

INTEGRAL
Mission Report
INT-MOC-SYS-RP-1001-TOS-OF
No. 024
Week 10
07.03.03
Routine Phase

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LIST OF CONTENTS

1	General.....	3
2	Summary of Activities.....	3
3	Satellite Status.....	3
3.1	Platform.....	3
3.1.1	AOCS.....	3
3.1.2	Power.....	3
3.1.3	Thermal.....	4
3.1.4	OBDH.....	4
3.1.5	RF.....	4
3.2	Payload.....	4
3.2.1	SPI.....	4
3.2.2	IBIS.....	4
3.2.3	JEM-X.....	4
3.2.4	OMC.....	5
3.2.5	IREM.....	5
4	Ground Facilities.....	5
4.1	Mission Operations Centre.....	5
4.2	Ground Stations & Network.....	6
4.3	Science Ground Segment.....	6
4.3.1	ISOC.....	6
4.3.2	ISDC.....	6
5	Special Events.....	6
6	Anomalies.....	6
7	Future Milestones.....	7
8	Appendix.....	8
8.1	Overview of Revolutions.....	8
8.2	Consumables.....	8
8.2.1	Detailed Fuel Book-keeping.....	8
8.3	Detailed Satellite Information.....	8
8.3.1	AOCS SUMMARY OPERATIONS REPORT 28/02/2003-06/03/2003.....	9
8.3.2	SPI Operations.....	10
8.3.3	IBIS Operations.....	11
8.3.4	JEM-X Operations.....	12
8.3.5	OMC Operations.....	12
8.3.6	IREM Operations.....	12
8.4	List of Anomalies since Launch.....	13

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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 01.03.03 until 07.03.03 (both dates inclusive) and covers the revolutions 46 & 47.

2 Summary of Activities

The operations were performed according to the planning inputs from ISOC.

The initial target for revolution 46 was XTE J1720-318 (RA 17:19:58.99; DEC -31:45:01.2), The rest of the revolutions 46 and 47 were devoted to a Galactic Plane Survey and a Galactic Centre Deep Exposure.

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. There was one loss of the Guide Star that is currently not fully explained.

3.1.1 AOCS

The two main events from the AOCS point of view during this week were an unexplained loss of the guide star, and a relative change in the RMU drift for the yaw axis. The drift has been closely monitored after that, and no further jump has been observed.

The fuel consumption over the last 7 days was 0.275 Kg. The remaining propellant is in the order of 178.7 Kg on the 04th of March.

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 at a Solar Aspect Angle of 0 deg is in the order of 2340 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. In order to avoid the occasional OEMs generated by the SECL task when the OMC Lens Temperature falls below 10° C the limit in the Heater table has been lowered from – 10° C to – 11° C.

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

3.2.1 SPI

The status is nominal.

The instrument is operating in photon by photon mode at 85K. The TM bandwidth assigned to SPI was 59 pkts until rev.47 with Spectra telemetry enabled; since rev.48 the allocation has been increased to 69pkts with Spectra TM disabled.

The problem of unused TM slots got worse with the current PST of 69pkts: the unused TM slots is 3.

The Cryocooler is working nominally.

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

3.2.2 IBIS

The status is nominal. The On Event Messages that were generated by IBIS were understood and no special operations were required.

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

3.2.3 JEM-X

Since the end of revolution 45, only JEM-X2 has been active and performing science operations while JEM-X1 has been dormant with the HVs off. This will be the nominal JEM-X operational configuration until further decision is made by ISOC.

Near the end of the revolutions 46 and 47 and before the execution of ED LESAFE01 in the timeline, JEM-X2 went to SAFE mode, triggered by its onboard protection when the SW trigger count rate reached the HV switch-off threshold. In both cases it was decided to leave

the unit in SAFE mode for the remaining part of the revolution. The switch-off was at altitudes of 84.000 Km and 82.500 Km.

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 a few times due to different ground segment related problems, which resulted in missing of slews. Each time OMC timeline driven operations resumed after recovery of the schedule.

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

3.2.5 IREM

The status of the unit is nominal.

4 Ground Facilities

The overall performance of the ground segment was good, well above the required 95 %. This concerns the number of executed pointings with respect to the planned pointings and the provision of real-time data to ISDC.

The real-time data return from the stations was in revolution 47 as shown in the following table.

Date	Virtual Channel	Station	Total Effective Coverage
03.03	0	Redu	99.98 %
03.03	7	Redu	99.98 %
04.03	0	Redu	99.97 %
04.03	7	Redu	99.83 %
04.03	0	Goldstone	99.85 %
04.03	7	Goldstone	99.65 %
05.03	0	Redu	100.00 %
05.03	7	Redu	100.00 %
05.03	0	Goldstone	97.87 %
05.03	7	Goldstone	97.91 %

The amount of actual available science data is higher because missing data are replayed from the ground station as far as available at the ground station.

About 4 % of the planned slews could not be executed for various reasons.

4.1 Mission Operations Centre

The performance of the MOC was good in the reporting period. There were only a few problems at the MOC. Most of them did not impact the execution of the Timeline.

The situation concerning the Telemetry Data Retrieval System (TDRS) that was mentioned in the previous has slightly improved and further upgrades of the system are in preparation.

Further details concerning the anomalies are provided in chapter 6.

4.2 Ground Stations & Network

The performance of the operational network was in general good though there were a few problems related to the ground stations at Redu and at Goldstone.

There were a couple of cases when the TM & TC links were impacted, which caused the loss of several pointings.

Further details concerning the anomalies are provided in chapter 6.

4.3 Science Ground Segment

4.3.1 ISOC

No ISOC Input has been provided

A few replanning activities were performed and some of the planning inputs have been revised but the planning process is working generally smooth.

4.3.2 ISDC

No ISDC Input has been provided

The distribution of the real-time and auxiliary data to ISDC is in general working smooth. There were a few cases when the auxiliary data files did not provide the expected information. These cases were analysed and as far as possible / required new files were provided.

5 Special Events

No special events this week.

6 Anomalies

The main problem is still the frequent data gaps when receiving data from Goldstone. One modification of the set-up that might cure one of the causes of the problems has been identified and will be tested in week 11.

Another problem related to the ground stations was identified during the hand-over from Goldstone to Redu on 01 March. It seems that this was caused by the antenna at Redu, which is used to support ARTEMIS. The position of this antenna has been moved and might now impact the link to INTEGRAL at certain constellations. A new antenna profile might have to be defined.

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

7 Future Milestones

The power supply will not be available at ESOC on 18th March for several hours. A complete switch-off of the control system is required and the operations from MOC have to be interrupted for about 10 hours. In order to ensure the safety of the satellite it is envisaged to man the Local Command & Telemetry Facility (LCTF) at Redu during this period. INTEGRAL will perform a staring observation during this time. The scientific data will be recorded at the station and later replayed into the data archive at ESOC.

It is planned to test a modified communication set-up at Goldstone in week 11 that should cure the problem of the frequent small data gaps.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Revolution 46

Revolution 46 began with a raster dithering observation centered on XTE J1720-318 (RA 17:19:58.99; DEC -31:45:01.2) lasting approximately 50 hours. This was followed by 10 pointings of a GPS (~8 hrs) and then by 2 pointings of a GCDE observation (~90mins). The TM allocation throughout all observations was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC.

SPI, IBIS and OMC were in their nominal science modes for all observations (IBIS configuration was adjusted manually to the optimum configuration for its TM allocation during the first observation). JEM-X1 was in SAFE mode for the entire revolution and JEM-X2 was in Data Taking for the raster and GPS observations (it was scheduled to be put in SAFE by the Timeline after the GPS although it actually went to SAFE autonomously ~2 hours earlier).

Revolution 47

Revolution 47 consisted of a GPS lasting approximately 12 hours (17 pointings) followed by a GCDE lasting ~ 48 hours.

The TM allocation throughout all observations was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC.

All instruments were in their nominal science modes for all observations, except for JEM-X1 which remained in SAFE mode for the entire revolution. JEM-X2 transitioned to SAFE mode autonomously at 2003-03-05T14:39:44Z, about 2 hours earlier than scheduled in the Timeline.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

2003-02-25T01:52:12.000Z	179.0027	F	Automatic TM processing.
2003-02-26T12:24:31.000Z	178.9802	F	Automatic TM processing.
2003-02-27T16:50:10.000Z	178.9493	F	Automatic TM processing.
2003-02-28T01:40:03.000Z	178.9170	F	Automatic TM processing.
2003-03-01T12:10:54.000Z	178.8773	F	Automatic TM processing.
2003-03-02T15:38:33.000Z	178.8477	F	Automatic TM processing.
2003-03-03T01:26:58.000Z	178.7963	F	Automatic TM processing.
2003-03-03T10:27:39.000Z	178.7834	F	Automatic TM processing.
2003-03-03T15:37:39.000Z	178.7378	F	Automatic TM processing.
2003-03-04T11:37:50.000Z	178.7277	F	Automatic TM processing.

This report was generated at Wed Mar 5 08:00:07 GMT 2003

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 28/02/2003-06/03/2003

AOCS operations were executed from the Automatic Timeline.

During this period, 83 Open Loop Slews, 157 Closed Loop Slews and 8 Momentum Bias were executed. 9 slews were missed due to non-AOCS problems, this is around 4% of the total.

28/02/03 (Day of Year 059, Revolution 46)

Jump on the RMU drift: The daily RMU drift calibration shown a particularly big change in the value for the yaw channel. The values changed from:

Day	Roll	Pitch	Yaw
27/02/03	-101.52	58.32	-78.48
28/02/03	-114.48	73.44	-116.64

This change can not be described as anomalous when compared with the expected behaviour of the unit, but it is much bigger than the usual day to day change. The drift evolution since then has been normal.

01/03/03 (Day of Year 060, Revolution 46)

Slews lost due to ground problem (NCTRS-IMCS communication): After the station H/O from Goldstone to Redu, it was not possible to get the TM flowing into the control system. It is unclear where the actual problem was. The problem was cured after a control system reboot. The impact was the lost of slews 00460065 to 00460070.

02/03/03 (Day of Year 061, Revolution 46)

Nothing to report.

03/03/03 (Day of Year 062, Revolution 47)

Nothing to report.

04/03/03 (Day of Year 063, Revolution 47)

Nothing to report.

05/03/03 (Day of Year 064, Revolution 47)

Guide Star Loss: During pointing 00470089 the guide star was suddenly lost from one cycle to the next. No reason has been found.

The details are:

```
2003.064.04.27.26.938 VALID FULL VALID MAG 8.20 6759 -2049
2003.064.04.27.27.438 FREE INVALID MAG 8.60 -1 -1
```

There was no mapping in progress, and no Bright Object in the FoV. The altitude was 128000 Km. There was no other star being tracked by the STR. Since the problem happened shortly before the start of a slew, and there was no time to assess the situation, the AOCS subsystem was disabled from the timeline. The impact of this problem was that slews 00470090, 00470091 and 00470092 were lost.

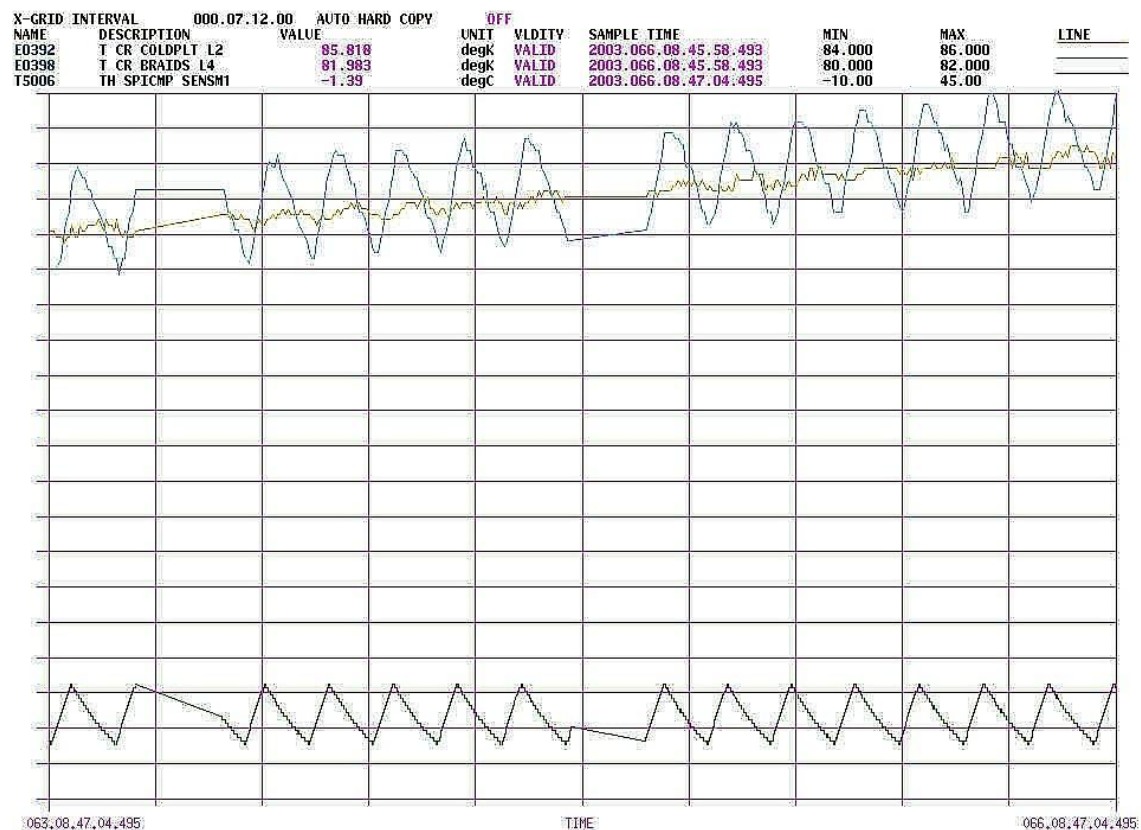
06/03/03 (Day of Year 065, Revolution 48)

Reaction wheel bias performed manually due to a control system problem: During the perigee passage the control system was restarted in order to perform some archive maintenance activities. For some reason that is being investigated, the command verification was not working properly after AOS. Due to this the RWB uplink from the timeline did not work, and it had to be done manually once the problem was cured. The problem had no impact.

8.3.2 SPI Operations

During the reporting period the following main events occurred:

- At the end of the rev.48 the instrument configuration has been manually changed in order to tune the science TM pkts generation for the PST of 69pkts (see CR PI-OPS-237). Until that moment the configuration has remained unchanged since the Crab observations, with the PST of 100 pkts.
 After the PST change, it has been noted that now the DPE "looses" 3 TM pkts, i.e. the unused TM allocation is of 3 pkts (with 59pkts it was 1 pkt). Special tests are being devised to understand what is the PST lay-out causing this increment.
- The Cryocooler stroke setting have remained constant to 4x38raw. The cold plate temperature drift phenomena has re-started after active cooling stabilisation, confirming that outgassing of on-board materials still continues and affects the cooling performances, requiring constant monitoring and stroke tuning when necessary. The drift of the cold plate temperature is about 0.07K/day. See attached plot.



- New limits and cold plate temperature control procedure have been recently agreed with CNES/CSE in order to reduce to the minimum necessary ground intervention for stroke tuning (a CR is in preparation). Procedures FCP_SPI1/2_0075/0076 START ACTIVE COOLING for 85K OPS will be updated soon.
- ED EEORTM01 and EECLEX02 has been updated to increase the instances of report commands scheduled in the EPOS when SPI performs an automatic mode transition (e.g. rad belt entry/exit). This is to avoid long periods of alarms being displayed on the IMCS, in case the timing of the ED scheduling does not exactly coincide with the automatic transition. CR is in preparation, new EDs will be available for next database export.
- It was requested to increase the PST allocation inside the belts from 36 to 100pkts. The advantage is that at the exit of the belts, when SPI makes automatically the transition to science modes, it can exploit a period of about 25min with this allocation. In fact in this period no other instrument is performing science, since the science window is not yet open. The change will take effect from rev53 onward.

8.3.3 IBIS Operations

Status Nominal, on-going routine phase.

Reported (many) during Belt passage the OEM ID 167 Class 2 <<IBIS1 PICsIT NOISY SEMIMODULE>> due also to the fact that the PICsIT detectors are ON without the VETO anticoincidence system, as it was required by Pls.

Reported on DOY 2003. 59.05.16Z

the OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>> due to a later exit from the Radiation belt. The relevant TM_para G6062 reported values inside limits after few TM cycles and therefore the problem has been disregarded, as suggested by the nominal reaction to this OEM.

Reported on DOY 2003. 59.07.02Z and DOY 2003. 59.09.56Z

the OEM ID 180 Class 2 <<IBIS1 VETO COUNTER LATERAL EXCEEDS ALERT VALUE>>. The relevant TM_para G6063 reported a value inside limits and therefore the problem has been disregarded, as suggested by the nominal reaction to this OEM.

Reported on DOY 2003. 59.11.15Z

the OEM ID 183 Class 2 <<IBIS1 VETO +5V VECU VOLTAGE OUT OF RANGE>>. The relevant TM_para G6106 reported a value inside limits and therefore the problem has been disregarded, as suggested by the nominal reaction to this OEM.

Reported on DOY 2003. 60.19.27Z

the OEM ID 179 Class 2 <<IBIS1 VETO COUNTER BOTTOM EXCEEDS ALERT VALUE>> due to a later exit from the Radiation belt. The relevant TM_para G6062 reported values inside limits after few TM cycles and therefore the problem has been disregarded, as suggested by the nominal reaction to this OEM.

The last configuration of the unit foresees to have the TM allocation to 122 pkt/sec and the ISGRI Rise time threshold to 8000 ns, as requested by the IASW patch in order to work correctly.

8.3.4 JEM-X Operations

02-Mar-2003, DOY 061, Revolution 46

- 14:37:00, JEM-X2 went to SAFE mode by its on-board protection when the S/W trigger rates reached the threshold of 20000 cnts/8sec. This happened at a descending altitude of ~84000 km and about 2 hours before the execution of JEM-X2 SAFE TC, planned in the timeline (ED LESAFE01). JEM-X2 remained in SAFE mode for the remaining part of revolution 46.

05-Mar-2003, DOY 064, Revolution 47

- 14:39:44, JEM-X2 went to SAFE mode by its on-board protection when the S/W trigger rates reached the threshold of 20000 cnts/8sec. This happened at a descending altitude of ~82500 km and about 2 hours before the execution of JEM-X2 SAFE TC, planned in the timeline (ED LESAFE01). JEM-X2 remained in SAFE mode for the remaining part of revolution 46.

8.3.5 OMC Operations

01-Mar-2003, DOY 060, Revolution 46

- 20:37:00, Problems with the IMCS/NCTRS and the reboot of the IMCS-A machine interrupted the nominal operations and slews 00460065 to 00460070 were missed. Nominal OMC operations resumed from pointing 00460071.

8.3.6 IREM Operations

The status of the unit is nominal.

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 - 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 - 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 - 002199	2003/01/17	Incorrect handling of CLCW wraparound in CLTU mode	Ground	ESA Sta.	Pending
INT - 002197	2003/01/20	Lost Tele-commanding via REDU	Ground	IMCS	Pending
INT - 002200	2003/01/20	TM/TC Link lost via REDU	Ground	ESA Sta.	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 - 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
INT - 002215	2003/01/30	Occasional TM drops on DSS-16	Ground	NASA Sta.	Pending
INT - 002216	2003/01/31	TPF generation failed	Ground	FDS	Pending
INT - 002217	2003/02/06	TC link drop	Ground	NASA Sta.	Pending
INT - 002218	2003/02/08	Loss of lock at DSS-16	Ground	NASA Sta.	Pending
INT - 002219	2003/02/10	IBIS: PICsIT PDMs counters SET to 0 (twice) during nominal operation	Space	IBIS	Pending
INT - 002220	2003/02/10	Wrong Scrolling Display definitions on IMCS following Import	Ground	IMCS	Pending
INT - 002221	2003/02/10	IBIS: SCI sub-mode table loaded only if forcing the sub-mode	Space	IBIS	Pending
INT - 002224	2003/02/12	Uplink problems via DSS-16	Ground	NASA Sta.	Pending
INT - 002225	2003/02/13	Drop in TM via REDU	Ground	ESA Sta.	Pending
INT - 002226	2003/02/13	Drop in telemetry from REDU	Ground	ESA Sta.	Pending
INT - 002227	2003/02/16	IDDA/IDDB crash	Ground	IMCS	Pending
INT - 002229	2003/02/18	Autostack hangs when loading timeline	Ground	IMCS	Pending
INT - 002230	2003/02/19	TC link outage via REDU	Ground	ESA Sta.	Pending
INT - 002231	2003/02/19	HFA task crashed	Ground	IMCS	Pending
INT - 002228	2003/02/21	STR 1750 Processor Fault in the presence of Saturn in the FoV	Space	Spacecraft	Pending
INT - 002232	2003/02/23	TC outage via REDU	Ground	ESA Sta.	Pending
INT - 002233	2003/02/24	Time Calibration not Coherent among Ground Stations	Ground		Pending
INT - 002234	2003/02/24	S2K unable to access READ ONLY disk in IDDA.	Ground	IMCS	Pending
INT - 002237	2003/02/24	Telemetry loss from DSS-24	Ground	NASA Sta.	Pending
INT - 002235	2003/02/25	Too narrow window for RMU cal in PSF of rev 49	Ground	I/F to SGS	Pending
INT - 002238	2003/02/25	Time Correlator at REDU	Ground	ESA Sta.	Pending
INT - 002239	2003/02/26	Attitude Determination Failed	Ground	FDS	Pending
INT - 002236	2003/02/27	Wrong ERT in the TM frames	Ground	ESA Sta.	Pending