In Brief

Erasmus User Centre Inaugurated at ESTEC

An important part of Europe's contribution to the International Space Station (ISS) was inaugurated at the Agency's ESTEC site on 28 June. The Erasmus User Centre (EUC) was officially opened by Mrs Monique de Vries, the Dutch State-Secretary of Transport, Public Works and Water Management, supported by ESA's Director General Mr Antonio Rodotà, Director of Technical and Operational Support Mr David Dale, and Director of Manned Spaceflight and Microgravity Mr Jörg Feustel-Büechl.

EUC is primarily a resource centre for those interested in conducting research aboard the International Space Station's European elements. Scientists, engineers and businesses can learn about the orbital facilities and how to access them, and discuss with ESA experts the procedure for developing experiments. First-time and potential users from the non-space sector – as well as those from the 'traditional' space-research community – can familiarise themselves with Space Station hardware, in particular with the full-size, functional model of ESA's Columbus laboratory. Interactive 3D virtual-reality simulations enable them to explore the entire Station, inside and out. A comprehensive electronic library provides information on completed and planned experiments, and gives access to a Space Station database.

Mr Rodotà commented that Mrs de Vries was responsible in her ministerial capacity for roads and waterway, adding that, *"We in ESA are also opening new roads. We open them to increase our scientific knowledge, to improve the capabilities and quality of our products, and to create new business opportunities for our economy.*

The Netherlands occupy a prominent place in the European space ventures. This is the place where the ESA management team is based which is responsible for the development of the European elements of the International Space Station and for the utilisation of the Station by Europe. Therefore, we thought that Noordwijk would be an excellent place to install the Erasmus User Centre [to] bring the utilisation potential of the Station closer to its users and … explain to the public at large the utilisation and, last, but not least, the utility of the International Space Station."

State-Secretary de Vries noted that, *"With the Space Station we are building a unique research centre for important tests that we cannot conduct on Earth. Such a beautiful research facility should be put to good use. This is why I am happy to open*

Mr Antonio Rodotà: "… the Erasmus User Centre … will bring the utilisation potential of the Station closer to its users."

State-Secretary Monique de Vries: "Of course, I truly hope that scientists from all over Europe will find their way to this Centre."

this user information centre today. Scientists who want to conduct experiments in the Space Station can obtain all the information they need right here. What's more, they can prepare their experiments here.

Just as with the premiere of the latest Star Wars film, all available [Space Station] room has already been booked for the first period. Yet I should like to appeal to all companies, laboratories and scientific institutes to determine how they can best use these facilities. Excellent projects can always find the capacity they need.

… perhaps you've seen the film Apollo 13 … so you probably also remember the famous call, 'Houston, we have a problem.' I am positive that we will hear totally different signals here in the years to come. How about, 'Noordwijk, we've got some great result'"

The Dutch Government contributed significantly to the cost of creating the Erasmus User Centre, supported by the Gemeente (Council) of Noordwijk.

The International Space Station is now becoming a reality – two modules are already in orbit, a third is set to join them in November and the first astronauts are scheduled to go aboard in March 2000. The first experiments will begin in the second half of 2000 and exploitation will continue throughout the life of the Space Station, until at least 2013. It is expected that several hundred experiments per year will be carried out in Europe's Columbus laboratory alone.

Mr Jörg Feustel-Büechl: "Let me thank again all those who have contributed to making this Centre a reality."

Mr Feustel-Büechl outlined the centre's four main purposes. Firstly, the team of engineers and documentalists will show potential users what the Space Station offers. There is direct contact with the managers responsible for facility development and utilisation. Not only that, he said, *"It will be equally important to attract new users who today are not yet well aware of the Station and who do not know where to ask for information and advice."*

Secondly, the EUC will provide access through its multimedia library to recorded Station data and to related experiment information within ESA's own databases and those of our international partners.

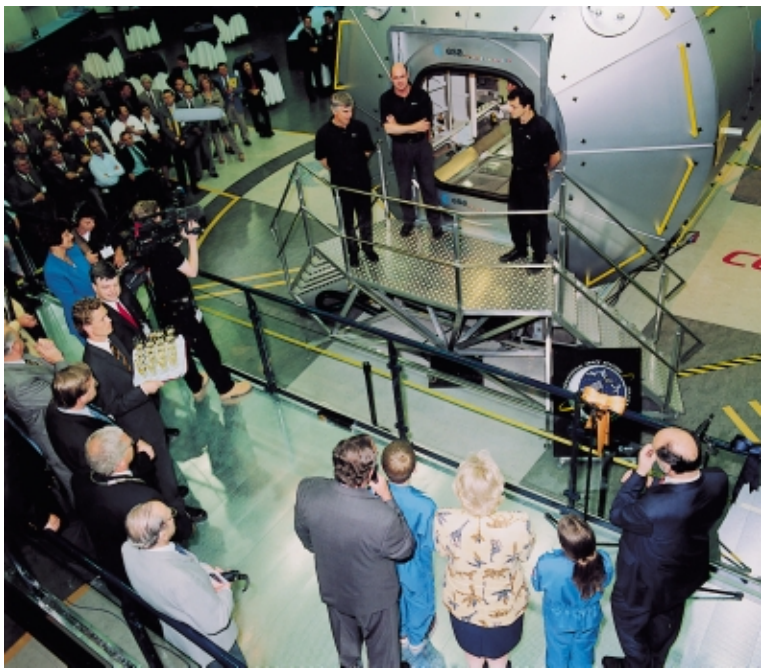
Thirdly, the centre will be used to operate experiment facilities such as the European Drawer Rack in the Columbus laboratory. This makes the EUC, in Space Station terminology, a Facility Responsible Centre (FRC).

Fourthly, it will enable the public and media to share in the Space Station as it becomes the communications hub between the European public and the working astronauts. It offers narrowcasting techniques (visioconferencing and Internet visiophone) and a television and multimedia studio (satellite transmission of video images and Internet streaming).

Broadcasters will be able to conduct interviews with ESA specialists from the television studio or broadcast live via satellite. In addition, ESA will offer broadcasters a daily menu of satellite news items, including interviews down-the-line and archive material of relevance to the day. Ariane launches from Kourou and launches of Space Station hardware from Cape Canaveral and Baikonur and inflight events with crews will be broadcast live via the centre.

Mrs Monique de Vries (centre) with, from left, Mr Jean-Claude Degavre (EUC project manager), Mr Jörg Feustel-Büechl, Mr H. Tankink (Dutch Ministry of Economic Affairs), Mr David Dale, Mr T.B. Sweers (Deputy Mayor of Noordwijk), Mr Antonio Rodotà and Ms Pola Wickham, who painted the fresco in this pre-show area.

Mrs de Vries cuts the ribbon to begin the unveiling of the full-scale Columbus training model.



Mrs de Vries discusses the finer points of Space Station design with Lieke Jitte and Joost de Bont, who took part in the EUC inauguration as winners of a space-drawing competition in a Dutch Primary School.

Introducing three of ESA's astronauts following the Columbus unveiling. From left: Ulf Merbold, André Kuipers and Pedro Duque.

Mr. C. Heemskerk (right) of Fokker Space describes the man-machine interface for the European Robotic Arm to Mrs de Vries and Mr Feustel-Büechl.

Rosetta – ESA's New Comet Chaser Unveiled

In 1986, the European Space Agency's Giotto spacecraft made history by providing mankind's first close-up views of a comet nucleus. Now, 13 years after this remarkable encounter with Halley's Comet, ESA is preparing its Rosetta spacecraft for an even more ambitious robotic space mission to Comet Wirtanen. At a press event held on Thursday 1 July at the Royal Society in London, ESA's Director of Science, Dr. Roger Bonnet, presented this next mission in ESA's ambitious comet exploration programme and unveiled a quarter-sized model of the Rosetta Orbiter and Lander. The full-size spacecraft is 32 m across, almost 90% of this span being accounted for by the giant solar panels needed to power the spacecraft in the darkest depths of the Solar System. The Orbiter will 'chase' Comet Wirtanen for two years and millions of kilometres through space, sending back valuable data and ensuring that Europe retains its lead in cometary science. The Lander will attach itself to the comet's surface and will analyse samples of this lump of frozen ice and dust as it travels through space at over 130 000 km per hour.

Comets – among the oldest and least altered objects in the Solar System – are regarded as the building blocks from which the planets formed. Virtually unchanged after 4.6 billion years in the deep freeze of the outer Solar System, they still contain ices and dust from the original solar nebula. They also contain complex organic compounds that some scientists believe may have been the origin for life on Earth. Therefore, just as the re-discovery of the Rosetta Stone, 200 years ago, enabled the mysteries of ancient Egyptian hieroglyphics to be unravelled, so the Rosetta mission will help scientists learn even more about the birth and evolution of the planets and about the origin of life.

The timing of this 1 July event was chosen to coincide with the London meeting of the Rosetta Science Working Team, and the second Earth flyby of the Giotto spacecraft (no longer operational), 13 years after its original encounter with Comet Halley. Also, the opening of the British Museum's 'Cracking Codes' Exhibition, for which the Rosetta Stone is the centrepiece, was set to take place just a few days later.

Dr. Roger Bonnet, ESA's Director of Scientific Programmes, holding a 1:15 model of the Rosetta spacecraft

The Press Conference. From left to right: Peter Evans, Journalist and Press Conference Moderator; Alan Fitzsimmons, Queens University of Belfast; Gerhard Schwehm, Rosetta Project Scientist; Bruno Gardini, Rosetta Project Manager; Roger Bonnet, ESA Director of Scientific Programmes, with the 1:4 scale model of Rosetta in the background

The Rosetta Mission

Rosetta is the third Cornerstone mission in ESA's 'Horizon 2000' Long-Term Scientific Programme. It will be launched by an Ariane-5 from Kourou, in French Guiana, in January 2003.

In order to gain sufficient speed to reach the distant comet Wirtanen, Rosetta will require gravity assists from the Earth (twice) and Mars. After swinging around Mars in May 2005, the spacecraft will return to Earth's vicinity in October 2005 and October 2007 before heading away from the Sun to rendezvous with Comet Wirtanen.

As it bounces around the Solar System, Rosetta will also make two excursions into the main asteroid belt, where it will obtain the first close-up images and information on two contrasting objects, 4979 Otawara and 140 Siwa. Scientists believe Otawara is less than 20 km across, whereas Siwa is probably 110 km in diameter, and therefore much larger than any asteroid so far visited by any spacecraft. Rosetta will fly within 1000 km of Otawara in July 2006, before making a similar rendezvous with Siwa two years later.

The most difficult phase of the mission will be the final rendezvous with the fast-moving comet. The main rendezvous manoeuvre is foreseen for 27 November 2011, close approach is set for 20 May 2012, and orbit insertion around the nucleus should occur on 28 May 2012. Thus, after a 5.3 billion km space odyssey, Rosetta will make its first contact with Comet Wirtanen about 675 million km from the Sun. At this distance, the sunlight will be 20 times weaker than on Earth, and the comet's nucleus will be frozen and inactive.

Once the navigation team are able to determine the comet's exact location from images returned by the spacecraft camera, a series of braking manoeuvres will allow Rosetta to match its speed and direction with those of its target. After about seven months of edging closer, Rosetta will eventually close to within 2 km of Comet Wirtanen's frozen nucleus. From this close orbit above the tiny nucleus, Rosetta will be able to send back the most detailed images and information ever obtained from a comet. When a suitable landing site has been chosen, about a month after global mapping starts, the Orbiter will release the 100 kg Lander. Touchdown on the comet's surface must be quite slow – less than one metre per second – to allow for the almost negligible gravitational pull of the tiny nucleus. To ensure that the Lander does not bounce and disappear into space, an anchoring harpoon will be fired into the surface on impact.

By this time, the warmth of the Sun will probably have begun to vapourise parts of the nucleus, initiating some form of surface outgassing. For a period of about a month, data from the Lander's eight experiments will be relayed to Earth via the Orbiter, providing unique information on the nature and composition of the nucleus. Samples for chemical analysis will be taken of the organic crust and ices to a depth of at least 20 cm. Other instruments will measure such characteristics as near-surface strength, density, texture, porosity and thermal properties.

Meanwhile, as Comet Wirtanen approaches the Sun, the Orbiter will fly alongside it, mapping its surface and studying changes in its activity. As its icy nucleus sublimates, 12 experiments on the Orbiter will map its surface and study the dust and gas particles it ejects. For the first time, scientists will be able to monitor at close quarters the dramatic changes that take place as a comet plunges sunwards at 46 000 km/h.

By mission's end in July 2013, Rosetta will have spent almost two years chasing the comet for millions of kilometres through space. It will also have returned a treasure trove of data, allowing us to learn a great deal more about how the planets formed and where we all came from.

Dr. Gerhard Schwehm, Rosetta Project Scientist, presenting the mission's scientific goals to the assembled audience

Members of the Rosetta Science Working Team and ESA and Industry Project Teams

Cassini-Huygens Swings by Earth

On 18 August, the NASA/ESA Cassini-Huygens spacecraft bade goodbye to Earth as it completed a highly accurate pass of our planet and swung away towards its encounter with Saturn. The Earth flyby, at 3:28 UT, gave the space probe a 5.5 km per second boost in speed, propelling it towards the ringed planet, more than 1 billion kilometres away.

Engineers at ESA's European Space Operations Centre (ESOC) in Darmstadt, Germany, and NASA's Jet Propulsion Laboratory, in Pasadena, California, confirmed that the spacecraft passed within about 1171 km of Earth, as planned, over the South Pacific.

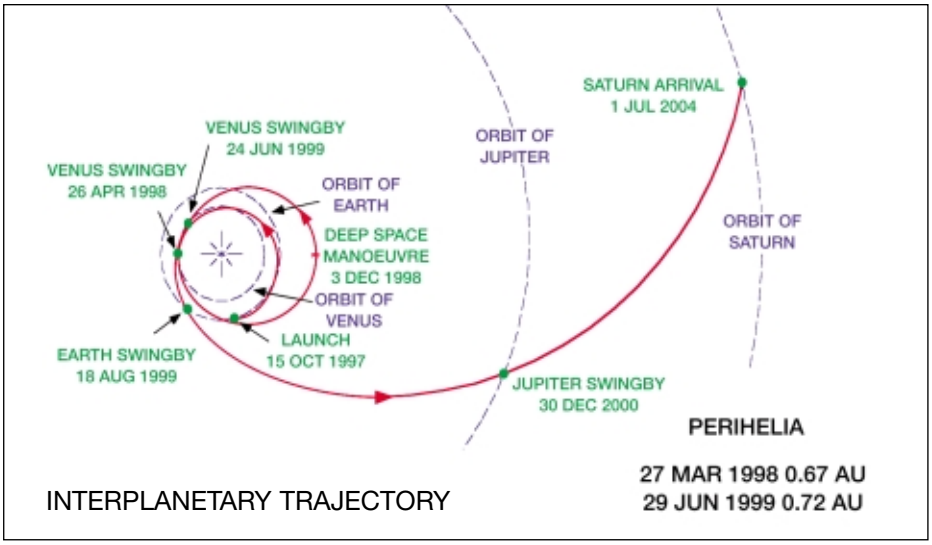
"Everything worked just perfectly and we're very happy" said Jean-Pierre Lebreton, ESA Project Scientist for Huygens. *"Now we're looking forward to an exciting mission of discovery inside the atmosphere and on the surface of Titan, Saturn's largest moon."*

The spacecraft remains in excellent condition as it continues its seven-year flight to Saturn. During the Earth flyby, nine of the twelve scientific instruments on Cassini were turned on to gather data on the Earth/Moon system. The Huygens Probe and its six scientific instruments remained dormant during the Earth flyby. The next bi-annual in-flight Probe checkout activities will take place in mid-September.

Having completed its cruise among the inner planets, Cassini-Huygens' future now lies in the cold, dark realms of the outer planets. It will pass by Jupiter on 30 December 2000 and the giant planet's gravity will bend the spacecraft's trajectory and put it on course for its arrival in orbit around Saturn on 1 July 2004. In November 2004, the Huygens Probe will be separated from Cassini to parachute through Titan's atmosphere and onto its surface.

More information about the Huygens mission can be found at:

http://sci.esa.int/huygens/ esa



More Discoveries from SOHO

SOHO Shows Us the Far Side of the Sun! A truly astounding discovery about our Sun was unveiled by a European team of scientists headed by Jean-Loup Bertaux, of the CNRS Service d'Aéronomie in France, when he reported to the SOHO-8 Workshop in Paris (22 to 25 June). They have found a way of studying the hidden far side of the Sun, allowing us, among other things, to predict the imminent appearance of solar storms originating out of our view behind the Sun.

Bertaux presented a compelling video sequence based on images captured by the ESA/NASA Solar Heliospheric Observatory (SOHO) using one of its instruments called SWAN (Solar Wind ANisotropies). It shows how projections of sunspots on the far side of the Sun rotate through the sky in time with the Sun's own rotation, ultimately emerging on the eastern (left-hand) side of its visible surface. This intriguing discovery could be used to predict the solar storms that periodically threaten the Earth.

"Strong ultraviolet emissions from active regions at the back of the Sun behave like the beams of a lighthouse sweeping over the sea", explained Bertaux, who is Principal Investigator for SWAN. *"The 'beams' rotate through the sky with the Sun,"* taking approximately 28 days to complete one cycle, *"and allow us to monitor activity on the far side of the Sun without observing it directly. This method could be used in future studies on space weather, which is capable of disrupting orbiting satellites and Earth-based electronics".*

"SOHO has allowed us to study the Sun extensively, from its interior to the space surrounding it. It is fascinating to think that now we can detect what's coming at us from the other side of the Sun", says Martin Huber, Head of ESA's Space Science Department.

Figure 1. The observational geometry. The Sun illuminates (in Lyman alpha) the hydrogen atoms of interstellar origin in the Solar System. An active region on the Sun's surface which emits more Lyman-alpha radiation will illuminate the hydrogen atoms within its view even more. This increased illumination (a few percent) can be detected by SOHO's SWAN instrument, even if the active region is on the far side of the Sun. The hydrogen cloud in the Solar System acts as a screen onto which the rotating beam from the active region is projected.

Figure 2. Comparison of SWAN normalised images of the two hemispheres of the sky, and an image of the solar disc taken by SOHO's EIT instrument, both on 30 July 1996. The left hemisphere is that surrounding the Sun (fiducial white circle in centre), and is therefore illuminated by the far side of the Sun. The right hemisphere is the anti-solar hemisphere, seen from the Earth and illuminated by the Sun as seen by EIT.

There is a conspicuously bright active spot on the EIT image, and a corresponding wide brighter area in the right-hand SWAN image.

Figure 3. Same data as in Figure 2, but acquired 10 days earlier, on 20 July 1996. There was no bright spot in the EIT image, and no corresponding brighter area in the right-hand SWAN image. In the SWAN image on the left, however, corresponding to the area of the sky illuminated by the far side of the Sun, there is indeed a wide brighter area. It therefore already reveals the presence of the bright spot on the far side of the Sun which only came into our and EIT's view several days later.

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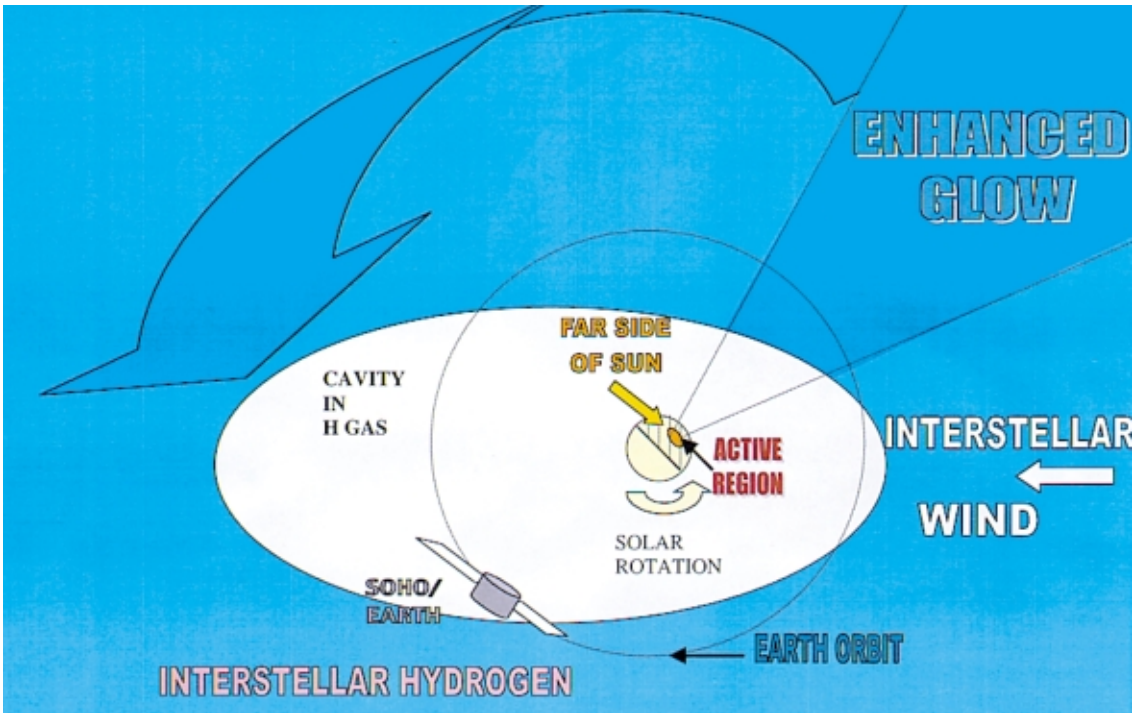
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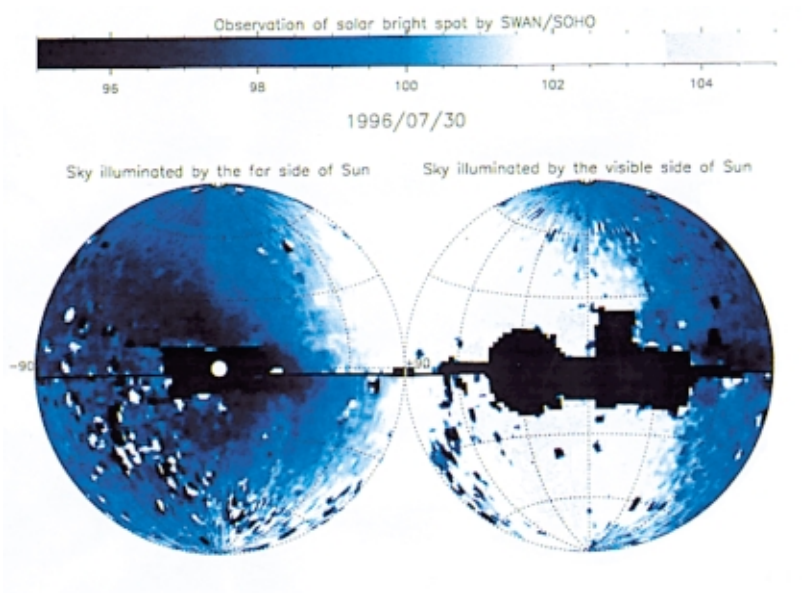
Observation of solar bright spot by SWAN/SOHO
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Sky illuminated by the far side of Sun
Sky illuminated by the visible side of Sun
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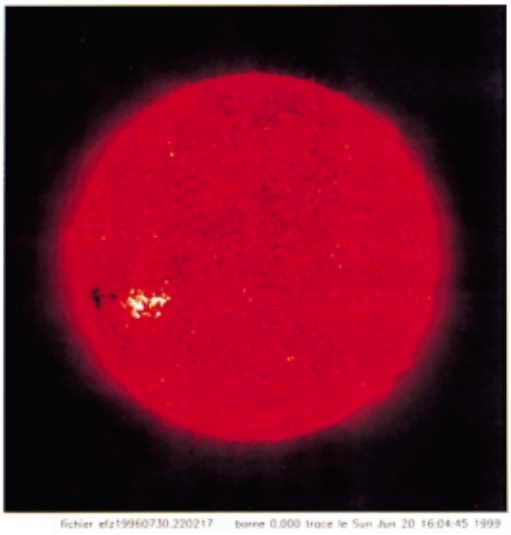

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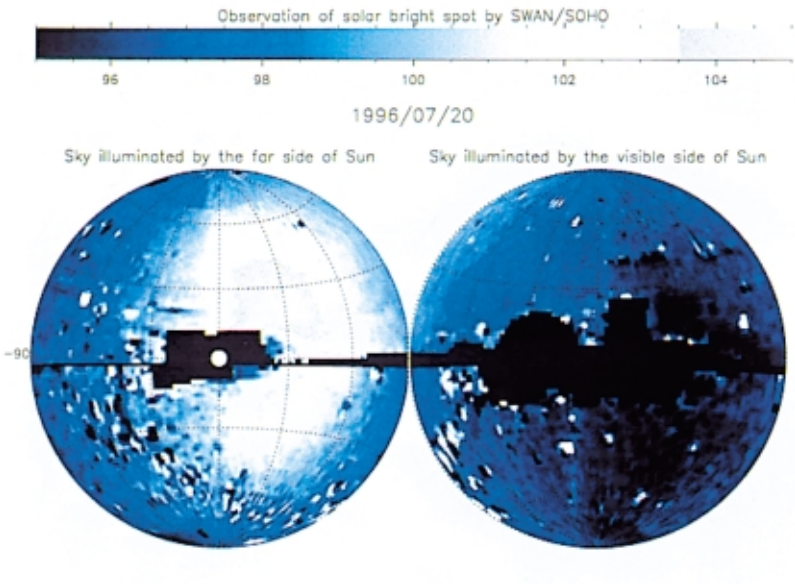
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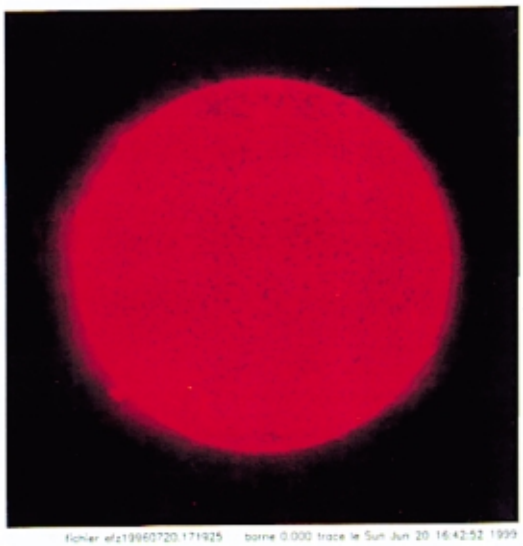


SOHO Sees the Shadow Cast in Space by a Passing Comet

SOHO's SWAN (short for Solar Wind ANisotropies) instrument was designed to create an ultraviolet map of the entire sky. It has chalked up another first by recording the biggest shadow ever observed in our Solar System: the shadow of a passing comet.

Although most of the hydrogen atoms in the Solar System blow in from interstellar space, comets are surrounded by large hydrogen clouds of their own. When Comet Hale-Bopp blazed past the Sun in 1997, sporting a tail 100 million km long, SOHO was on duty in orbit to observe it. Scientists studying the data recorded by SWAN have now detected a remarkable, hitherto unknown feature: the comet cast a shadow more than 150 million km long on the sky behind it.

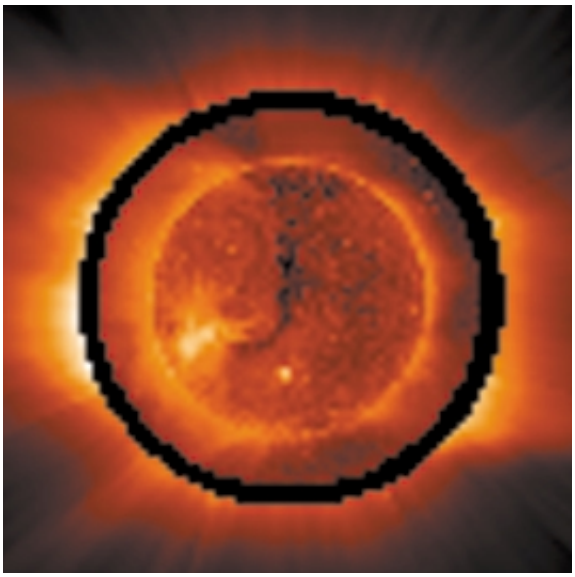
"This allows us to calculate directly the amount of hydrogen and water released by the comet, namely about 300 tonnes per second," says Jean Loup Bertaux.

Roger Bonnet, Director of ESA's Scientific Programme, expressed his appreciation for the SOHO results: *"After many years, SOHO is still at work and fully operational. As in the case of the comet's shadow, it keeps making discoveries and amazing observations."*

Says Bernhard Fleck, SOHO Project Scientist for ESA: *"The nice thing about this discovery is that with SOHO we're not just confined to studying the Sun. Here we are contributing to a different and intriguing field. We are learning more about comets and their physics."*

Solar Wind Surfs Waves in the Sun's Atmosphere!

Solar scientists believe they may have solved yet another long-standing enigma about the Sun. Working on data first gathered from the ESA's Solar and Heliospheric Observatory (SOHO) and then by NASA's Spartan 201 spacecraft, researchers have found that the solar wind streams out of the Sun by 'surfing' waves in the Sun's atmosphere. The fact that this electrified plasma speeds up to almost 3 million kilometres per hour as it leaves the Sun – twice as fast as originally predicted – has been known for several years. The interpretation of how it happens is the real and surprising novelty: *"The waves in the Sun's atmosphere are produced by vibrating solar magnetic field lines, which give solar wind particles a push just like an ocean wave gives a surfer a ride",* says Dr John Kohl, Principal Investigator for the Ultraviolet Coronal Spectrometer (UVCS) – the instrument aboard SOHO which gathered the data – and for the Spartan 201 mission.



The outermost solar atmosphere, or corona, is only seen from Earth during a total eclipse of the Sun, when it appears as a shimmering, white veil surrounding the black lunar disc. The corona is an extremely tenuous, electrically charged gas, known as plasma, which flows throughout the Solar System as the solar wind. The waves are formed by rapidly vibrating magnetic fields in the coronal plasma. They are called magneto-hydrodynamic (MHD) waves and are believed to accelerate the solar wind.

The solar wind is made up of electrons and ions, electrically charged atoms that have lost electrons. The electric charge of the solar-wind particles forces them to travel along invisible lines of magnetic force in the corona. The particles spiral around the magnetic field lines as they rush into space.

"The magnetic field acts like a violin string: when it's touched, it vibrates. When the Sun's magnetic field vibrates with a frequency equal to that of the particle spiralling around the magnetic field, it heats it up, producing a force that accelerates the particle upward and away from the Sun," says Dr. Ester Antonucci, an astronomer at the observatory of Turin, Italy, and co-investigator for SOHO's UVCS instrument, which was developed with financial support from the Italian Space Agency (ASI).

In a way, this is similar to what happens if two people hold a string at opposite ends after threading it through an object like a ring. If one person wiggles the string rapidly up and down, waves form in the string and move towards the person at the other end. The ring will 'surf' these waves and also move towards the other person.

"Even with this major discovery, there are questions left to answer. The observations have made it abundantly clear that heavy particles like oxygen 'surf' on the waves, and there is also mounting evidence that waves are responsible for accelerating the hydrogen atoms, the most common constituent of the solar wind. Future observations are needed to establish this fact. Many other kinds of particles, such as helium (second most common), have never been observed in the accelerating part of the corona, and new observations are also needed to refine our understanding of how the waves interact with the solar wind as a whole," says Dr. Steven Cranmer of the Harvard-Smithsonian Center for Astrophysics, lead author of the research to be published in the Astrophysical Journal*.

Nevertheless, SOHO has again been able to reveal another of the Sun's mysteries: *"This is another triumph for SOHO, stealing a long-held secret from our Sun",* says Dr Martin Huber, Head of ESA Space Science Department and a co-investigator for UVCS. esa

* Article by S.Cranmer, G.B. Field and J.L. Kohl in Astrophysical Journal (Vol. 518, p. 937-947) available on the web at:
http://www.journals.uchicago.edu/ApJ/journal/issues/ApJ/v518n2/39802/sc0.html

Head of Cabinet Retires

Karl-Egon Reuter retired as ESA's Head of Cabinet at the end of July, after having been involved in European space activities for almost 30 years.

A graduate of Aachen Technical University, Karl Reuter joined the ESRO Forecast and Programmes Division in Paris in 1969, from the Nuclear Research Centre KFA Jülich in Germany, where he had been Head of the Project Planning and External Contracts Section. Following the formation of ESA, in 1976 he was appointed Head of the General Planning Department, a post he held until 1980.

From 1981 to 1985, he returned to Germany where, as a DFVLR staff member, he served as Project Control Manager for the Franco-German Direct Broadcast Satellite Project TV-SAT/TDF-1, in Munich.

Karl Reuter returned to ESA in late 1985 as Head of the Agency's Coordination and Monitoring Office. He was appointed Head of the Director General's Cabinet in 1988, with responsibility for the Secretariats of the ESA Council, Administrative and Finance Committee (AFC) and Management Board, the ESA Publications and Public Relations Divisions and the ESA Offices in Brussels, Moscow and Washington.

Karl Reuter was also the initiator, in 1990, of the ESA History Project, which was hosted for the first five years by the European University Institute in Florence and is now being continued at the University of Bologna

ESA Signs the European Physiology Modules Contract

The contract for the development and delivery of ESA's European Physiology Modules (EPM) facility for the International Space Station was signed on 26 May 1999, at ESTEC in Noordwijk (NL), by Mr J. Feustel-Büechl, ESA's Director of Manned Spaceflight and Microgravity and Prof. M. Fuchs, for the EPM Prime Contractor, OHB GmbH.

EPM is a multi-user physiology laboratory developed under ESA's Microgravity Facilities for Columbus (MFC) Programme. It consists of several Science Modules which will allow studies to be conducted in space in the areas of cardiovascular, musculo-skeletal, neuro-sensory and regulatory physiology.

It is planned to launch EPM on board the Columbus laboratory, where it will initially contain the following Science Modules:

- Bone Analysis Module (BAM)
- Multi-Electrode EEG Mapping Module
- Biomedical Analysis Sample Drawer
- Cardiolab Module (provided by CNES/DLR, to investigate the cardiovascular system)
- ELITE-S2 Module (provided by ASI, to investigate motion in space)
- Physiological Pressure and Skin Blood-Flow Instruments (provided by DAMEC).

The EPM facility is designed so that the Science Modules can be exchanged in orbit, allowing in-orbit facility upgrades to be made to perform research in other fields of physiology. As a part of the ESA-NASA co-operation, and in order to optimise utilisation and minimise hardware duplication, EPM will be co-located with the NASA Human Research Facilities 1 and 2. This co-location will allow experiments to be conducted through the combined use of equipment items contained in the ESA and NASA racks.

The industrial consortium, led by OHB GmbH, which is a Small/Medium-sized Enterprise (SME), includes the following subcontractors: EREMS (F), Carlo Gavazzi (I), Innovision (DK), Verhaert (B) and CIR (CH). This is the first contract that has been awarded by ESA to OHB as Prime Contractor. This step underlines the increasing role that SMEs will play in the technology innovation process in Europe, in line with European Union and ESA strategy.

Prof. Fuchs (left) and Mr J. Feustel-Büechl

European Space Initiative to Support Disaster Management

Natural disasters such as floods, earthquakes, volcanic eruptions, forest fires or tropical storms and man-made disasters such as oil-spills continuously strike our planet, causing tremendous human suffering and severe damage to property. Data from Earth-observation satellites such as ERS-1 and ERS-2 operated by ESA, and Spot-1, 2 and 4 operated by CNES (in the framework of cooperation with Belgium and Sweden) can provide the authorities responsible for disaster management with reliable information to complement conventional ground-based and airborne systems.

Over the last few years, many initiatives have been undertaken by space agencies in conjunction with civil protection authorities to demonstrate the usefulness of space techniques for improving our management of natural and man-induced catastrophes. On 21 July, in the context of the UNISPACE-III Conference in Vienna, ESA's Director General, Antonio Rodotà, and the Director General of CNES, Gérard Brachet, announced plans to create a Space System Operators' Charter to promote efficient support to disaster management.

In the event of a disaster, Charter signatories will undertake to support organisations involved in disaster assistance and rescue by making available Earth-observation assets, including satellites, instrumentation, ground facilities and archive image data resources. These will be provided, on request, to civil protection authorities in the signatories' countries. In particular, ESA and CNES specifically agree to jointly allocate their satellite resources to the observation of geographical areas affected by a disaster, with a view to rapidly providing the authorities with the relevant data.

This Charter will be open to all space agencies and satellite operators around the World. esa

Eyes in Space Monitor Floods in Bangladesh

Since 11 July when river levels rose dramatically due to heavy monsoon rains and several embankments gave way, Bangladesh has once again been battling against floods, affecting half a million people and one tenth of the nation's territory. To assist local authorities in coping with this natural disaster, a local receiving and processing station is ready to provide near-real-time flood information derived from data transmitted by radar imaging systems on board ESA's ERS Earth-observing satellites.

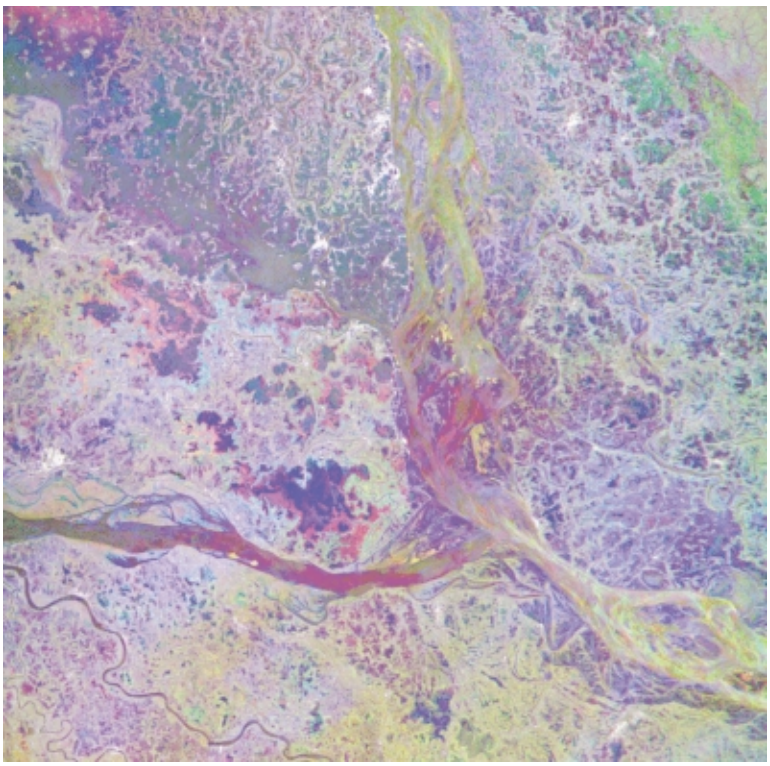
This low-cost station, dubbed RAPIDS (Real-time Acquisition and Processing Integrated Data System), funded by British and Dutch national co-operation programmes, covers the Ganges and the Brahmaputra-Jamuna flood plain. Installed at Dhaka by the Dutch national aerospace research institute NLR, Synoptics (NL), BURS (UK) and NRI (UK), the station is operated by Bangladeshi experts, working with the Bangladesh Water Resources Planning Organisation.

These operations have been made possible by an ESA-funded project, covering six months of ERS data acquisition, processing and associated training activities, under the ESA Data User Programme, one of the Agency's optional programmes, funded by Belgium, Switzerland and the Netherlands. This project is a practical demonstration of Europe's commitment to putting space technology to effective use on behalf of the developing countries most severely affected by major catastrophes. Bangladesh was hit last year by the worst flooding this century, which killed over 1200 people and caused economic losses of more than two billion Euros.

The Synthetic Aperture Radar (SAR) imager on board ERS-1 and ERS-2 is particularly well suited to monitoring floods over large areas since it penetrates clouds and operates day and night. The accompanying archive images cover a 100x100 km^2 area, where the Ganges (left) and Brahmaputra or Jamuna (top) rivers converge in Bangladesh (right).

These images are an example of one of the techniques used in flood mapping. The first is a multi-date, false-colour image derived from three black and white SAR images taken before and during the flood. The colours in image 2 distinguish between the flooded (blue) and the non-flooded (brown) areas, with the normal riverbeds in black, following analysis and interpretation of the multi-date image. This information is then matched against a digital elevation model to derive water levels and estimate the duration of the flooding.

1



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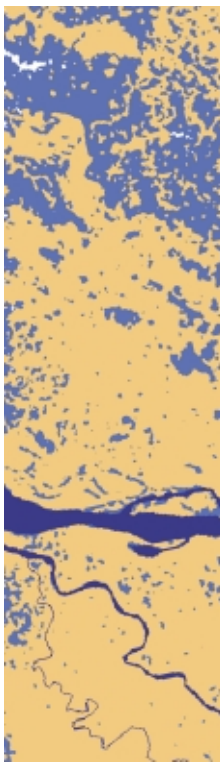

Over the long term, the radar image archive on Bangladesh in the monsoon season will facilitate mapping of hazards in areas where the population fishes and farms (growing rice in particular), when the flood plain is subject to unusual flooding or droughts. The radar archive also serves to identify river migration and coastal processes due to the yearly monsoon and flooding.

ESA's ERS-1 and ERS-2 Earth-observing satellites, launched in 1991 and 1995, respectively, have been collecting a wealth of valuable information on the Earth's land surface, oceans, sea ice, polar caps and atmosphere. Europe's future contribution to addressing worldwide environmental problems comes in the shape of Envisat. This sophisticated satellite, to be launched in 2000 by an Ariane-5, will provide users with even more refined and specialised remote-sensing data with which to chart and document changes in our environment, and will supply reliable information for better management of natural or man-made disasters.

For further information, please contact:

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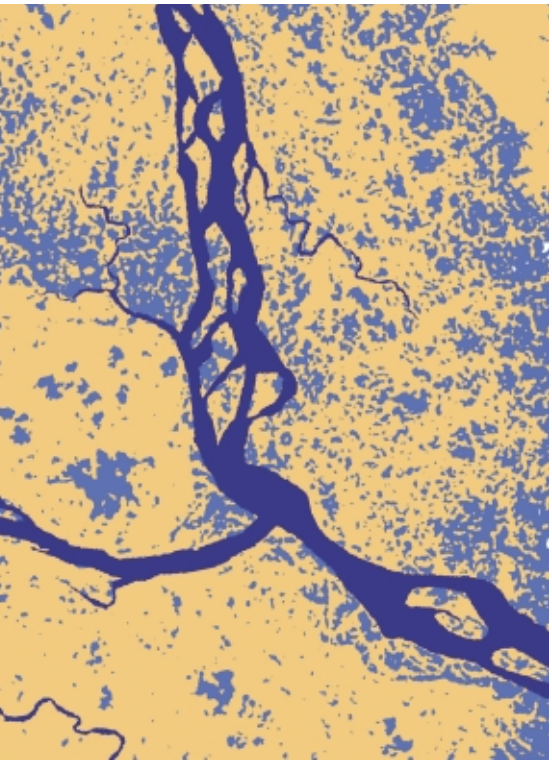

European Students Explore Possible Mars Mission

Seventy-two students from the Agency's Member States attended this year's Alpbach Summer School from 3 to 12 August, in the small mountain village of Alpbach in the Austrian Tyrol. The annual Alpbach Summer School is co-organised by the Austrian Space Agency, the Austrian Federal Ministry of Science and Transport, and ESA with support from its 14 Member States.

This year, the students were set the task of defining a future Mars Exploration Mission. Some twenty-five European experts were on hand to provide them with an overview of all aspects of the Red Planet, including the chemical and mineralogical composition of its surface, its geophysics and its geochemistry. A review of past, present and future exploration of Mars was also presented. ESA's Director of Science, Dr. Roger Bonnet, opened this year's gathering with a lecture on "Mars Exploration: For What Purpose? How?"

Having studied a variety of possible missions to Mars, the students proposed the use of an airship, or 'Zeppelin', as a highly versatile vehicle for exploring the Red Planet. Space scientists have so far traditionally concentrated their efforts on rovers, balloons or planes, i.e. systems that are bound to the surface, are free-flying but not steerable, or are too fast for detailed local investigations. The novel idea of using a Zeppelin provides for three-dimensional steering and a choice between sojourning at an interesting spot, and travelling for surveying the landscape or to visit another location. A Zepplin would be especially useful for studying the so-called 'Mars dichotomy', a seven-kilometre-high wall that gives access for the study of many geological layers which could otherwise only be studied by deep Martian drilling.

"The students of this Summer School demonstrated with their studies that we can look forward to a future generation of European space scientists with excellent skills and creativity", said Prof. Hans Balsiger, Chairman of ESA's Science Programme Committee, when he summarised the results of the two weeks' work by the 72 students.

Additional information on this and other Alpbach Summer Schools can be obtained from:

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Some of the Alpbach students at work

Black Sun: ESA's Eclipse99 Activities

The total solar eclipse of 11 August 1999 was a unique opportunity to share our enthusiasm for space with the public. Scientists and technicians from ESA's Space Science Department prepared a range of activities culminating with dedicated eclipse events in Europe as part of the Eclipse99 campaign. The experience and emotions proved to be overwhelming, even for those who suffered cloudy skies. More than 300 million Europeans became eclipse viewers as the shadow swept across the southwest of England, northern France, Belgium, Luxembourg, Germany, Austria, Hungary, Romania and Turkey.

ESA's multi-site campaign along the path of totality provided a longer sequence of coronal observations plus video images transmitted for live internet distribution.

The core SSD science experiments built on previous eclipse campaigns to study coronal temperature and density structure and dynamics, and to search for cool material in the very hot corona. These eclipse results are now being analysed in conjunction with Soho data.

ESA concentrated its activities in Noyon, France, where some 8000 amateur astronomers and general public at the official eclipse viewing site included 380 staff from ESA ESTEC and Paris, plus 40 000 people in the city of Noyon itself. This was a major public relations event for ESA and the solar-viewing Soho satellite. Soho images and results were shown and described for the public and radio listeners by Eclipse99 coordinator Bernard Foing and M. Laurent, vice-president of Societé Astronomique de France. Live interviews were given to national radio stations such as France-Inter, France Info and even Washington, DC. More than 30 interviews were given by the Agency's multinational staff. Although the cloud cover thickened before totality, the darkness still provided a unique experience and the partial eclipse was visible later.

In Thionville, France, ESA's small eclipse imaging team found good weather conditions and took eclipse pictures that were used by the BBC's online site. At Chateau de Malbrouk, near Metz, Roger Bonnet, ESA's Director of Science, appeared on French TV several times over two days, but the sky was cloudy at totality.

The whole week leading up to the eclipse saw daily press conferences in the France 3 TV auditorium at Strasbourg, where Soho videos, CD-ROMs and the latest images were presented by Bernard Foing and the Soho Deputy Project Scientist Pål Brekke. "*The eclipse day started with morning rain, then clouds. Just before*

Noyon

Alan Denton was proud of his home-made viewer.

Eclipse99 coordinator Bernard Foing maintained a flow of information at the site.

Photos: Anneke v.d. Geest, ESA Photographer

Spreading the ESA word at Noyon.

eclipse totality, the sky just opened up", Dr Brekke says. "*It was blue and it was dark and people were just stunned.*" A beautiful eclipse video sequence was obtained.

Soho Project Scientist Bernhard Fleck was in Stuttgart, where the Science Fair attracted 500 000 participants. It was, however, raining on the day of eclipse. Detlef Koschny and Joe Zender had better luck in Munich, where there was a clear sky at totality and great eclipse video images were obtained and relayed to ESTEC.

In Burgenland, Austria, a team from the Space Generation Forum that last met at the UNISPACE III conference in Vienna had organised a trip led by ESTEC Young Graduate Trainees Norbert Frischauf and Gudrun Weinwurm to the central totality line near Oberwart, where they watched the shadow approaching from the west and experienced the longest period of totality of all the ESA member states (2 min 21.5 s).

At the International Youth Astronomy Camp in Vep, near Szombathely, Hungary, more than 150 students had been enjoying lectures and experimental activities since the beginning of August. Salvatore Orlando and his local collaborators installed the SSD eclipse science experiments previously used in total eclipses in Chile in 1994 and Guadeloupe in 1998. There was rain and clouds during the morning until first contact, but clear sky at totality. Excellent video images were obtained, routed to the BBC for their web broadcast.

In Bucharest, Romania, the superb blue sky allowed Bernard Zufferey (ESA Prodex) to obtain video eclipse images. In Turin, Italy, Eclipse99 committee member Ester Antonucci reported that 6000 people turned up and that the eclipse live on TV took 41% of the national audience, with a peak of 6 million people.

At ESTEC, a public event was organised at Noordwijk Space Expo for more than 1600 people. SSD solar scientist William Chaplin and eclipse veteran Thierry Beaufort gave presentations about the Sun, Soho and eclipses. Working from ESTEC, Frans Moser and Thierry Beaufort coordinated the installation of the cameras and simultaneous data acquisition and transmission system from ESTEC for the six different sites. The captured images were relayed directly for the BBC's live web site.

Selected images from the eclipse sites can be found on and downloaded from http://sci.esa.int/eclipse99/index.html

Ulysses Project Scientist Richard Marsden took a different view of the Sun this time.

Willem Smit and daughter Fiona brought their own eclipse, just in case.

The view towards Noyon during totality. Inset: the partial phase was visible after totality

Noordwijk

Although the Netherlands was outside the path of totality, Noordwijk Space Expo drew a large audience.

Trevor Sanderson, of the ESA Space Science Department, decided to fly on the morning of the eclipse from Rotterdam in a light aircraft with the ESTEC Flying Club down to Le Tréport, a small private airfield on the Normandy coast, on the northern edge of totality.

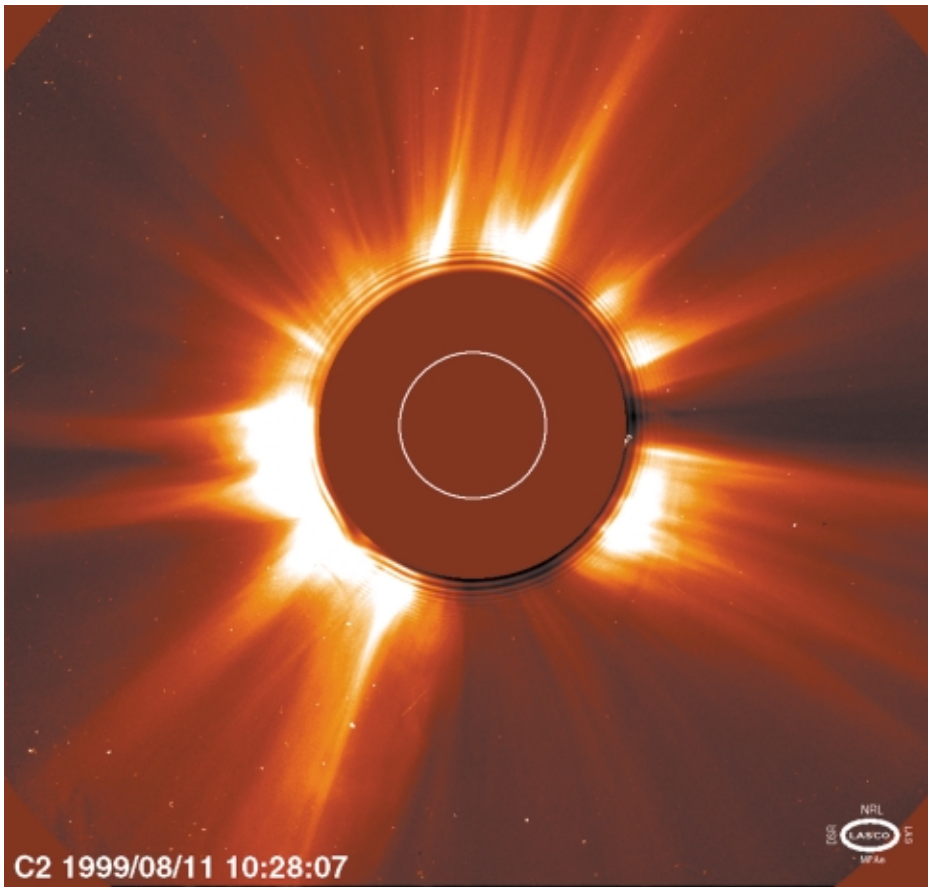
"We were lucky in choosing Le Tréport because, by the time we landed at 9am, visibility was 90 km as a result of a high-pressure area pushing into France. Thanks to clear skies, the temperature dropped dramatically in the hour before totality, so much so that most of us had to put on pullovers or jackets to keep warm. In the few seconds before totality, the excitement grew. The Sun's crescent was now very thin, and already it was possible to see some of the planets. Then the Diamond Ring appeared for a few seconds, and suddenly totality was upon us.

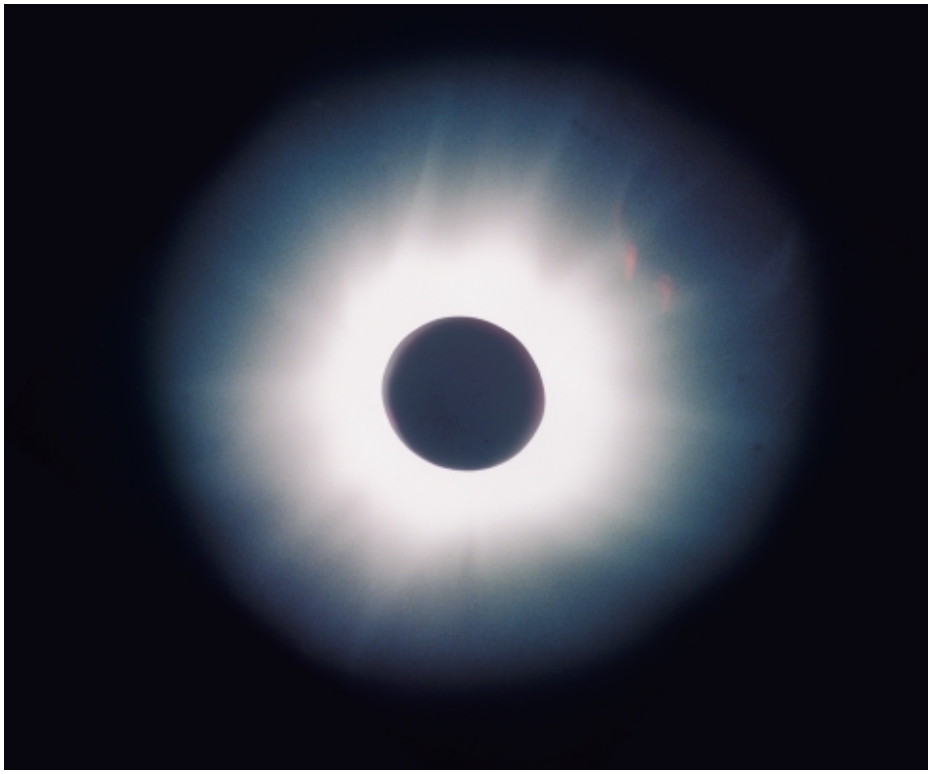
Looking into the viewfinder of my camera, with its 500 mm lens, the sight was overwhelming. Baily's Beads were visible,

extending almost all the way around the Moon's disc, sparkling all the time. Now it was also possible to look through my binoculars, where the eclipse looked truly fantastic. I was enthralled by the red chromospheric light in the beads. No photograph can really do this justice.

Then, someone shouted 'Don't look any more!', as the Diamond Ring reappeared and a brilliant shaft of light emerged, and it was all over. Only 1 1/2 minutes, gone in a flash. Slowly, the crescent filled out and the temperature rose again. Unbelievable. Incredible.

Afterwards, we learned that we were part of the privileged small fraction of the population of Western Europe who had seen the whole of the eclipse under not only blue skies, but such exceptionally clear blue skies. Not far to the south, it was still raining for the eclipse, and inland, in the rest of France, it was generally overcast."





Baily's Beads were captured by Hubert Degroote positioned at St-Martin-aux-Buneaux, Normandy, in a 1/1000 s exposure on 100 ISO film using a 1000 mm lens. The beads are created by sunlight flickering through mountain ranges on the Moon's limb.

Trevor Sanderson used an exposure of 0.5 s with a 500 mm lens and 200 ISO film to reveal the extent and structure of the corona as seen from Le Tréport, France. The coronal features can be compared with those recorded at the same time by the LASCO coronagraph aboard Soho (courtesy of Simon Plunkett, US Naval Research Laboratory, Washington DC).

This sequence of images was returned by the Meteosat-6 weather satellite from its position at 9°W in geostationary orbit. Instead of covering the full Earth disc at 30-minute intervals, as Meteosat does in its normal operating mode, a large part of the northern hemisphere was scanned every 10 minutes. This provided a more frequent observation sequence as the Moon's shadow moved across the Earth's surface. The images were rectified to 0° longitude and enhanced to emphasise the shadow. The first frame (right) shows the eclipse-free Earth at 10:10 CET. The heavy cloud cover that spoiled the view for many along the path of totality is evident. The next frame, at 12:10, shows the eclipse approaching Europe across the Atlantic. The final three frames are of 12:30, 12:50 and 13:10 CET. (©1999 EUMETSAT)