In Brief

Focus on Foton

The ISS User Information Centre at ESTEC has a new exhibit: a Foton science capsule. Marked by the fires of its 2500-degree reentry – if visitors stand close enough, they can still smell the scorched heat-shield – the small Russian spacecraft is the descent module from the Foton-12 mission, launched in September 1999.

Foton craft have been flying since the mid-1980s, carrying anything up to 650 kg of scientific experiments into an orbit around the Earth. This means around two weeks of excellent weightlessness conditions. At launch, Foton weighs roughly 6.5 tonnes and consists of three modules: a battery module, a service module, and the descent module with the scientific payload. A Soyuz booster from Plesetsk near Archangel launches the craft; once its mission is completed, the descent module lands near the border between Russia and Kazakhstan and its contents are usually available to researchers within a few hours.

ESA has been a Foton partner since 1987 – long enough to develop an excellent working relationship between the agency and the Russian manufacturers and launch teams. The Foton programme gives researchers the opportunity for relatively low-cost work in weightlessness for much longer durations than with sounding rockets and a faster turn-around than they could expect with long-term experiments aboard the International Space Station.

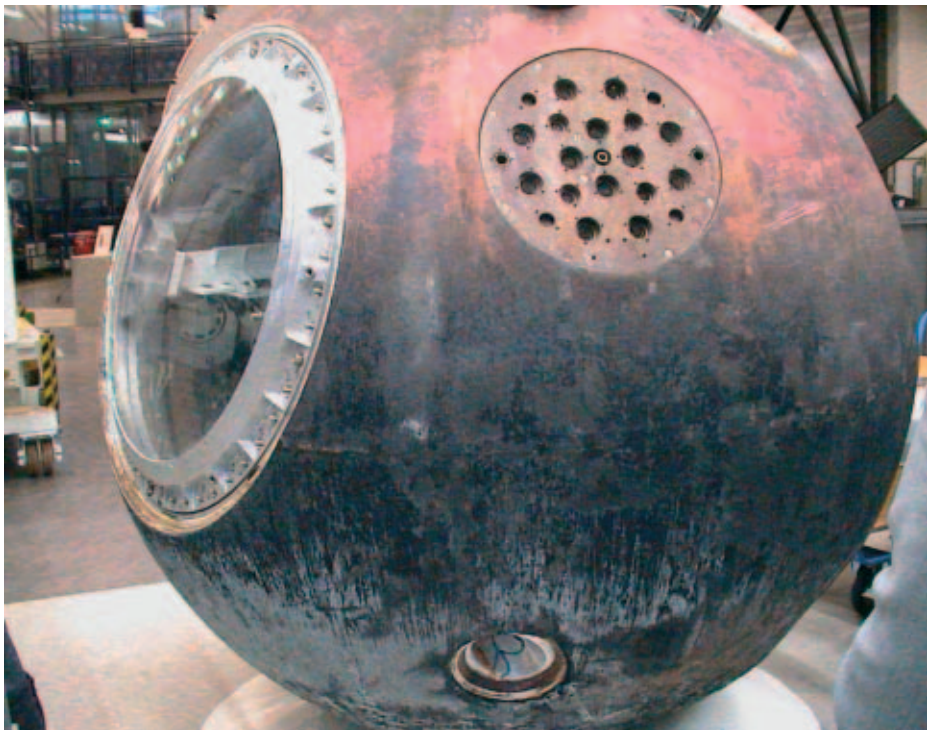
ESA Technical Officer Antonio Verga has worked with Foton for years. “It’s very good value for money. Foton carries a multi-disciplinary payload – anything from biological experiments to fluid physics and technology testing. Since the spacecraft is unmanned, logistics are greatly simplified and safety concerns are minimised.”

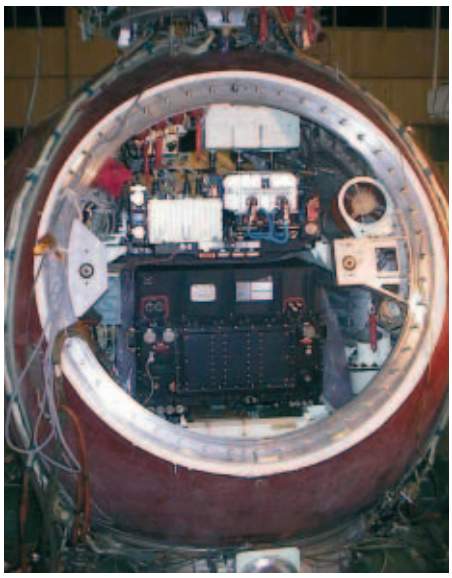
Foton is about opportunity. “It’s not a museum piece,” says Verga. “It’s there to show visitors what is possible.” Foton-12, its experiments long since removed, is not quite an empty shell. “You can still see some of its major characteristics: the external vacuum venting line, the power supply interface and the parachute compartment, for example.” Verga hopes that visitors to the User Information Centre will see it as a potential platform for their ideas for experiments. The next Foton mission – Foton M-1 – is scheduled for October 2002, and will include experiments designed by student groups from York, Edinburgh and Zurich.

Focus on Foton Seminar
The Foton group is organising a “Focus on Foton Seminar” at the User Information Centre on Wednesday 20 March.
The seminar for scientists and non-scientists covers facts on Foton as a 0g-research platform, programmatic highlights and testimonials by past scientific users.

For more details on the seminar and registration forms contact Antonio Verga (ext. (+31) 71 565 3098) or Pietro Baglioni (ext. (+31) 71 565 3856).

The Foton capsule in the ISS User Information Centre





Fluidpac on Foton

When Time is Critical: Charter Website to Assist Rescue Operations

On 16 January, the members of the International Charter on Space and Major Disasters launched a new website that will assist rescue teams dealing with severe disasters. It will enable satellite planners to accelerate the immediate tasking of space-based resources, including ESA's ERS, CNES's SPOT, Canada's Radarsat-1 and soon selected Indian and US satellites, to acquire new images in order to assist humanitarian help.

The International Charter was set up in the framework of the UNISPACE III conference of the UN in 1999 and has been in force since 1 November 2000. It aims to put space technology at the service of rescue authorities in the event of major disasters. To date the Charter has been activated to deal with floods, landslides, volcanic eruptions, oil spills and earthquakes in all corners of the globe. For example, it provided important assistance to rescue operations following a series of earthquakes in El Salvador in 2001.

Current members of the Charter are the Canadian Space Agency (CSA), the French Space Agency (CNES), the Indian Space Research Organisation (ISRO), the US National Oceanic and Atmospheric Administration (NOAA) and the European Space Agency.

The new website offers information about updates in procedures, disasters covered and links to non-governmental organisations, civil protection agencies, international organisations involved in disaster mitigation and humanitarian assistance, and the individual partner agencies. For more information, check on *http://www.disasterscharter.org*

Jérôme Béquignon, ESA member of the International Charter's Executive Secretariat, commented *"this website is an important step forward in promoting the Charter and the results obtained and in assisting rescue teams during real emergencies".*

esa

José Achache
(photo: CNES/E. Martin 2000)

New Director for Earth Observation Programmes

On 1 January 2002 José Achache took up his duties as ESA's Director of Earth Observation Programmes for a period of four years. The ESA Council had made this appointment at its restricted session on 20 December.

José Achache, 48, obtained his doctorate in geophysics at the Pierre et Marie Curie University in 1979 and his doctorate in physical sciences at the René Descartes University in 1984. He joined the Institut de Physique du Globe de Paris (IPGP) in 1978 and was a Visiting Scholar at Stanford University for one year. In 1989 he was appointed Professor, created the Department of Space Studies at the IPGP, and from 1989 to 1995 he was Director of the Post-Graduate School of Earth Sciences.

In 1996 he joined the Bureau de Recherches Géologiques et Minières as Deputy Director of the Research Division and the following year became its Director. In 1999, he was named advisor to the President of the French Space Agency (CNES) and in 2000 was appointed to the post of Deputy Director General for Science.

José Achache has published more than 60 refereed papers on such subjects as geodynamics, plate tectonics, the magnetic fields and environments of the Earth and other planets, natural hazards, Earth observation and space technology.

esa

18 November 2001: The Leonids Have Been Back!

The Leonids are small dust particles that enter the Earth's upper atmosphere with a very high velocity of about 71 km/s, burn up and appear in the night sky as shooting stars. They are visible every year in November when the Earth passes through or close to the debris cloud of comet Tempel-Tuttle. They are called "Leonid" events because the meteors seem to be coming from the direction of the constellation Leo. There is evidence that this comet has created meteor showers and meteor storms for more than 1,000 years. Tempel-Tuttle, named after Ernst Tempel and Horace Tuttle who first discovered the comet in 1865 and 1866, has a nucleus about 4 km in diameter and orbits the Sun with a period of just over 33 years. At its closest approach to the Sun, it also passes close to the Earth's orbit. The Earth passed through that same region in space on 18 November 2001 and Leonid observers saw an increase in the amount of cometary debris.

The 2001 Leonid meteor storm

The intensity of the Leonids is usually measured in zenithal hourly rate (ZHR). The ZHR indicates how many meteors per hour would be visible if the observed shower were to come from the direction of the zenith under optimum observing conditions (no moon, no clouds). The limit of visibility is at 100 micrograms per dust particle that travel at 71 km/s, which is equivalent to a magnitude of 6.5 or a diameter of about 0.5 mm. The 1999 Leonids were a virtual storm with an hourly rate above 1000, but in 2000 they took it a bit easier with a maximum ZHR of about 500. Still, scientists awaited the arrival of the Leonids in 2001 on 18 November with great suspense. Predictions by Asher/McNaught and other scientists suggested two peaks, the first one around 10 UT and a second larger one at about 18:15 UT with possibly 8000 meteors per hour.

The best place to observe the first peak was North-West America. For the later second peak Australia was a favourable location. ESOC participated in an observation campaign organised by Peter Jenniskens from NASA Ames Research Center. The campaign consisted of two groups: one climbing Mount Lemmon in

Arizona equipped with cameras to film the first peak, the second group waiting in Alice Springs, Australia for the big storm.

The first data arriving from Mount Lemmon showed that at 10:00 UT the ZHR had passed 500 and increased continuously until about 11:00 UT when the computed ZHR peaked at about 2500. Within a few minutes it dropped back to below 500. The first peak was about 1 hour later than expected but quite spectacular. ESOC then had to wait about 3 hours until the constellation Leo rose above the horizon of Alice Springs. The first data from there indicated that Leo was prepared to roar again with a ZHR of 500 and continuously increasing. Around 18:00 UT the activity reached its maximum ZHR of about 2000 and for more than one hour 20 shooting stars dashed through the sky every minute!

Prudent spacecraft operations at ESOC

The curve of the meteor rate was displayed on the ESOC web-page. It was the only website where people all around the world could follow the Leonid peak in real-time if they were not lucky enough to be under a clear night sky with the constellation Leo above the horizon. Many journalists and amateur astronomers were among the 18000 hits on the web-site, but the spacecraft operators at ESOC were also keeping a close eye on the activity level of the Leonids. They were worried about the physical integrity of their spacecraft: ERS-2, XMM, the 4 Cluster spacecraft, Marecs B2 and ECS-4 are under ESOC control, but also SOHO and the Hubble Space Telescope were under threat of getting hit by a tiny meteoroid.

The ERS-2 payload, for example, was switched off in the evening hours of the day before the predicted peaks to minimise the risk that an impact of a meteoroid could permanently impair the electronics of the spacecraft due to plasma generated by the collision. Additionally, the thrusters and gyros were warmed up, the spacecraft was switched to Fine Pointing Mode (a more robust flight mode), the solar array was placed in an automatic Sun re-acquisition mode, the payload heater thresholds were lowered and the on-board memory and the power system were continuously checked.

At 21:32 UT the Kiruna ground station received telemetry from ERS-2 indicating that the satellite was healthy. In the following hours it became clear that the other ESA spacecraft had also survived the Leonids unscathed. This year, if the predictions are as reliable as last year, there will be the last Leonid storm for many decades to come. For this storm Europe will be the place to be!

More Space for Space

Three new buildings at ESTEC in Noordwijk (NL) give more space for satellites under test, more storage space for workshop equipment and – of course – more working space for engineers and scientists in offices. The three buildings were officially opened on 16 January by the Dutch Minister for Economic Affairs and Deputy Prime Minister, Mrs A. Jorritsma-Lebbink, with ESA's Director General Antonio Rodotà and ESTEC's Director Gaele Winters also present.

The most important of the new buildings is an extension to the satellite test facilities, which are already among the largest and most advanced in the world. The new satellite integration hall provides an additional 19-metre high clean room and several preparation rooms. This means that three large satellites can now be tested at the same time.

The other new buildings are somewhat more conventional. Even so, they are much needed. These buildings will, in part, replace temporary offices that have been in use for many years and will provide a new workshop with office space and a new wing for ESTEC's main building to accommodate the ESA engineers and scientists. esa

Minister Jorritsma-Lebbink and the ESA Director General on a tour through the new buildings.

Automated Transfer Vehicle Test Model at ESTEC

The Automated Transfer Vehicle (ATV), has successfully started its 11-month test programme at ESTEC in Noordwijk (NL). The first successful test of the full-size model in the Large European Acoustic Facility (LEAF) was to simulate with acoustic vibrations the stress the ATV will encounter during the first three minutes of launch on top of the powerful European Ariane-5 launcher. Detailed computer analysis of the test data acquired during the acoustic tests will continue in parallel with the post-test inspection and reconfiguration of the ATV for the next tests. Until next October, the ATV mock-up will undergo a series of mechanical and critical thermal tests, including solar-array deployment.

The 20-tonne cylindrical cargo-ship financed by ESA has been designed to periodically service and re-supply the ISS with up to 7500 kg of cargo, starting in Autumn 2004. About once a year a new ATV will fly unmanned and automatically dock with the ISS. The ATV can remain docked for up to six months before being loaded with waste and then disposed of in a destructive re-entry.

The ATV is sharing the ESTEC Test Facilities with two other ESA spacecraft: Rosetta and Integral are also being tested in Noordwijk before they are launched. esa

Transfer of the ATV to the LEAF facility

First Flight Hardware Delivery for the ESA Pulmonary Function System (PFS)

ESA has delivered a science module, the Pulmonary Function System (PFS), to NASA for use on board the International Space Station (ISS). It forms part of the Microgravity Facilities for the Columbus programme and the co-operation between ESA and NASA in the field of human physiology research.

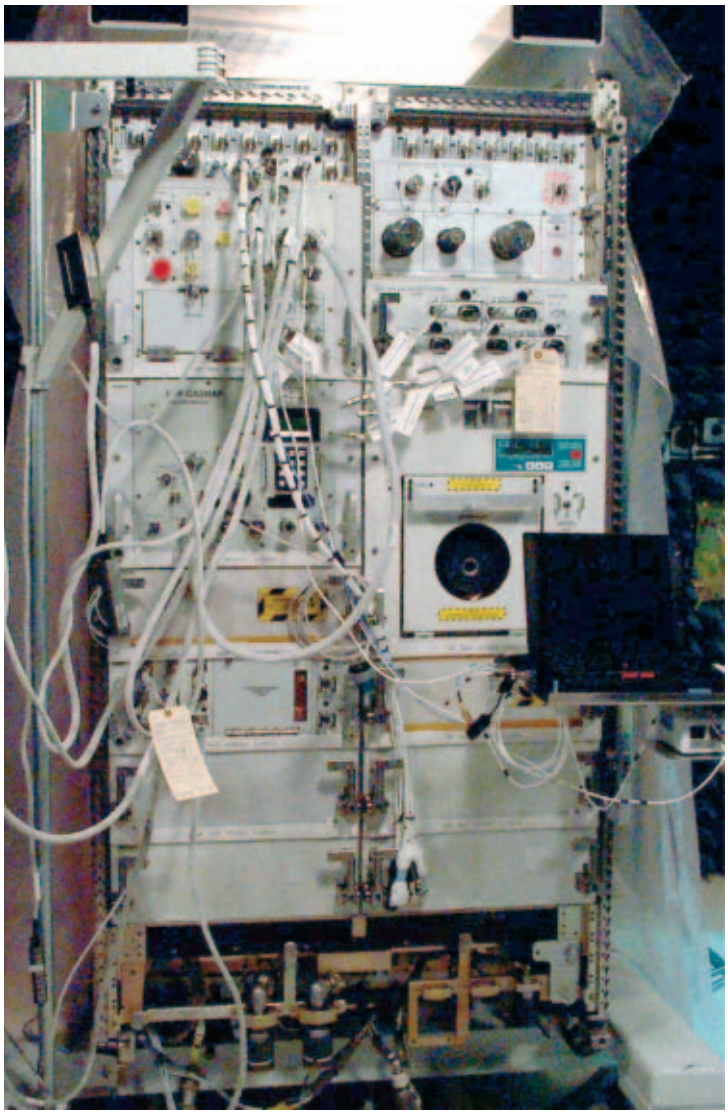
The PFS forms part of the European Physiology Modules (EPM) facility and was originally planned to be launched in the Columbus Laboratory. However, in view of the high NASA interest, ESA was offered an earlier flight opportunity as part of the NASA Human Research Facility (HRF-2) to be launched on ULF-1 in November 2002 and installed in the US Destiny Laboratory.

The PFS is designed to determine the concentration of the different components of a respirated gas mixture (oxygen, carbon dioxide, etc.) by using photo-acoustic methods. The gases for inhalation are supplied by the Gas Distribution System in the NASA HRF facility. The PFS analyser system is a low-power consumption system that can detect gases contained in the breath of the test subject with great sensitivity.

These specific features of the PFS offer exciting possibilities, both with regard to research opportunities on board the ISS and also for clinical medicine on Earth.

The flight model has been delivered to the Johnson Space Center for integration in the HRF-2 Laboratory. Following completion of the testing programme, the HRF-2 will be shipped to the Kennedy Space Center for launch.

The PFS was built by the Danish company INNOVISION S/A and is a fourth-generation ESA development, with the first two generations already launched in 1993 and 1995, and the third planned for flight in mid-2002. INNOVISION S/A, a high-tech company specialised in the field of biomedical engineering, has played a key role in each of these developments. They have also used the expertise gained from each space hardware development to develop and market a corresponding ground-based instrument.



The PFS (top left) integrated in the NASA Human Research Facility

The commercial instrument derived by INNOVISION S/A from the PFS is called INNOCOR. The main purpose of this instrument is to non-invasively measure cardiac output in patients with cardiovascular diseases. In many cases the INNOCOR replaces a potentially dangerous invasive method, which involves insertion of a catheter into the patient's heart. INNOCOR was recently approved for CE marking and is thus ready for sale in all EU countries. The potential market for INNOCOR is estimated at several million Euros, as it is intended for use with patients with such common diseases as heart complaints and hypertension.

Transponder for ATV Arrives at Astrium

An important step in the development of the communications systems for ESA's Automated Transfer Vehicle (ATV) was achieved at the end of December, with the successful delivery of the electrical qualification model (EQM) Transponder to Astrium SAS by Alcatel Espacio. This TDRSS-compatible transponder will handle communication with the TTC ground stations via the NASA Tracking and Data Relay Satellite System (TDRSS).

When work on the EQM is completed, Alcatel Espacio will deliver the flight units for each ATV mission to the International Space Station. It is estimated that there will be one such mission per year, with a first mission planned by 2004.

Sophisticated Thermometer

A special device will allow monitoring of the temperatures in the MELFI payload on board the International Space Station (ISS). MELFI, the "Minus Eighty Degrees Laboratory Freezer for the ISS" will provide cooling and storage capabilities for scientific experiments at three different temperatures (4, -26 and -80°C). In order to confirm that MELFI is meeting the requirements in orbit, a team at ESTEC has developed, built and tested MOOCE – the MELFI ON-Orbit Commissioning Experiment.

MOOCE consists of two parts – one inside one of the four MELFI trays and a laptop-based data-acquisition unit on the outside.

The connection between the two parts is provided by wires going through the MELFI door, which caused some initial problems and hardware restrictions. In order to give a complete temperature map of the tray and the samples, special Multiplexers operating at -80°C are used to read out the 21 temperature sensors.

Another restriction for MOOCE was that it should minimise the additional work for the astronauts. A specific temperature measuring scheme has been developed and tested, and almost all sensors are mounted on the tray or the sample holders themselves, minimising the need for the astronauts to place temperature sensors directly on the samples after insertion. The device has been successfully tested at ESTEC with a temperature measurement accuracy better than 0.5°C. As a next step, MOOCE will be integrated into a flight model of MELFI for a final performance and qualification tests to verify compliance with the strict requirements for ISS payloads.

esa

All About Space Weather: Alpbach Summer School 2002

If you want to learn more about space weather, Alpach in Austria is the place to be. This year's Alpach Summer School from 23 July to 1 August has the theme "Space Weather: Physics, Impacts and Predictions".

The school has a long history. Started in 1975, it takes place every year and addresses different subjects of space research. The aim of the Summer School is to offer advanced training and working experience to European graduates and post-graduate students as well as young scientists and engineers on subjects that are not usually part of the academic curricula. The Summer School is co-organised by the Austrian Federal Ministry of Transport, Innovation and Technology and the Austrian Space Agency (ASA) and co-sponsored by ESA and the national space authorities of its Member States. The Summer School is also supported by the Government of Tyrol.

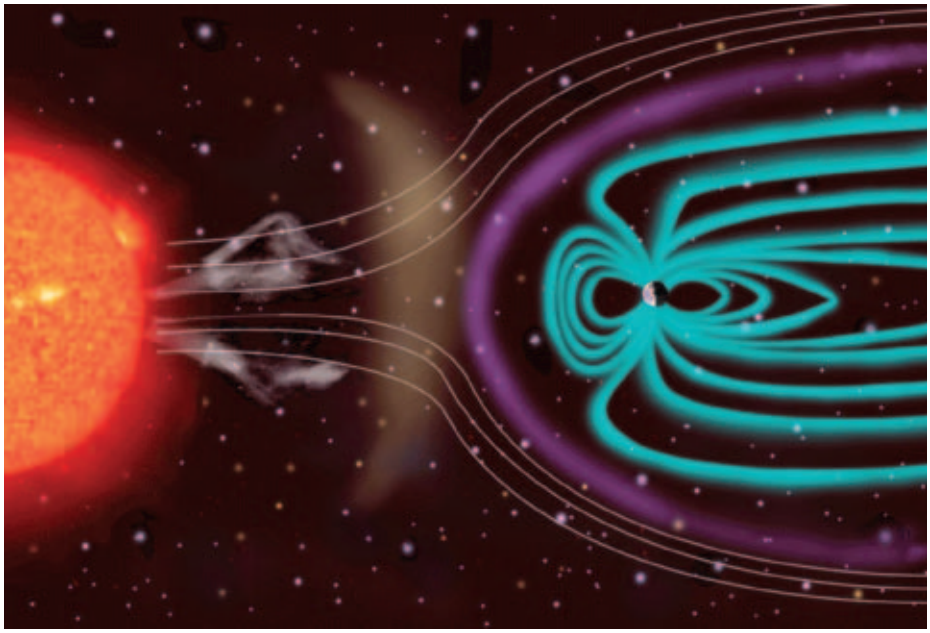
There will be lectures on the basics of space plasma physics and more detailed ones addressing the impact of space weather events ('space storms') on the technical infrastructure in space and on the Earth's surface. Students will also be provided with information on the scientific instruments and data sets that are most important for space weather applications and will be introduced to the engineering tools that are used for designing space missions. Last but not least, the students will learn about new numerical techniques that are used in space weather predictions. Participants can deepen their knowledge in workshops, in which case-studies or representative space projects are conducted. The lecturers are renowned scientists and experts in the field, from universities and space-related agencies.

The application deadline for the Summer School is 29 March. Detailed information can be found at *http://www.asaspace.at*

Two competing teams will each deal with three topics. The workshop teams will be guided by experts, who will act as tutors for the workshops. The lecturers will also participate in the workshops, providing assistance in the definition of the mission to be designed. The results of each workshop team will be presented by the students on the last day of the Summer School to a review panel.

An accompanying social programme will provide students, lecturers and tutors with a convivial atmosphere for informal discussions.

esa



First Image Transmitted by means of an Optic Laser between Artemis and Spot-4

On 30 November 2001, the first-ever transmission of an image by laser link from one satellite to another took place. The system used, called SILEX, consists of the Opale terminal on Artemis and the Pastel terminal on the Spot-4 satellite. It was designed in close cooperation between ESA, the French space agency (CNES) and manufacturer Astrium with over 20 European contractors involved. The terminals exchange high-definition imagery data at 50 megabits per second. Artemis subsequently beams the data to the receiving station operated by Spot Image at Toulouse, using a conventional 20 GHz radio link.

The potential of the new technology extends beyond Earth observation; it promises to revolutionise sat-to-sat communications for constellations in low-earth orbit, geostationary satellites and deep-space exploration probes.

Further information was provided in ESA Bulletin 108, page 114.

First image transmitted by the first optical link in space between SPOT-4 and the Artemis satellite - Lanzarote, Friday 30 November 2001