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

INTEGRAL
Mission Report

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

No. 018
Week 04

27.01.03

Routine Phase

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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 18.01.03 until 24.01.03 (both dates inclusive) and covers the revolutions 32 & 33.

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 3C 273, SN1006 and SN 1987A, The observations included two raster dither patterns, and one Hexagonal dither pattern.

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.

3.1.1 AOCS

It was a very smooth week for the AOCS. The overall performance of the subsystem was good. The AOCS operations were almost not affected by ground segment problems, and only 1 slew was “lost”.

The fuel consumption over the last 10 days was 0.25 Kg. The remaining propellant is in the order of 179.54 Kg on the 21st 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 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

3.2.1 SPI

Nominal operations performed according to the automatic timeline.

The Cryocooler performance is nominal: The positive drift of GeD temperature is still present (0.03K/day).

SPI eclipse passage operations were performed manually according to Operational request (OR) nr. 14.

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

3.2.2 IBIS

Status Nominal, on going the routine phase.

There have been minor problems with OEM's 131 and 133, these have been put down to a communications problem.

A ground station response time-out caused a sequence failure, which was recovered manually.

A VETO OEM indicating Voltage out-of-range has shown not to affect instrument safety.

Finally CR 215 was implemented setting ISGRI VETO zoning to ALL.

3.2.3 JEM-X

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

In revolution 32, about 15 minutes before the BCP radiation belt start time JEM-X2 went to SAFE mode by its onboard automatic protection due to high software trigger rates.

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

3.2.4 OMC

During this period OMC operations were performed nominally except for one instance when a slew was missed.

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

3.2.5 IREM

The status of the unit is nominal.

No problems have been observed.

4 Ground Facilities

The overall performance of the ground segment was good. The performance of the Operational Ground Segment was well above the required 95 %. Only a few problems impacted the mission, see the chapters 6 and 8.

4.1 Mission Operations Centre

The performance of the MOC was good. The production of the CD ROMs was properly working and the backlog that was caused by some problems with the data consolidation has been mostly recovered.

4.2 Ground Stations & Network

The performance of the operational network was in general good.

4.3 Science Ground Segment

4.3.1 ISOC

No ISOC Input has been provided

4.3.2 ISDC

No ISDC Input has been provided

5 Special Events

Eclipses

20/01/2003 (DOY 020)

Eclipse passage:
Eclipse #8 of the current eclipse season.
Total Eclipse Duration: 51m 44s
Umbra Duration: 49m 09s
ECD measured DOD Battery 1 20.17% (4.84Ah)
ECD measured DOD Battery 2 19.96% (4.79Ah)
(Note DOD calculation assumes nominal battery capacity rating of 24Ah)
Recharge time battery 1 2h 53m
Recharge time battery 2 2h 51m
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.

23/01/2003 (DOY 023)

Eclipse passage:
Eclipse #9 of the current eclipse season.
Total Eclipse Duration: 44m 41s
Umbra Duration: 41m 32s
ECD measured DOD Battery 1 16.88% (4.05Ah)
ECD measured DOD Battery 2 16.71% (4.01Ah)
(Note DOD calculation assumes nominal battery capacity rating of 24Ah)
Recharge time battery 1 2h 24m
Recharge time battery 2 2h 22m
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

There were only a few problems this week that impacted the operations.

One slew was missed due to a problems at the Redu ground station and the automatic update of the slew parameters failed a few times due to problems with the processing of the Task Parameter Files (TPF) provided by the Flight Dynamics System but without impacting the execution of the Timeline.

There were only a few problems concerning the instruments, which did not impact the execution of the mission.

The new anomalies reported this week were:

INT - 002199	2003/01/17	Lost Tele-commanding via REDU.	Ground	ESA stat.	Pending
INT - 002197	2003/01/20	Incorrect handling of CLCW wrap-around in CLTU mode	Ground	IMCS	Pending
INT - 002200	2003/01/20	TM/TC Link lost via REDU	Ground	ESA stat.	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 Stat	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 Stat	Open

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

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.

8 Appendix

The appendix includes various detailed information.

8.1 Overview of Revolutions

Summary of Activities Scheduled via Automatic Timeline for Revolutions 32-33.

Revolution 32 began with a raster dither pattern around the source 3C 273 (RA 12:29:06.7; DEC +02:03:07.2). This lasted for approximately 33hours. Following this, a raster dither pattern was performed around SN 1006 (RA 15:02:54.96; DEC -41:57:00.0). The TM allocation was 59 SPI, 122 IBIS, 1 JEM-X1, 8 JEM-X2, 5 OMC throughout the science observations and all instruments except for JEM-X1 were in their nominal science modes.

Revolution 33 consisted of a hexagonal dithering observation centred on SN 1987A (RA 05:35:28.32; DEC -69:16:12.0). This dither pattern was repeated throughout this revolution and is to be continued throughout revolutions 34 and 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.

8.2 Consumables

8.2.1 Detailed Fuel Book-keeping

```
2003-01-11T12:34:13.000Z     179.7900    F   Automatic TM processing.
2003-01-12T15:13:36.000Z     179.7768    F   Automatic TM processing.
2003-01-14T05:56:59.000Z     179.7513    F   Automatic TM processing.
2003-01-15T15:28:47.000Z     179.6845    F   Automatic TM processing.
```

```
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.

This report was generated at  Wed Jan 22 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 17/12/2002-23/12/2002

AOCS operations were executed from the Automatic Timeline.
During this period, 44 Open Loop Slews, 174 Closed Loop Slews and 7 Momentum Bias were executed. 1 slew was missed due to non-AOCS problems. This is about 0.5% of losses with respect to the total number of scheduled pointings.
The OTF as reported by the AOCS has flickered in 13 occasions. 9 of them were due to roll error at the end of the slew, and the other 4 to undetected false events in the STR CCD.

17/01/2003 (Day of Year 017, Revolution 32)

Slew missed due to Ground Station problem (Redu): At 07:28 the Redu station stopped given TC responses to the control system (Reception, Radiation and AD verification). This made the timeline commanding to stop. As a result the slew 00320002 was not performed, and a recover schedule operation was needed. The next slew was nominally performed.

Update of slew parameters failed validation (IMCS problem): The TPF to update the parameters of slews 00330026 and 00330027 failed validation by the control system. The reason was found to be a bug in the Autostack. The bug is that TPF files are not closed after using them. When the Autostack runs for a long time without being restarted, the Sun UNIX limits in the number of opened files is reached, and new TPF files can not be open. The problem will be fixed with the next IMCS delivery.
Since the not updated slews were in a sequence of Close Loop Slews, the problem had no impact.

18/01/2003 (Day of Year 018, Revolution 32)

Nothing to report.

19/01/2003 (Day of Year 019, Revolution 32)
Nothing to report.

20/01/2003 (Day of Year 020, Revolution 33)

Nothing to report.

21/01/2003 (Day of Year 021, Revolution 33)

Slew parameters not updated (TM loss): Due to TM drops during the mapping execution, the FDS could not determine the attitude and generate the update TPF for slew 00330061. The mapping was repeated manually, and the slew parameters updated with the Recover Schedule tool.

22/01/2003 (Day of Year 022, Revolution 33)

Nothing to report.

23/01/2003 (Day of Year 023, Revolution 34)

Slew parameters not updated (misidentified star): The update of the slew 00340026 failed due the FDS not being able to reconstruct the attitude. The attitude determination was repeated manually using the Recover Schedule tool (different tolerances), and the slew updated. The problem had no impact.

8.3.2 SPI Operations

SPI was operated nominally by POS in Photon/Photon mode with a PST of 59 pkts/cycle. The cryocooler performances are nominal. The positive drift of GeD temperature is still present (0.03K/day).

The following manual operations were necessary during this period:
- rev.31 SPI eclipse passage operations according to Operational request (OR) nr.14
- rev.32 SPI eclipse passage operations according to Operational request nr.14
- rev.33 SPI eclipse passage operations according to Operational request nr.14

The OR foresees to force SPI in config mode at rad belt entry, switch off the ACS High Voltages (HV), disable automatic reactions to rad belts. In this way, after the ground driven reactivation after eclipse (Event Designator EECLEX02), the LVPS and HVPS of the AFEE (SPI GeD electronics) are turned on automatically, avoiding the GeD Pre-Amplifier temperatures to exceed the lower out of limits.
At rad belt exit the automatic reactions to rad belts are re-enabled, the ACS HV are turned on and the SPI is put in Photon/Photon to continue operations driven by POS.

The ED EEORTM01 refreshing the SPI status TM at AOS, after eclipse and before the subassembly re-activation, has been manually removed from the POS, to avoid command failure. The same commands are in fact already sent by the ED EECLEX02 after subassembly re-activation.

Preparation to future operations

The ISWT held on 16th January decided to proceed with the annealing of the Ge detector. Discussions are on-going with SPI team, ISOC/ISDC to prepare the procedures and the timeline for this 1st annealing.
The annealing will likely starts during rev.38 and lasts about 5 revs.

8.3.3 IBIS Operations

Status Nominal, on going the routine phase.

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 foreseen in the incoming IASW patch.

On DOY 2003.07.35Z the sequence GESTAN02 for the scientific configuration failed the release apparently due to a time-out in the response of the ground station (reception, radiation and on-board reception verification stages were all in time-out). At 2003.17.08.20Z the CCCF flag has been enabled in order to recover the instrument configuration.

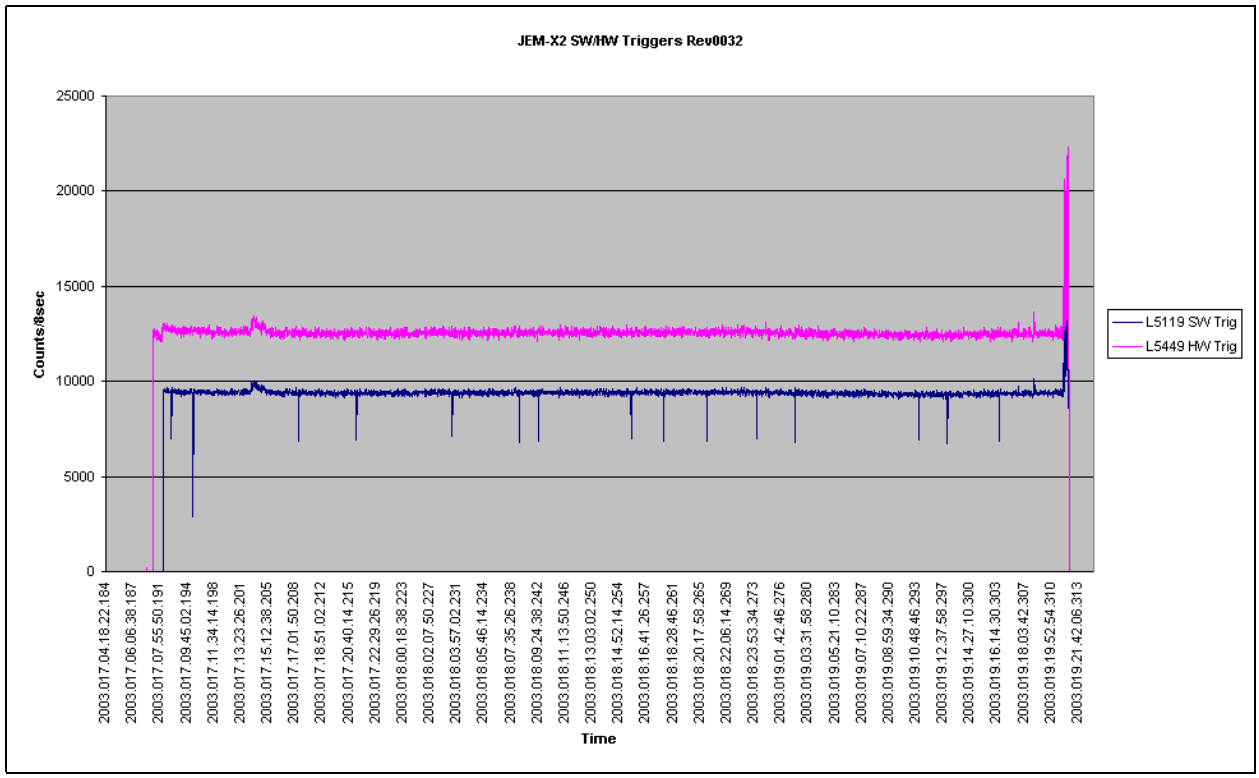
On DOY 2003.020.23.24Z the following VETO OEM has been generated: APID 1280 ID 184 Class 2 << VETO +28V VDM/CDM voltage out of range>>. The investigation performed, as suggested in the Integral Payloads FDIR, reported no problem for the instrument safety.

On DOY 2003.021.10.49Z has been implemented the CR 215, requested by IBIS PIs, in order to set the ISGRI VETO zoning to ALL (all VETO modules contribution).

8.3.4 JEM-X Operations

19-Jan-2003, DOY 019, Revolution 32

- 21:02:46, software trigger rates reached 20000 cnts/8sec and cause automatic transition to SAFE mode of JEM-X2. No recovery action was taken since this was about 15 minutes before the BCP Radiation Belt start time (21:17:24). The reason was probably an extension of the radiation belts to altitudes above 60000km. The plot below shows the JEM-X2 HW and SW trigger rates for revolution 32.



8.3.5 OMC Operations

17-Jan-2003, DOY 017, Revolution 32

- 07:28:00, Due to failure of release of TCs from the automatic stack, slew 00320002 was missed. The schedule was recovered for slew 00320003.

8.3.6 IREM Operations

The status of the unit is nominal.

No problems have been observed.

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	2002/10/19	Command failure from TCE2 at Redu1.	Ground	ESA Sta.	Pending
INT - 002007	2002/10/22	Command sequence TENPE_00 is incorrect.	Space	Procedures	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 - 002058	2002/11/06	Telemetry Play Back Failed	Ground	NASA Sta.	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 - 002078	2002/11/14	Antenna Tracking Problems	Ground	ESA Sta.	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 - 002093	2002/11/19	Incorrect MOUT in POS/EPOS/TSF	Ground	ISOC	Pending
INT - 002094	2002/11/19	TDRS does not work with super-commutated parameters	Ground	IMCS	Pending
INT - 002095	2002/11/19	TDRS incomplete retrievals.	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 - 002099	2002/11/20	SPI1 periodic task overrun	Space	SPI	Pending
INT - 002107	2002/11/21	TDRS produces gaps in the retrieval, that don't correspond to gaps in the archive	Ground	IMCS	Pending
INT - 002118	2002/11/25	Autostack crashed	Ground	IMCS	Pending
INT - 002121	2002/11/26	ISGRI count-rates increase up to 8000 counts/sec in one module	Space	IBIS	Pending
INT - 002116	2002/11/27	SPI Spectra process / cycle stopped	Ground	ISOC	Pending
INT - 002117	2002/11/27	Command releaser failed	Ground	IMCS	Pending
INT - 002124	2002/11/29	Telemetry Drops from Goldstone	Ground	NASA Stat	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 - 002127	2002/12/02	Telemetry loss from REDU	Ground	ESA Stat	Pending
INT - 002129	2002/12/03	VC-7 data loss	Ground	ESA Stat	Pending
INT - 002130	2002/12/04	Reaction Wheel Task Stopped	Ground	FDS	Pending
INT - 002131	2002/12/04	Lost TC capability via Goldstone(Dss-16)	Ground	NASA Stat	Pending
INT - 002132	2002/12/05	TM/TC loss via REDU	Ground	ESA Stat	Pending
INT - 002135	2002/12/06	Inconsistency in Pointing ID vs Slew ID found in POS for revolutions 17 and 18	Ground	ISOC	Pending
INT - 002136	2002/12/06	Invalid PST of SPI in Oper Mode	Ground	ISOC	Pending
INT - 002137	2002/12/08	Handover to DSS-16 delayed due to hardware problems	Ground	NASA Stat	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 - 002144	2002/12/15	Command verifier failed	Ground	IMCS	Pending

INT - 002145	2002/12/15	Commands failing PTV for no reason	Ground	IMCS	Pending
INT - 002146	2002/12/17	Late telemetry from REDU	Ground	ESA Stat	Pending
INT - 002149	2002/12/17	OBQD giving wrong results	Ground	IMCS	Pending
INT - 002150	2002/12/17	TM drop via REDU	Ground	ESA Stat	Pending
INT - 002151	2002/12/17	ISDS-ISDC Disconnected	Ground	I/F to SGS	Pending
INT - 002152	2002/12/18	NCTRS-A required resetting	Ground	NCTRS	Pending
INT - 002153	2002/12/19	RWS Plot Stopped	Ground	FDS	Pending
INT - 002154	2002/12/19	Drops in link to ISDC	Ground	I/F to SGS	Pending
INT - 002155	2002/12/19	Star Tracker false events	Ground	Spacecraft	Pending
INT - 002157	2002/12/20	Lost VC-7 from NCTRS	Space	NCTRS	Pending
INT - 002158	2002/12/20	Telemetry drop for both Redu and Goldstone	Ground	Spacecraft	Pending
INT - 002162	2002/12/22	Late AOS via Goldstone	Ground	NASA St.	Pending
INT - 002164	2002/12/27	ED DEBWLO00 has incorrect Interlock conditions	Ground	ODB	Pending
INT - 002165	2002/12/27	ED EEHTF_02 has incorrect IL	Ground	ODB	Pending
INT - 002166	2002/12/27	TC P2431 and P2931 have incorrect CEV.	Ground	ODB	Pending
INT - 002174	2002/12/29	Wrong GuideStar selected.	Space	Spacecraft	Pending
INT - 002175	2002/12/29	Telemetry retrieval problem	Ground	IMCS	Pending
INT - 002181	2002/12/31	NCTRS-A went down	Ground	NCTRS	Pending
INT - 002183	2003/01/01	Dyn PTV failure	Ground	IMCS	Pending
INT - 002167	2003/01/02	MRU Resumes Battery full Charge Mode when EOC Timer Automatic Mode is Selected.	Ground	Spacecraft	Pending
INT - 002168	2003/01/03	PSTREQs no longer included in the CCCF	Ground	ISOC	Pending
INT - 002169	2003/01/03	IREM sw local resets due to SEU (twice)	Space	IREM	Pending
INT - 002170	2003/01/03	IBIS: VETO VDM 4 & 12 HVs break down	Space	IBIS	Pending
INT - 002185	2003/01/03	Telemetry Drops from Goldstone	Ground	NASA Stat	Pending
INT - 002190	2003/01/10	Telemetry lost from DSS-16	Ground	NASA Stat	Pending
INT - 002191	2003/01/11	FDS not able to update slew parameters	Ground	FDS	Pending
INT - 002192	2003/01/12	FDS failed to create IPF	Ground	FDS	Pending
INT - 002193	2003/01/13	Problems configuring DSS-24	Ground	NASA Stat	Pending
INT - 002194	2003/01/16	Wrong handling of the OTF after Open Loop Slew	Ground	Spacecraft	Pending

INT - 002195	2003/01/16	Could not establish uplink on DSS-16	Ground	NASA Stat	Pending
INT - 002196	2003/01/17	Automatic Stack Needed to be restarted.	Space	IMCS	Pending