setting commands (K/LU0004, K/LU0003A and K/LU0004A) to prevent their uplink before the previous HV level is set.
  - Setting of new default value for the TC parameters that set the Low Level Discriminator after radiation belt exit by EDs K/LEACAL01 and K/LEHVON01. AS requested by JEM-X PI, the nominal value of Low Level Discriminator was changed from 10 to 2.
- 13:46:00, Time-tag commands were uplinked to put JEMX1 and JEMX2 in SAFE mode at 90 minutes before Rev 18 BCP radiation belt entry time.

#### **8-Dec-2002, DOY 342, Revolution 18**

- 21.23.00, OOL on parameters K5136 and L5136 (BUFFER LOSS), which indicate the number of events rejected due to lack of buffer space. The high limit for these parameters is 100. These parameters remained OOL for about 2 minutes. The time corresponded to a peak in JEM-X count rates. Variation of these parameters is shown in the following plot.



- 21.28.36, S/W trigger counts on both JEM-X units increased to 20000 counts/8sec, which is the new value of S/W High Voltage switch OFF limit. This caused the switch OFF the HVs and transition of both units to SAFE mode: K/L5022=SAFE and K/L5462=SAFE. This was at an altitude of about 79000 km descending and about 2.5 hours before the 60000 km descend time. JEM-X H/W and S/W counters started increasing at 21.21.00 with the first peak of the count rates at about the same time when the BUFFER LOSS out of limits (mentioned above) occurred. IREM counters did indicate any high count-rates at the time but the IBIS VETO counts increased at the same time. The event looked more like an extension of the radiation belts to higher altitudes. The following graph shows the JEM-X H/W and S/W trigger rates until instruments went to SAFE. IBIS VETO counts are also shown, continuing until instrument Critical Altitude Descend time when VETO went to STANDBY.



- 21.28.36, K/L5584 (EXT HV OFF) = ACTIVE, due to HV switch OFF by internal ratemeter.
- 21.28.44, the IASW DFEE reference state, K/L5462 went to SETUP while the DFEE state remained in SAFE.
- 21.28.49, OEM 189, JEM-X2 PROB DFEE 9 (Unexpected DFEE state) with Expected State = DATA TAKING [10] and Reported State = SAFE [1]
- 21.28.50, OEM 189, JEM-X1 PROB DFEE 9 (Unexpected DFEE state) with Expected State = DATA TAKING [10] and Reported State = SAFE [1]
- 21.28.56, OEM 189, JEM-X2 PROB DFEE 9 (Unexpected DFEE state) with Expected State = SETUP [10] and Reported State = SAFE [1]
- 21.28.57, OEM 189, JEM-X1 PROB DFEE 9 (Unexpected DFEE state) with Expected State = SETUP [10] and Reported State = SAFE [1]
- 21.44.33, to correct the unexpected IASW DFEE state, SAFE commands were sent to both JEM-X units. This changed the IASW DFEE state also to SAFE and the OMEs 254, ERROR OFF were issued. At this time it was decided not reactivate the high voltages because in one hour the already loaded time-tag TCs would have switched the HVs off. The full HV activation takes about the same time.

JEM-X PI was informed of the HV switch OFF and also of the unexpected change in the IASW DFEE reference mode from SAFE to SETUP.

- 22:37:00, K0008 SAFE TT TC executed but JEMX1 was already in SAFE mode
- 22:37:10, L0008 SAFE TT TC executed but JEMX2 was already in SAFE mode

#### **9-Dec-2002, DOY 343, Revolution 19**

- 17:44:00, Time-tag commands were uplinked to put JEMX1 and JEMX2 in SAFE mode at 90 minutes before Rev 19 BCP radiation belt entry time.

#### **11-Dec-2002, DOY 345, Revolution 19**

Change request received from JEM-X PI to reduce the nominal HV setting of JEM-X1 by 20 volts. This decision was made after 3 more degraded anodes were seen on JEM-X1. The change was made to the default values of the affected TC parameters in the DB.

- 22:27:00, JEMX1 to SAFE by time-tag TC
- 22:27:10, JEMX2 to SAFE by time-tag TC

#### **12-Dec-2002, DOY 346, Revolution 20**

- The new ODB update (IODB 3.1\_0013\_05-12-02), which was propagated during the perigee of REV 20, contained the new settings for JEM-X1 HV activation commands. At the beginning of revolution 20, JEM-X1 was activated with the new anode HV setting of 80 decimal (~800 V), which is 20 volts lower than the previous setting.

### **8.3.4 OMC Operations**

#### **OVERVIEW**

During the reporting period OMC operations were interrupted 3 times. Once because the PTV NO-GO condition did not clear, the second time because AOCS commands failed release and two slews were missed and the third time was due to loss of TC link, which also resulted in missing of slews.

A test of OMC remote commanding through IBAS was performed on 10 December 2002.

#### **DETAILS**

#### **10-Dec-2002, DOY 344, Revolution 19**

- 08:38:32, OMC IMAG\_Bx commands for pointing 44 failed release because the PTV on the commands had remained in NO-GO although OMC was in the correct mode, i.e. STANDBY. For this reason OMC image acquisition did not start in pointing 44. To prevent the failing of the imaging commands for the following pointings the timeline was stopped, the Autostack task was restarted and the timeline was reloaded. A S/W patch has been made to correct this PTV problem. Software support is currently validating this patch.

#### **Test of OMC remote commanding**

On 10 December 2002 (DOY 344) four OMC TRIGGER remote commands were sent to MOC by ISDC. The reception time of the TPFs at MOC were:

- CMD Nr1: 10.03.26
- CMD Nr2: 10.45.00

- CMD Nr3: 14.19.45
- CMD Nr4: 14.59.00

Commands Nr1 and Nr2 failed loading into the system due to a software problem at MOC, which was detected and fixed by the software support team before the reception of command Nr3. The S/W fix is now on the system and will be included in the next official release of the IMCS S/W.

Command Nr3 was received and successfully loaded into the command system and was dispatched. This command was accepted on-board and the OMC mode changed from NORMAL to TRIGGER. The timing of events from reception of the TPF at MOC to the completion of the first TRIGGER shot is presented here.

For CMD Nr3:

|                       |                                                                                                                  |
|-----------------------|------------------------------------------------------------------------------------------------------------------|
| 2002.344.14.19.45.500 | Reception of TPF at MOC                                                                                          |
| 2002.344.14.19.47.217 | TPF IBAS_ALERT_00005.TPF loaded                                                                                  |
| 2002.344.14.19.47.269 | TC M1329 (MIMAG_BX) armed                                                                                        |
| 2002.344.14.19.47.287 | TC M1329 dispatched                                                                                              |
| 2002.344.14.19.54.623 | Reception of OEM 150 "MODE TRANSITION" (from NORMAL to TRIGGER). On-Board Generation time: 2002.344.14.19.48.890 |
| 2002.344.14.20.02.119 | Reception of OEM 235 "TRIGGER" with X-tar=96 and Y-tar=171. On-Board Generation time: 2002.344.14.19.54.265      |

Reception of OEM 169 "SHOT COMPLETE". On-Board Generation time: 2002.344.14.20.59.515

At the request of MOC, ISDC triggered a fourth remote command during a slew when OMC was in STANDBY mode. This request was made because originally it was planned to send command Nr2 during a slew to verify the on-board rejection of TRIGGER commands during slews. However, as was mentioned, this command had failed loading into the system. As expected, the fourth command was rejected on-board without having any side effects on the operations of OMC. TRIGGER commands are accepted on-board only when OMC is Science NORMAL or FAST-MONITORING modes. During slews, when OMC should be in STANDBY mode, these commands are rejected on-board.

#### **11-Dec-2002, DOY 345, Revolution 19**

- 08.18.00, Due to failure of release of an AOCS command the timeline was stopped and the OMC imaging commands for pointing 84 were not uplinked. Since slew 84 was missed, OMC remained in NORMAL mode with the imaging parameters from pointing 83.
- 08.52.00, Timeline was restarted but with the AOCS sub-system commanding disabled. OMC was still in NORMAL mode because of the missed slews and the imaging commands for pointing 85 failed release. The schedule was fully recovered for pointing 86 and OMC started normal operations from this pointing.

#### **12-Dec-2002, DOY 346, Revolution 20**

- 12.22.17, Due to loss of TC link at 12.21.00, OMC imaging commands for pointing 7 failed uplink. This also resulted in losing slew 7. AOCS commanding was disabled to recover the schedule to the pointing of slew 9.
- 12.53.59, after re-establishment of the TC link, OMC imaging commands for pointing 8 failed PTV because slews 7 and 8 were missed and OMC had remained in NORMAL science mode (see above). Commands for pointing 9 were uplinked after the recovery of the schedule and OMC resumed normal operations.

#### **NOTE:**

To prevent the failing of OMC commands when the slews are missed or the schedule is being recovered, the SPACONS will be instructed to disable commanding to OMC subsystem on the

automatic timeline during the schedule recovery operations. OMC commanding should be resumed only when the schedule is fully recovered.

## 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 (Status: 04.12.02). 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. The ARs have just not yet been formally closed.

| 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 - 002049 | 07/11/2002      | Beginning of a gradual erosion of the anodes on the microstrip plates           | Space   | JEM-X      | 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 performance 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 - 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 occurrences of 3 status parameters OOL                                | Space  | SPI        | Pending |
| INT - 002099 | 20/11/2002 | SPI1 periodic task overrun                                                        | 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 |

Doc. Title : INTEGRAL Mission Report # 12  
Doc. Ref. : INT-MOC-SYS-RP-1001-TOS-OF  
Date : 13/12/02

Issue : 1  
Rev. : 0  
Page : 19

|              |            |                            |        |      |         |
|--------------|------------|----------------------------|--------|------|---------|
| INT - 002140 | 02/12/2002 | Commanding System          | Ground | IMCS | 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 |