Solar and Solar-Terrestrial Missions in Orbit Report to SSWG, October 2005

Ulysses:

Payload operations are being conducted according to the experiment Power Sharing Plan, which implies e.g. that the Gamma-ray Burst instrument is currently switched off. Apart from that the science operations during the reporting period were nominal.

A draft Call for Proposals for the 2005 Sun-Solar System Connections (S^3C) Senior Review has been issued by NASA HQ. Performance factors against which proposals will be judged are to include scientific productivity, technical status, budget efficiency and participation in the "Great S^3C Observatory". Also of importance will be the degree to which missions under review support the objectives of the 2005 "S^3C Foundation Roadmap". Proposals are due at NASA HQ on 5 October, and the Senior Review panel will meet in the week of 14 November. Publication of the panel's report and dissemination of new budget guidelines and instructions to the projects is foreseen on or about 6 February 2006. The proposal for the 2005 Senior Review is nearing completion and will be submitted on October 5.

Preparations are underway for the "15 years in orbit" celebration that will take place in conjunction with the 54th Ulysses Science Working Team meeting (4-7 October, in Pasadena). As one of the highlights, it is planned to have a live video conference with John Phillips (ex-PI for the Ulysses solar wind experiment) who is presently on board the International Space Station. Other events include a lunchtime colloquium devoted to 15 years of Ulysses in the Von Karman Auditorium at JPL. An ESA commemorative certificate is being prepared for presentation to the PI teams during the SWT.

SOHO:

Spacecraft and instrument operations have been nominal with one exception. On 15 July, the CDS Normal Incidence Spectrometer (NIS) high voltage MCP current showed multiple yellow high limit violations. As a safety precaution, the high voltage input to the NIS was disabled shortly after the violations started. While the anomaly was under investigation, CDS only ran Grazing Incidence Spectrometer (GIS) studies. On 14 September, the CDS Normal Incidence Spectrometer (NIS) returned to normal science observations after the MCP current signatures and the science data looked normal again after several weeks of testing. The cause of the anomaly is not yet clear. Possible explanations that have been invoked include a very fast energetic particle or an out-gassing episode.

Using SUMER and MDI data, a Chinese-German team of scientists has located the source region of the fast solar wind between 5,000 and 20,000 km above the surface in magnetic funnels. According to their new model, the solar wind plasma is supplied by closed magnetic loops that are swept by convection to funnel regions where they undergo reconnection with existing open field lines. Thereby plasma previously confined within closed loops is released and accelerated to form the solar wind. The results appeared in the 22 April issue of *Science* magazine.
On 5 August, SOHO captured images of its 1000th comet, and SOHO comets now account for almost half of all orbit-determined comets to date. The story, including results of a competition involving almost 10,000 participants worldwide to guess the perihelion time of SOHO-1000, was covered by ESA and NASA releases
(see http://www.esa.int/ esaCP/SEMCA3908BE_index_0.html for details).

Also SOHO will be subject to the NASA Senior review, but its evaluation is less critical than e.g. Ulysses (see above). Nevertheless an effort is under way to prepare for expected budget cuts in SOHO operations funding by NASA, starting with FY 2007. It is expected that unattended DSN passes will have to be accommodated to reach the targeted cost reduction. An on-board patch to automate certain aspects of daily operations is being considered, as are ground system changes to facilitate automated commanding and alarm notification.

For December 2, the 10th anniversary of the SOHO launch we plan a press event, and a limited dinner party at ESTEC with members of the SOHO project team. A major event to celebrate SOHO's 10 years in Orbit will be held on Sicily in May 2006. The first announcement for this symposium has recently been posted on the web.

CLUSTER:
Cluster science operations have been nominal throughout the reporting period. The short eclipse season was passed in early summer. On spacecraft 1, one of the two batteries had a voltage drop about 3 min before the end of the eclipse leading to a computer switchover, shutting off all instruments. To prevent this problem from happening again a third battery was brought on line on each of the four spacecraft. The transponder had to be switch to low power mode in between eclipses when not dumping data to keep the spacecraft warm enough. This created some problems with WBD (NASA wave instrument) that had some difficulties to get the signal with DSN. The transponder is back to high power mode since the end of the eclipses.
During the summer season we also successfully executed very complex constellation manoeuvres. These were the most complex manoeuvres ever done, reaching the largest separation distance of 10000 km. 49 individual manoeuvres were executed with a total of 21 hours of thruster firing. Cluster

is now in a multi-scale configuration with 3 spacecraft (C1, C2, C3) at 10000 km and 2 spacecraft (C3,C4) at 1000 km.
A renewed new attempt to switch on CIS on C2 (the instrument that failed during commissioning) was been prepared by ESOC and the PI team. Since it contained a small risk of a problem on the spacecraft in case
of failure of the latch current limiter, the final decision to go ahead was taken by D/Sci in September, following a presentation from the project. Unfortuntely on September 13 the attempt to switch on the CIS instrument was not successful. High voltage drafts similar to the ones observed during commissioning were observed and the instrument was switched of automatically. This is disappointing for the Pi group, who had some hope to recover full 4 satellite CIS measurements.
The FGM (magnetometer) PI (A. Balogh) has retired, and following his proposal (supported by other PI's and the Cluster project team) Dr. E. Lucek was selected as successor. Another request has been received for transfer of PI-ship for EDI from G. Paschmann (MPE/ISSI, Germany) to R. Torbert (UNH, US). As all effective work with EDI has recently been transferred to UNH and no further funding from DLR can be expected on the German side we aim to follow the presented proposal, thereby increasing the number of US PI's in Cluster to two
A Nature article has been published at the beginning of August. It presented the first observations of short-scale Alfven vortices with Cluster in the polar cusp. These are produced in turbulent plasma and have never been observed in space, although theory predicted their occurrence.
Another Nature paper has been published at the beginning of September using Cluster data. It presented the first evidence that Chorus emissions, electromagnetic waves observed near the equator, can accelerate electrons to energies of a few MeV feeding into the radiation belts. This is quite an important result since previous theories about the formation of radiation belts were suggesting mainly particle diffusion as the generation process.
The Cluster - Double Star symposium in late September at ESTEC was a great success with 162 participants. Cluster Certificates and awards were given to the Cluster community for the 5th anniversary of Cluster launch.

The Implementation Review for the **CAA** has been held in May and the final review report was received in July, indicating some problems with the data delivery of a few experiments. After the retirement of Trevor Sandersen the new CAA project manager Harri Laakso has initiated negotiations to rectify those problems before the planned release of the first CAA data in autumn. The CAA was finally opened for Beta testing on 26 September; which was announced in the previous week to the participants of the Cluster symposium. Earlier in September, the main activities at ESTEC were related to the improvement of the ingestion software, the web user interface, and CAA. All the PI groups were very active in September and a significant enhancement in data provision on CAA was seen.

DSP:
Resets off PEACE (electron sensor) on TC-2 do still occur on a regular basis. As a workaround and to avoid spontaneous resets during interesting times the Chinese MOC has received a recovery procedure to switch PEACE off&on after a reset had occurred, and even in a random fashion before interesting regions would occur. The other six instruments worked nominally.
A document describing the evolution of the attitude of the spacecraft has been provided by China. TC-1 spin axis will have drifted by 9 deg. by the end of 2006 and TC-2 spin axis drift will be 30 deg. by July 2006. On the basis of this information - and of course backed up by an excellent science case for the mission extension - the SPC, at its meeting in May unanimously agreed to the Double Star extension for 1 year for TC2 and 1.5. years for TC1. Since summer 2005 Double Star is therefore formally in the extension phase.
The Beijing ground station has finally been repaired in June 2005 after almost a year out of work after a thunderstorm. Unfortunately, in late August we were informed that the station was again hit by another thunderstorm. This is particularly unfortunate since we were planning an upgrade at Maspalomas. Now Cluster and Double Star will have to share Vilspa II.
TC-2 has since a few months an orbital season with low perigee (200 km), and consequently problems with atmospheric drag making orbit predictions less reliable. Giving higher switch-on margins for Peace the problem can be circumvented, but some science data is presently being lost. In a few months the orbit perigee will rise again and these problems will disappear.

Other activities

ILWS / China
CNSA has now formally announced the selection of Kua-Fu with some minor changes. This clearly opens possibilities for a China ESA collaboration, and we have recommended to hold a Europe-China science workshop to discuss refinement of the mission outline and capabilities before the start of Phase B.

NASA: A draft LoA for a coordinated AO for Solar Orbiter and Solar Sentinels in early/mid 2006 is being prepared.

ISAS/JAXA: An offer has been received from Norway for the ground-support of Solar B. In a TEB meeting on Sept 28 no major showstoppers were identified, and we have informed our JAXA partners that the formulation of an MoU can now proceed speedily.