European Space Agency

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No. 18 - Payload Commissioning

13 Feb 2004

Spacecraft Status

The spacecraft is now in its 216th orbit, in good status and with all functions performing nominally. The electric propulsion engine was switched off on 30 January 2004 for a period of three weeks to allow instrument commissioning activities to take place.

Commissioning Activities

AMIE
Commissioning began on the 18 January 02:00 UTC, at a distance of 60 000 km from Earth with the capture of 4 images of the last quarter Moon through a clear filter. These first images of the Moon allowed the instrument team to check:

- The camera had not suffered radiation damage
- The camera orientation, with respect to star trackers, was the same as pre-launch

In addition to these first technical results, the first images were important for the project as a whole with the Moon being the final destination of SMART-1.

For the following week, the Moon was not visible so the AMIE camera tried to image star fields. Its target, on 23 January, was the naked-eye open cluster the Pleiades, found in the constellation of Taurus.

During long exposures of up to 60 seconds the thermal noise limits the visibility of faint stars. The experiment provided scientists with an understanding of the thermal behaviour of the camera while taking long exposures. This should enable controllers to place a better fix on the operational constraints of the camera when imaging stars.

On 29 January, as reported in the previous status report, the camera reacquired the Moon and took images using all of its filters. As well as providing images the test also allowed mission controllers to demonstrate the excellent attitude control of the spacecraft.

D-CIXS
The D-CIXS/XSM part of the remote sensing instruments on-board SMART-1 has yet to be tested outside the radiation belts. D-CIXS is even more sensitive than AMIE and SIR because it is easily damaged by the protons. Radiation of this nature is still present at a distance of under 65 000 km from the Earth. D-CIXS and XSM will be tested at the end of the three week commissioning period.

KaTE
As reported in the previous status report the KaTE established an initial X-band link with the ESA ground station located at Perth, Australia. In the past week an initial test of the Ka-band link took place. On 6 February KaTE pointed to the DSS13 ground station, part of the JPL Deep Space Network stations, to rehearse for the ongoing tests from 13 to 20 February.

On 13 February, KATE transmitted some signals in Ka band to the DSS13 in the first part of the test.

EPDP & SPEDE

Commissioning of the two instruments studying the plasma environment, EPDP and SPEDE, took place at the start of the mission. The three-week commissioning window has been utilised, therefore, by performing activities that require the spacecraft to slew to different targets.

Part of EPDP is a solar cell, which monitors the degradation of the solar output power due to mass deposition. The functioning of this cell needs calibration at different Sun incidence angles. On 9 February, to test different incidence angles, the spacecraft turned through a series of complex rotations.

The results show that the solar cell reacts as expected. Determination of the extent of degradation, however, requires a significant number of such experiments.

The two booms of the SPEDE instrument have been working well since the launch. The booms measure an integrated current coming from a number of different sources. One component is the photoelectron current created by both the boom and the spacecraft as a reaction to incident solar photons. By rotating the boom towards the Sun the contribution of the photoelectron current from the boom becomes nil and the boom only measures the photoelectron current from the spacecraft. A more accurate calibration of earlier data is possible once this contribution is calculated.

Unfortunately, this calibration attempt was halted. Due to the required complex spacecraft rotation, the behaviour of the spacecraft in a limit position (angle between the Sun and the solar panels at the limit of the constraints) led to an overheating of the star trackers. This produced a Safe Mode transition before the end of the calibration.

SIR
SIR, an infrared spectrometer, had an initial functionality test on 5 February revealing no damage from the passage through the radiation belts. The first observations took place on 8 February with 18 consecutive scans of the surface of the nearly full Moon. This allowed testing of most of the instrument modes. Calibration of the instrument has begun using the aquired data.

Planned Instrument Activities

11 – 17 February 2004

AMIE	14/15 Feb A laser beam will be sent from the Optical Ground Station in Tenerife, Spain to reach a filtered part of the AMIE camera field of view 15 Feb Imaging bright stars Vega, mag 0.03, Arcturus, mag -0.04, and ? Crater, mag +4.7
KaTE	Ongoing test of Ka band with DSS13

18 February 2004 onwards

AMIE	23 Feb Looking at the Earth
EPDP	End of Feb Second solar incident angle test
SPEDE	20 Feb Second calibration attempt
D-CIXS	19-21 Feb Initial tests

Planned Spacecraft Activities

March 2004

There will be a period of EP thrusting and long eclipses, which will limit the payload to simple operations at apogee. Once this period has finished, normal operations can resume and an extended commissioning and cruise science phase will operate from April-June during the coast arcs.

Long Term

A series of lunar resonance gravity assists will take place on 20 August, 16 September and 14 October. The STWT20 agreed to have only one lunar swingby, on or around 9 November, before lunar capture takes place in early December. After capture and down spiral, the xenon fuel reserves will lower the apolune to the final science orbit.

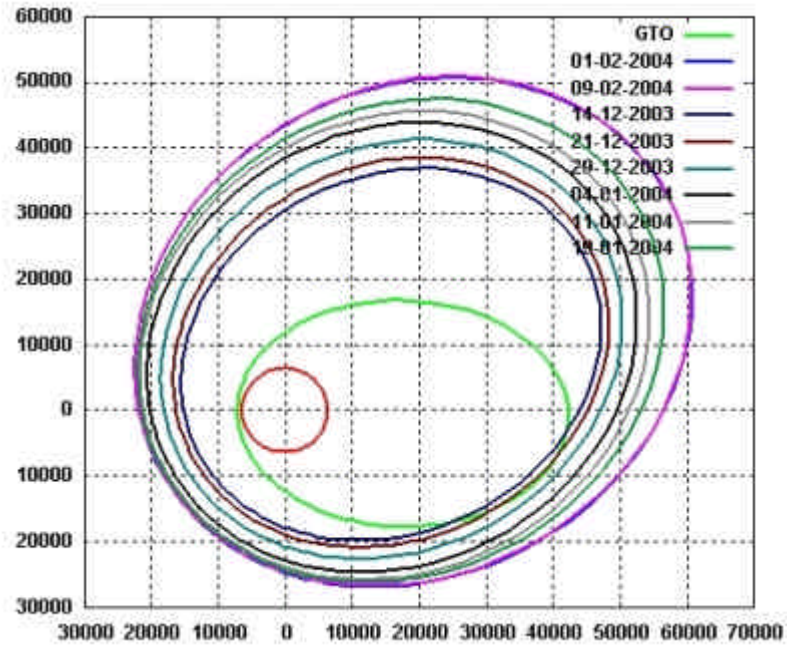
Orbital/Trajectory information

The ESOC specialists periodically compute the osculating orbital elements. These elements define the so-called "osculating orbit" which would be travelled by the spacecraft if at that instant all perturbations, including EP thrust, would cease. Therefore, it is an image of the situation at that epoch. In reality, the path travelled by the spacecraft is a continuous spiral leading from one orbit to another. The most recent osculating elements are as follows:

EPOCH (UTC) 2004/02/09 05:00:57.1

Elements WRT Earth (J2000)	
Pericentre Distance (km)	20 640.561091
Apocentre Distance (km)	65 927.041210
Semi Major Axis (km)	43 283.801151
Eccentricity	0.523134
Inclination (deg)	6.954713
Asc. Node (deg)	149.918938
Arg. of Pericentre (deg)	212.232295
True Anomaly (deg)	180.000133
Osc. Orbital Period (h)	24.894108

Displayed in the plot are the osculating orbits at launch (GTO) and at different times throughout the mission. The last two orbits are virtually identical as the only perturbations in the orbit are natural ones as the electric propulsion is dormant.



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