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Expanding cooperation: German ground station tracks ESA Moon mission

12 January 2006



In a first-ever technical tie-up, the German Aerospace Center and the European Space Agency have agreed to share network facilities, initially using a German ground station to track ESA's SMART-1 mission.

As part of a larger framework agreement, the tie-up will boost interagency co-operation and foster additional cost-saving activities in the future.

In November 2005, ESA and DLR, the German Aerospace Center, successfully initiated an innovative and deep-reaching technical interconnection in which, for the first time, the two agencies will share network facilities, including ground tracking stations, communication networks and flight management data.

The co-operation is part of a cross-services framework agreement aimed at enabling the two to share infrastructure, resources and expertise. Specifically, this will provide reciprocal telemetry, tracking and telecommand services to respective spacecraft using each agency's network of ground tracking stations. The framework agreement was concluded in July 2005.

In the first implementation of the agreement, DLR's Weilheim ground station, controlled via the German Space Operations Centre (GSOC) in Oberpfaffenhofen, will start this month to provide routine tracking services to ESA's SMART-1 spacecraft, now orbiting the Moon. Both GSOC and the Weilheim station are located near Munich, Germany.

In a first for the two agencies, respective networks have been made able to 'talk' to each other, allowing the DLR ground station to receive science data from SMART-1 and transmit flight control signals to the spacecraft. Weilheim will transmit data from SMART-1 via GSOC to ESA's European Space Operations Centre (ESOC), in Darmstadt, Germany, where it will be further transmitted to mission scientists exactly as if it had come from one of ESA's own ground stations.

Later, DLR is expected to support ESA's Integral mission as well.

Another significant aspect of the cross-services framework agreement includes each agency accounting and billing for services provided, placing the co-operation on a sound, long-term technical and economic footing.

In the next stage, ESA's Malindi ground station, located in Kenya, will provide tracking services to DLR during the launch and early orbit phase (LEOP) for the TerraSAR-X satellite, to be launched by DLR in mid-2006. As a co-operating station, Malindi is operated by the University of Rome on behalf of ESA's global ESTRACK network.

Interagency co-operation cuts costs, expands resources



Planning and negotiations for the cross-services framework agreement and the future sharing of resources also involved CNES, the French space agency.

"Discussions between ESA, DLR and CNES began in mid-2004, and once we had harmonised the schedule of fees and reciprocity, negotiations proceeded quickly," says ESA's Nicolas Bobrinsky, Head of the Ground Facilities Operations Division at ESOC. "Compared to the past, there is now a much stronger will to co-operate. It's a new approach which will benefit all three," he adds.

To implement the cooperation, ESOC and GSOC have established robust and scalable technical and network interfaces into each other's control centres, allowing data to be interchanged smoothly and seamlessly. "The control centres have to be able not only to exchange TT&C and science data, but also flight dynamics data, flight planning information, database interfaces and network channels," says Bobrinsky. "The challenge to integrate these was not trivial."

The initial ESA/DLR co-operation for SMART-1/Weilheim was achieved based on the widely used Space Link Extension (SLE) standard, a software standard that enables middleware to interchange data between different networks not initially designed to communicate with each other.

Common standards enable fast implementation



SLE was developed by ESA in cooperation with NASA, DLR and CNES to enable just this sort of network sharing. The main difference with respect to previous interfaces is that there is much less of a need to exchange hardware, thus avoiding the high costs incurred in the past.

Similar reciprocal services based on SLE had been successfully implemented in the past between ESA and NASA for missions such as Integral, Rosetta, Mars Express, SOHO and Ulysses.

Based on this positive experience and the availability of reusable software components from the earlier implementation, it was decided to base the ESA/DLR cooperation on the SLE standard as well. The maturity of the SLE software permitted SMART-1 mission controllers to implement it operationally in a record time with a minimum effort. "It only took 24 hours to turn the system on once we had agreed on the SLE configuration," says Wolfgang Hell with a lot of satisfaction. Hell is ESOC's project manager for the initiative.

He adds that teams working at ESOC and GSOC established the first communications between Weilheim and ESOC in November 2005 using a single leased telecom line. The ground station tracked SMART-1 during several live passes later in the month, and in January 2006 the link will be expanded to two lines to provide redundancy.

The two agencies had to install some new hardware at the ground station, which made use of commercial off-the-shelf (COTS) TT&C equipment instead of custom-designed devices, providing significant cost savings.



ESOC project team

Sharing resources expands agency capabilities

The benefits of the co-operation go beyond mere technology sharing, however, and provide significant support to respective missions that each agency would be pressed to achieve individually.

"ESA's Malindi station is a good ground station to use for TerraSAR-X due to its near-equator position; in fact, separation of the satellite from the launcher is planned to occur right over Malindi," says DLR's Martin Pilgram, the project co-ordinator for GSOC. He points out that DLR does not have a ground station of its own in a suitable location.

On the other hand, SMART-1 is one of a new series of low-cost 'Small Missions for Advanced Research in Technology' and does not have a dedicated ground station. "Weilheim was available, so it made sense to offer capacity to ESA," says Pilgram.

Future co-operation made easier



Main Control Room (MCR)

The ESA/DLR cross-services agreement is consistent with the 'Network of Centres' (NoC) initiative, a grouping of mission control facilities including ESA and space organisations in France, Germany and Italy. The NoC concept aims to share expertise, facilities and resources and avoid duplication, thus strengthening Europe's overall space operations capability.

In the meantime, ESA and DLR are already profiting from the tighter technical and staff cooperation based on Weilheim and SMART-1.

In the future, speculates DLR's Pilgram, the co-operation between the two could expand to include Earth observation missions operated by GSOC but using ESA ground stations. "Now that we've got the ESOC-GSOC link in place, it's easy to use — we can use it whenever we want," he says.

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