

**Report on Solar System Missions in Operations
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After the SPC at their 130th meeting 18/19 November 2010 had confirmed the extension of SOHO, Cluster, VEX and MEX and Hinode and adopted the support for Cassini for the 2011-2014 time frame and the extension of PROBA 2 until the end 2012, immediate action was taken to get IPC approval for the support of the UK Cluster, XMM-Newton and Cassini payload elements. The IPC at the end of November followed with a positive decision and subsequently we have been putting the contract action on its way to ensure that the work of the teams in the UK will not be interrupted.

We positively answered a request by NASA to support the LEOP of JUNO, that will be launched in summer.

In general all spacecraft and their payloads were nominal during the reporting period.

Ulysses

The work in the post-operational phase continued according to schedule. The legacy archive is planned to be completed in summer this year. The legacy archive will be hosted at ESAC.

SOHO

The payload and spacecraft performed nominally during the reporting period.

A nominal momentum management manoeuvre followed by a 180 + 5.5 deg roll was performed on 29 October 2009. That roll manoeuvre marked the beginning of the SOHO “Bogart” mission. From now on, SOHO will be aligned with ecliptic North/South rather than solar North/South.

The SOHO Experimenters' Operations Facility (EOF) and SOHO Experimenters' Analysis Facility (EAF) at Goddard Space Flight Center are history. At the end of November the SOHO instrument teams moved to new offices in Bldg. 21. Along with the staff, the SOHO servers and SOHO archive were moved. Even though all computers had to be migrated to an entirely new network with a complex web of firewall rules, all services were back up in less than 36 hours.

JHelioviewer, an advanced visualization software that enables everyone, anywhere to explore all SOHO images from the past 15+ years as well as images from NASA's Solar Dynamics Observatory, was launched on 14 December in conjunction with the AGU fall meeting. JHelioviewer allows users to overlay series of images from the Sun, from different instruments, and compile animated sequences and image-process those in real-time. In addition, it allows cross-referencing of different aspects of the large data sets. This is particularly important as many events observed on the Sun are interconnected and occur over vastly different temporal and spatial scales. More at:

http://soho.esac.esa.int/hotshots/2010_12_14/

The release was widely covered by the media and countless blogs.

The SOHO team at NASA-GSFC (D. Mueller, now at ESTEC, and B. Fleck) had been instrumental to develop this new exciting tool, which partially was funded by SRE-OS jointly with SRE-SM.

Cluster and Double Star

Spacecraft and the payload operations have been nominal despite the fact that minor problems show up from time to time, which are related to the age of the cluster fleet. However, these problems are well understood have hardly any impact on spacecraft and payload operations and on the science return from the mission. All spacecraft are currently passing through another eclipses season, which will last until late July 2011. Batteries continue to show their age. Battery 2 on Cluster 2 cracked and induced a small orbit change, as was experienced earlier on other occasions. This battery is now considered non-operational. No adverse affects were reported by instrument teams. Two CTU switch over were experienced (one on C3 and one on C4). Less than 9 hours of data were lost and both affected units have been tested and confirmed that the errors were temporary. These are of a familiar ‘family’ of SEU anomalies experienced previously. C1 experienced a CTU reboot during uplink of command sequences. It occurred during fluctuations of uplink (AGC fluctuations) and most likely one command was not received properly. In this case the incorrect spacecraft antenna was selected. Around 2 hours of data were lost. Preventive measures have been put in place.

Issues with the Perth ground station and WIMAX interference have been dealt with by the installation of a filter. Unfortunately, this has an impact on the link budget inducing a 2 dB reduction. Ongoing disturbances by the Spread-F phenomena during Maspalomas passes is counteracted by avoiding tracks during local evening time and using more the Kourou and Villafranca stations..

CAA (Cluster Active Archive): The CAA 12th Cross-calibration meeting was held at the end of October in Toulouse, hosted by CESR. Presentations from all PI teams on calibration and archiving progress were made, in addition to data visualisation tools and a project at the Finish Meteorological Institute (Helsinki, Finland), which determines magnetospheric boundaries and regions from CAA data. This information will be made available as separate datasets for CAA users.

The Cluster Active Archive had reached 1122 registered users by end of November 2010. The CAA user statistics is accessible at http://caa.estec.esa.int/caa/user_stats.xml.

The course of action for the migration of the CAA to the Cluster Final Archive (CFA) at ESAC was discussed between all parties involved; the detailed transition plan is currently under review.

Double Star: Network security issues in China stopped for a considerable time the re-processing of the Double Star data. However, these issues have been resolved and delivery of the data has restarted end of 2010. It is the intention to recover the time lost and come back to the original agreed schedule within the next months. Work on the inclusion of the Double Star data and related interface modifications in the CAA have re-started.

Hinode

The spacecraft and payload are nominal with data downlink through S-band.

The KSAT proficiency statistics for the Svalbard and Troll stations for 2010 shows that over the year a 99.2% proficiency was reached, i.e. from 3621 accepted tracking passes 3591 were actually delivered.

From September through November 2010 1016 GB of data were downloaded from the Hinode Science Data Centre at the University of Oslo.

All Hinode data (and usage statistics) are available to the community through the Hinode Science Data Centre Europe: <http://sdc.uio.no/sdc/>

Mars Express

Spacecraft and payload are nominal.

Another Phobos close flyby occurred on 9 January.

Mars Express performed a successful test of the transponder chain 2. This was done as an element in establishing and validating the status of all redundancy elements on-board.

Preparations for the solar conjunction early next year (mid-Jan – mid-Feb) are being finalized. This period without science operations will probably be followed by a cold reset and sequence of tests of the Solid-State Mass Memory. This is needed to cure the earlier reported 'double error' count issue in one of the SSMM memory banks (which probably is not a true H/W problem).

MEX is preparing to support the EDL of NASA's MSL mission.

Rosetta

Spacecraft and payload operations were nominal.

The last payload check-out, PC 13, was successfully completed in December. Especially noteworthy is the successful execution of the Philae Lander check-out, which demonstrated that the Lander is ready for the near-comet operations and its deployment onto the nucleus of comet Churyumov-Gerasimenko. Except for a few special payload checks that were agreed to be performed in February 2011 – including OSIRIS that could not participate in PC 13 - this concluded the cruise phase activities for the Rosetta payload.

For the spacecraft work has been concentrated on the preparation of the first rendez-vous manoeuvre that will start on 17 January and actually is a sequence of 5 manoeuvres stretching over a couple of weeks to be completed by 9 February. One has to recall that Rosetta does not have a main engine to perform these large manoeuvres. We will use the 10 N thrusters for the manoeuvres, i.e. the 'burn' are very long. This first manoeuvre will last about 390 minutes. Extensive tests were performed with the Rosetta EQM at ESOC.

The Flight Rules for these manoeuvres have been updated as they should be performed as close as possible to the optimal conditions. The tank temperature will have to stay in a tight temperature range to optimize fuel consumption. We need to stay within the fuel budget allocated as a consequence of the mission strategy we had to implement to mitigate the risk posed by the leak in the RCS that was discussed in detail in earlier reports.

In November Reaction Wheel C, which had shown increased friction levels, was re-lubricated twice. The second attempt improved the performance considerably and brought the performance back to nearly normal, however, we still have to consider RW C performance as a risk. The Reaction Wheel Task Force, which includes experts from the reaction wheel manufacturer, D/TEC, ESOC and the mission management has been very active with regular web conferences to define the strategy for the re-lubrication and to monitor closely the performance of the wheels.

In addition Flight Dynamics at ESOC has started to prepare back-up scenarios if the problems with RW C and B on Rosetta would persist.

A status of the Rosetta RCS and RW anomalies was provided to upper management in December, which closed the actions from the Rosetta Hibernation Readiness Review that took place 5 November 2010. It should be emphasized that Flight Dynamics did an excellent job to optimise the baseline mission, which led to a further optimisation of the fuel consumption compared to the tentative figures provided earlier. As a consequence the RDVM#1 in January can now be executed such that there won't be a week delay in the start of RDVM#2 as was announced earlier and still is reflected in the statement below discussed at the Rosetta Science Working Team meeting early December. RDVM#2 will therefore be scheduled to take place as planned at 4 AU distance from the Sun to start 21 May 2014.

The consequences of the RCS anomaly for the mission baseline were discussed in detail at the Rosetta Science Working Team meeting on 7/8 December at ESOC and the Rosetta Mission Manager presented the following statement to the Rosetta SWT:: "A delay in the arrival at the comet by 1 week will have no impact in comet operations as it is within the uncertainties that have to be considered in the planning. The science planning system will be opportunity-driven and therefore by its design capable of responding to such delays or orbit updates very quickly. In agreement with the PHILAE management team it can also be stated that a delay in Lander delivery by not more than 3 weeks from the date envisaged today is acceptable and within the margins one has to take into account and that will only be known once at the target.

A further delay of the comet arrival, however, would most probably have a real impact on the time available for comet characterization, landing site selection and preparation of the Lander deployment. This would have to be looked into by the Rosetta SWTM and its WG 1."

The Project Scientist and the PIs discussed and concurred with the above statements and the reflected approach.

The SWT also got a very detail overview of the payload operations approach for the orbit phase and some demonstrations of planning tools that are being developed by the Rosetta SGS team.

DSN support was provided for the Radio Science measurements performed during the superior solar conjunction.

The only open payload issue concerns OSIRIS where the PI declared that they were not ready to activate the instrument in the November-December 2010 PC 13 slot and that the activation prior to hibernation is highly desirable, however, not absolutely essential. As demonstrated by the excellent performance during the Lutetia flyby the instrument is fully operational, however, the instrument team would like to fine tune the operations of the instrument to mitigate potential risks with the lifetime of certain components. This required a number of tests on component level that couldn't be organised on time. The Rosetta Project agreed that on a best effort basis a time slot to activate the instrument will be provided in February/March 2011. The OSIRIS PI confirmed that if the activation is not possible due to other priorities or constraints on the spacecraft, he will accept that OSIRIS will enter hibernation in the current configuration.

Venus Express

Spacecraft and payload are nominal. The transition into the outbound quadrature phase, which lasts from 31 December 2010 until 5 February 2011 was executed as planned.

The orbit correction manoeuvre to raise the pericenter altitude by 172 km, from 165 km, was successfully executed on 1 November 2010. It was required to prevent the spacecraft from entering into the Venusian atmosphere.

Despite the failure of JAXA's Akatsuki spacecraft to enter the orbit around Venus all pre-planned science sequences intended to be performed with Akatsuki, will be executed as is.

Industry is under contract to study the aerobreaking scenario for VEX.

Hinode

The spacecraft and payload are nominal (with data downlink through S-band).

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Chandrayaan 1:

The raw data for the three European instruments supported by ESA were provided to the ISRO archive, which basically marks the end of the Chandrayaan 1 project for ESA. However, honouring a request by ISRO we will still support the archive peer review process to take place early 2011.

PROBA 2

The spacecraft, payload and the Ground Segment operated nominally during the reporting period. The downlink planning software was further improved and applied to the Redu downlink passes. The results obtained are very promising as no more interference between the spacecraft antennae was seen during the Redu passes.

Since November 2010, the PROBA2 spacecraft passes through its yearly eclipse phase, resulting in a transmission from UV-eclipse to visual eclipse to UV-eclipse every orbit. The duration of these eclipses peak around winter solstice and take about 30 minutes. Both SWAP and LYRA use these events to acquire valuable data when Sun light is travelling through the Earth atmosphere by the execution of several campaigns.

LYRA executes since November daily occultation measurements using one of the two back-up units. The obtained data set will allow analysis of atmospheric composition of several atoms and molecules over altitude, e.g. the ozone composition. Campaigns were also executed during the Geminid meteor shower peaking on 14 December 2010 joining in with radar, visual and rocket experiments.