125th SSWG, 11+ 12 October 2007

Report on Missions in Operation

(Gerhard Schwehm, 8/10/07)

General: The move of the Solar System Science Operations Division to ESAC, Spain, is nearly completed.

Ulysses: All instruments are currently switched on and functioning nominally. Nutation operations are proceeding as planned, using closed-loop Conscan and SOLACE manoeuvres (open-loop slews together with Conscan) to maintain Earth pointing and damp nutation. Perihelion passage occurred on 18 Aug, and the spacecraft is now in the northern helio-hemisphere. On 27 Aug, Ulysses was closer to the Earth (0.42 AU) than at any time since it headed towards Jupiter in 1990.

The status of Ulysses will be addressed as a special topic at the SSWG – mission extension is sought for an additional 12 months.

SOHO: Spacecraft and payload are behaving nominally.
An Operational Readiness Review (ORR) for SOHO automated operations was held in two stages on 19 July and 6 September. After rigorous testing for three months, the newly developed system for SOHO automated operations has been declared ready for operational support during unmanned night operations starting at the end of September 2007.
The SOHO Mission Management Plan has been updated accordingly.

Two very successful SOHO workshops took place over the summer:
- SOHO-19 on "Seismology of Magnetic Activity" at Monash Univ., Melbourne, Australia
- SOHO-20 on "Transient Events on the Sun and in the Heliosphere", in Gent, Belgium.

A SOHO/EIT image was prominently featured on the cover of the 13 August issue of Newsweek magazine.
SOHO has discovered its first periodic comet, which was publicised by an ESA news release.

Cluster: Constellation manoeuvres were finished on 4 July. C3 and C4 were put at 17 km from each other, their closest distance in the Cluster lifetime. This is to investigate very small plasma structures in the tail of the magnetosphere. Attitude manoeuvres were performed on 25 Jul to keep the spacecraft spin plane close to the ecliptic.

Cluster had again entered an eclipse season, which lasted until 28 September. The operations strategy had been changed slightly after the battery conditioning. It was found that the battery capacity on C3 was lower than expected and it was decided to run also the decoder-only mode on this spacecraft. C4 had also less capacity than expected and the FGM (magnetometer) and the SSR (data recorder) had to be switched off during two eclipses. The two eclipses, on 21 and 24 Sept., were a heavy load for the ESOC operations team since we had two spacecraft in decoder-only mode at the same time. To support these operations a special automatic procedure to recover the spacecraft has been successfully tested.

JSOC and ESOC have operated the spacecraft and instruments as planned in the master science plan. The average science data return of all spacecraft from 7 Jul. 2007 until end of Aug. was 98.7%. JSOC is looking at the conjunctions between Cluster the NASA Themis mission to maximize the data acquisition (burst mode) during the best conjunctions.
The Cluster Active Archive (CAA) development continues steadily. The CAA has 481 registered users as of end Aug. 2007. The downloading rate was 21 Gbytes in Aug. with a large portion of FGM (magnetometer), EFW (electric field) and CIS (Ion) data. The 15th Cluster workshop in March 2008, to be held in Tenerife, will include special sessions on the CAA products and tools and a hands-on workshop at the end.

A paper was published on 24 June by Xiao et al. in Nature Physics showing for the first time two magnetic nulls around a reconnection event. These were predicted by theory on 3D reconnection but never observed before.

On 18 July, Lavraud et al., published a paper showing that solar wind plasma can be accelerated by up to 60% (from 600 up to 1000 km/s) at it approaches the magnetosphere. This is due to enhanced magnetic forces associated with Coronal Mass Ejections.

A paper published on 29 Aug. by Walsh et al., showed for the first time two flux ropes (large magnetic bubbles) observed simultaneously by Cluster and Double Star spacecraft. Since the separation between Cluster and Double Star was 6.3 Re (~ 40000 km) and the size of the ropes was smaller - this is direct evidence that these were different flux ropes. These results will shed new light on the reconnection process occurring in the magnetotail.

As of Sept. 2007, there are 689 refereed papers and 35 Ph.D. theses in the Cluster/Double Star publication list.

Double Star: Contact was lost with the TC2 (the polar) spacecraft in early August 2007. To re-establish contact was up to now unsuccessful. Problems were expected on the spacecraft during this summer since the slow drift of the spin axis toward the sun would increase the temperature inside the spacecraft. After the failure of the attitude computer a few weeks after launch, the spin axis could not be kept perpendicular to the ecliptic anymore. The spacecraft, after almost 3 years of operations, was well beyond its nominal life-time of 6 months.

TC-1, the second Double Star spacecraft, which carries most of the European instruments, is operating nominally. On this spacecraft the drift of the spin axis is much slower than on TC-2. However the perigee is now decreasing dramatically and the re-entry into the atmosphere is expected for 10 October. If TC-2 is not recovered, it will be the end of the Double Star operations. Run down activities are expected after that time for the archiving of the data that we would like to combine with Cluster in the Cluster active Archive.

Lessons learned from the Double Star project will be discussed at the SWT meeting in Shanghai this week. It surely will be very valuable for future collaborations between ESA and China.

44 Papers have been submitted to J. Geophys. Res. for the special issue on Double Star-Cluster results. The review process is now taking place.

Cassini-Huygens: 15 October 2007 will be the tenth anniversary of the launch of Cassini/Huygens. The orbiter mission is progressing nominally all operations are proceeding well. A spectacular close flyby of Saturn's moon Iapetus was completed on 10 September with a closest distance of 1640 km. Just after the completion of the Iapetus flyby the Cassini orbiter went into safing mode for the first time in 4 years due to the RF

transmitter TWT solid state power switch being hit by a cosmic ray. Due to the reactivation procedures a few days of post-safing science was lost. The Huygens radio receivers on board Cassini will be re-activated on 4 November for about one hour. The objective of the test, which has been requested by the Orbiter radio science team, is to evaluate the usage of the Huygens radio science receivers for augmenting the capabilities of the Orbiter radio science investigation during the 2-year Cassini extended mission.

The review/validation of the submitted DISR archive data set is being completed. DISR data release on ESA's PSA is expected in November. Preparatory work is well advanced regarding the archiving of the Huygens VLBI observation data set (high-level data sets only).

The Huygens probe radar altimeter thermal recalibration is completed. Pre-flight results were confirmed. The discrepancy between radar altimeter altitude measurements and the various (indirect) altitude reconstruction profiles remain unresolved.

The next Cassini-Huygens PSG meeting will be held at JPL on 15-19 October.

No date has been announced yet as to when the formal announcement of the Cassini extended mission will be made. However, planning of the extended mission proceeds nominally.

The preparation of the two Cassini-Huygens conferences that will address the science achievements of the Cassini-Huygens nominal mission is well under way. The first conference, devoted to Titan, will be held in Corpus Christi (Texas), on 7-12nJuly 2008, the second devoted to all other aspects of the Saturn's System will be held in London, 28 July – 2 August 2008.

Mars Express: The recent dust storms had strong adverse effects on the quality of the HRSC and OMEGA science data. This has a very significant science impact as these dust storms took place during conditions which were otherwise very favourable for HRSC and OMEGA.

A very close (~140 km) Phobos flyby occurred on October 2nd.

The 2007 eclipse season ended on August 31st; preparations for the 2008 eclipse seasons, with long eclipses during aphelion, will start in October. The Phoenix EDL support will take place during the 2008 eclipse season. A number of tests were performed between Melacom (Mars Express communicationssystem for Beagle-2) and the MER rovers. These included interference tests between Melacom and ASPERA/MARSIS.

Preparations for The European Mars Science and Exploration Conference – Mars Express & ExoMars (12-16 November 2007 at ESTEC) are ongoing. About 260 abstracts have been received.
Further information is available at: http://www.rssd.esa.int/mars07/

A COSPAR Capacity Building Workshop for enhancing ESA/Mars Express data use among South American scientists took place in Montevideo (Uruguay).

On 23 November, Mars Express will perform its 5000th orbit around Mars.

Venus Express: An anomaly in the solar array drive circuitry, already known on Mars Express, was detected on Venus Express for the first time on 23-Aug-2007. Within 24 hours the error happened twice. This resulted in a three day stop of all science operations. It was decided to implement the Mars Express patch to solve the problem. Following the trigger of the same event for the –Y wing on 18-Sep, the patch was also enabled for that wing. Since then S/C operations have been performed nominally.

An anomaly has been reported for the VIRTIS-H cryo-cooler motor current, investigations are ongoing. Some dedicated tests with VIRTIS-H were performed and it was decided to introduce a new operational mode for the cryo-cooler, which will induce less stress on the engine. In the mean time all VIRTIS-H observations had to be cancelled, and the VIRTIS-M observations focus on the most important science goals to minimize the load on the coolers – a strategy envisaged also for VIRTIS-H once operational again.

A Venus Express science team meeting was held in Moscow on 1-2 October 2007.

Rosetta: The spacecraft and its subsystem continue to perform nominally.

Mid September the Rosetta spacecraft left Near-Sun Hibernation Mode (NSHM). No problems were reported during that period. Immediately after Payload Active Check-out No. 6 started, which is about to be completed.

Initial requirements for the asteroid Steins flyby in autumn 2008 were compiled and are being iterated with the Experiment Teams. This is in preparation of the dedicated Asteroid Flyby science workshop organized by the Rosetta Project Scientist in Athens, 22-24 October.

Regarding the pressurization valve leakage observed some time ago all data have been reviewed with industry and the Flight Dynamics Team at ESOC and both in general agree on the potential impact for the mission. An ESA internal review on Department Head level took place on 11 September. The Board decided that there is no need for the time being to change the mission scenario. However, a special test programme to qualify the thrusters for lower pressure levels will be initiated. In addition, in close collaboration with Flight Dynamics contingency scenarios for the near comet phase will be studied to optimize fuel consumption.

Archiving: The Division supported a NASA Knowledge Management Workshop, 17-19 July at Caltech. Problems related to Knowledge Management in organizations, in space projects with wide industrial participation and with regard to data archives from missions were addressed in detail. The presentations from the workshop demonstrated that Knowledge Management is seen as an important issue to prevent the loss of know how that has been build up over the decades in the Space Agencies and in industry.

On a project level NASA has recently been following a similar approach to what we had introduced for Rosetta - video interviews with key individuals in a project and transcripts that can be queried electronically.

The 2nd International Planetary Data Alliance (IDPA) meeting took place at Caltech, Pasadena, CA, 16-19 July and was well attended by representatives for a large number of Space Agencies, e.g. NASA, ISRO, JAXA, ESA, RKA, ASI, BNSC/PPARC, DLR. The work of the IDPA has been progressing excellently and has been recognized as instrumental

to assure interoperability of the data archives from the various international planetary and exploration missions.

It is being discussed to introduce the activities formally into COSPAR, either in Commission B or as a special panel like it has been established for Planetary Protection.