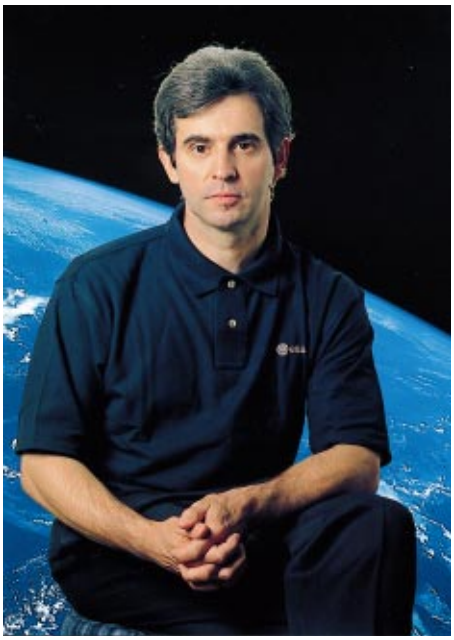
In Brief



Four European Astronauts Begin Training in Houston

Four European astronauts have joined 14 others from the United States, Canada and Brazil in the Astronaut Class of 1998, which began Mission Specialist training at NASA's Johnson Space Center in Houston, Texas, on 24 August. After successful completion of the 12-month basic training programme, they will be eligible for assignment to future missions on the US Space Shuttle and the International Space Station.

The four astronauts – Léopold Eyharts (F), Hans Schlegel (D), Paolo Nespoli (I) and Roberto Vittori (I) – will take part in courses ranging from an in-depth study of the Shuttle and Space Station systems to survival training in remote areas.

The astronauts joined ESA during the summer in the first phase of the creation of a single European Astronaut Corps. Existing astronaut programmes in individual European countries are being merged into a single one under ESA management in order to allow Europe to respond in a cost-effective manner to the mission opportunities that will become available to ESA as the European partner in the International Space Station (ISS).

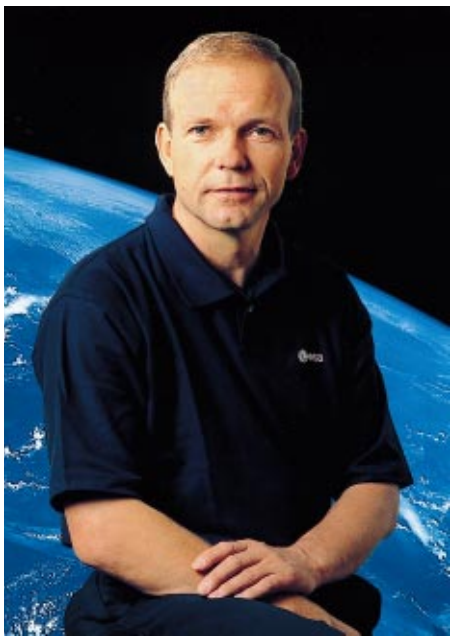
Léopold Eyharts is the European astronaut who has most recently spent time in space. He represented the French National Space Agency, CNES, on the French-Russian Pégase mission aboard the Russian space station Mir for three weeks in February 1998.

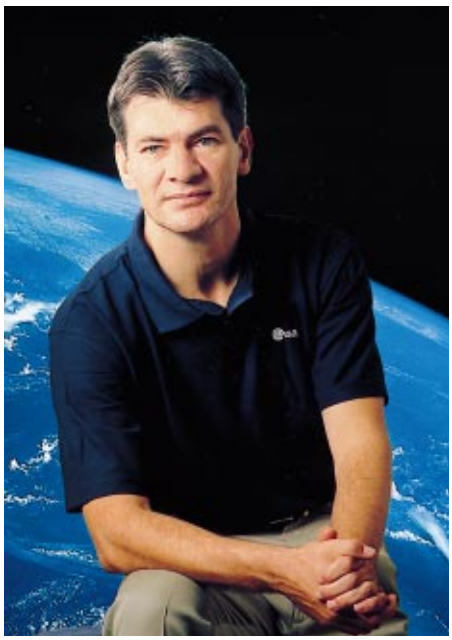
Hans Schlegel flew aboard the Space Shuttle's STS-55/D-2 mission in April-May 1993 as an astronaut of the German Aerospace Centre, DLR, and since then has trained extensively at Star City, in Russia.

Paolo Nespoli and Roberto Vittori are both astronaut candidates selected in July by the Italian Space Agency, ASI, in cooperation with ESA. Paolo Nespoli was previously an astronaut training engineer with ESA and prepared training for the ISS, while Roberto Vittori is a major in the Italian Air Force and is specialised as a test pilot.

The first element of the ISS was launched into orbit on 20 November (see page 123 of this Bulletin). The first astronauts will move into the Station about six months after its construction begins. European astronauts will begin living and working on the Station shortly thereafter. esa

Left: Léopold Eyharts
Below, left to right: Roberto Vittori, Hans Schlegel and Paolo Nespoli





ESA Recruits Two New European Astronauts

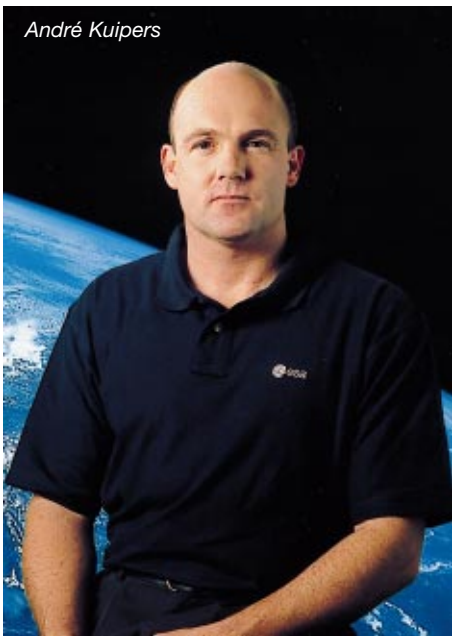
On 5 October, at Space Expo in Noordwijk (NL), ESA's Director General Antonio Rodotà, together with the Dutch Minister for Foreign Trade, Gerrit Ybema, announced the appointment of André Kuipers (NL) to the European Astronaut Corps.

On 19 October, during the opening of the Association of Space Explorers Congress, Mr Rodotà, together with the Belgian Minister for Science Policy, Yvan Ylieff, announced the appointment of Frank De Winne (B) to the Corps.

André Kuipers (aged 40), a medical doctor from Amsterdam and Frank De Winne (aged 37), a senior test pilot in the Belgian Air Force, will begin training, around mid-1999, in order to qualify for future missions aboard the International Space Station.

Kuipers is a specialist in space-related medical research. Since 1991, at ESTEC, he has participated in the preparation, data collection and ground control of physiological experiments developed by ESA for flight on the US Space Shuttle, the Russian Mir space station and, in the future, on the International Space Station. He also coordinates the life-science experiments for ESA's parabolic-flight campaigns and participates as an experimenter, test subject and flight surgeon.

Kuipers is the second Dutch astronaut. The first, Wubbo Ockels, was recruited in 1977 and flew on the Spacelab D-1 mission in 1985 on the US Space Shuttle.



André Kuipers

Frank De Winne

De Winne, a Major with 12 years of flying experience and a special interest in man-machine interfaces, has logged 2300 hours of flying time on various types of high-performance aircraft. He is currently the squadron commander of the 349th Fighter Squadron stationed at the Kleine Brogel Airbase in Belgium.

De Winne is the second Belgian astronaut. The first, Dirk Frimout, flew on the Space Shuttle's Atlas-1 (STS-45) mission in 1992.

With these nominations, ESA has completed the first phase of its creation of a single European Astronaut Corps by merging existing national astronaut programmes with the ESA programme (see ESA Bulletin 95, pages 47-53). The goal is to have a total of 16 astronauts by mid-2000 in order to meet the demand for European astronauts as the International Space Station is assembled and onboard research begins. The European Corps currently comprises 12 astronauts: Jean-François Clervoy, Léopold Eyharts, Jean-Pierre Haigneré (France); Thomas Reiter, Hans Schlegel, Gerhard Thiele (Germany); Umberto Guidoni, Paolo Nespoli, Roberto Vittori (Italy); Pedro Duque (Spain); Christer Fuglesang (Sweden); and Claude Nicollier (Switzerland). Their home base is the European Astronaut Centre in Cologne, Germany. esa

113-112-111-110-109....Lift-off

Four more successful Ariane-4 launches have taken place from the ESA launch site in Kourou (French Guiana) – on 25 August (V109), 16 September (V110), 5 October (V111) and 28 October (V113) – placing six more satellites into geostationary orbit as follows:

- V109: ST-1, the first telecommunications satellite operated by Chunghwa Telecom of Taiwan and Singapore Telecom
- V110: PAS-7, an international telecommunications satellite operated by PanAmSat Corp. (US)
- V111: W2 for Eutelsat and Sinus-3 for NASB (S)
- V113: Ge-5, a US television satellite and AfriStar, a direct radio broadcast satellite for the African continent.

Flight V112 corresponds to A503, the third flight of Ariane-5 which took place on 21 October (see page 4 of this Bulletin). esa

Ariane V110 lifts off on 16 September carrying the international telecommunications PAS-7 spacecraft

ESA Astronaut Awarded 'Soyuz Return Commander' Certificate

On 2 October, ESA astronaut Christer Fuglesang was awarded the 'Soyuz Return Commander' certificate at the Yuri Gagarin Cosmonaut Training Centre in Zvyozdny Gorodok (Star City), near Moscow, qualifying him to be the commander of a three-person Soyuz capsule during its return from space.

He is the second non-Russian to have earned this certificate (fellow ESA astronaut Thomas Reiter was the first, in July 1997). Moreover, Fuglesang will become the first European astronaut trained as a NASA Mission Specialist who is also able to command the Russian vehicle.

The Soyuz is used to transport astronauts to and from the Russian space station Mir. When the International Space Station (ISS) gets underway, the Soyuz will be one of two vehicles used by Station astronauts; the other is the US Space Shuttle. The Soyuz will also be the main vehicle that the astronauts onboard the ISS will use in the event on an emergency – at least one Soyuz will remain docked at all times to the Station as a 'lifeboat' in the initial years of operation.

Christer Fuglesang, of Swedish nationality, joined the European Astronaut Corps in 1992. After introductory training at ESA's European Astronaut Centre (EAC) in Cologne, Germany, and two years of intensive training in Russia, he was the "Board Engineer 2" remaining on stand-by for the joint European-Russian Euromir 95 mission.

In April 1998, he completed a two-year Mission Specialist course at NASA's Johnson Space Center, qualifying him for future Space Shuttle flights. He resumed training at the Yuri Gagarin Training Centre in Russia in June 1998 and since then has undergone some 500 additional training hours for the Soyuz Commander certificate. esa

New ESA Director of Application Programmes

At its 137th meeting held at ESA HQ in Paris on 21 and 22 October, the ESA Council appointed Mr Claudio Mastracci (I) as Director of Application Programmes.

Born on 30 March 1940, Mr Mastracci graduated with a degree in electronic engineering from the University of Rome in 1964. He subsequently completed a postgraduate degree in telecommunications.

In 1966 he joined Selenia (I) as a radio frequency designer in the Communication Division. In 1984 he was appointed Central Technical Director, a position he maintained when Selenia Spazio merged with Aeritalia GSS in 1990.

In 1994 he became Deputy General Manager of Alenia Aerospazio and then First Vice President of Operations in 1997.

Claudio Mastracci is presently Senior Vice President and a Member of the Management Board of the Space Division of Alenia Aerospazio, where he is in charge of strategic alliances and international cooperation, with particular regard to new initiatives, product strategy and research & development.

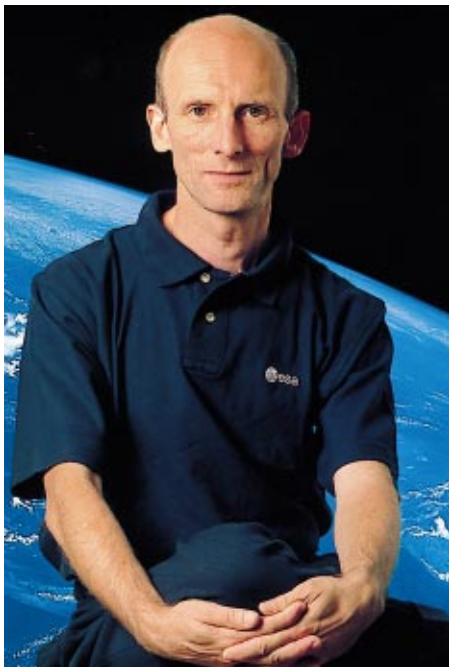
Mr Mastracci is expected to take up duty at ESA by 1 December 1998. esa

European Astronaut Assigned First Shuttle Flight

ESA and the German Aerospace Centre (DLR) have announced the assignment of Gerhard Thiele (D), as Mission Specialist on Shuttle flight STS-99. The Shuttle Radar Topography Mission (X-SAR/ SRTM), dedicated to the ecological mapping of the Earth's surface, is scheduled for September 1999.

Gerhard Thiele, a physicist, was trained as a Payload Specialist by DLR and was a member of the German D-2 flight back-up crew, in which he was responsible for communications between the astronauts onboard the Space Shuttle Columbia and the scientists in the Control Centre at Oberpfaffenhofen, Germany. He has since started Mission Specialist training at NASA-JSC to qualify him for missions on the Space Shuttle and the International Space Station. This will be his first Shuttle flight.

For the SRTM mission, the Shuttle will have a complex arrangement of radar systems onboard, including a high-tech instrument made in Germany. The mission's objective is to create a three-dimensional image of the Earth. For the first time, the planet's surface will be simultaneously scanned from two different perspectives. Opening the cargo bay will bring the planet into the sights of a 12-metre radar antenna and a second system, mounted on a 60-metre telescopic arm. With this configuration, a great technological challenge, the Earth will



Gerhard Thiele has been selected as Mission Specialist on STS-99 due to be launched in September 1999

be viewed by two "radar eyes" simultaneously. Both radar systems can receive the returning signal in more or less "stereo" mode, which is the mission's prime innovation.

Topographic surveying of the Earth supplies crucial basic data to solve many problems in the areas of geoscience and environmental protection. Radar is ideally suited for remote sensing, with two decisive advantages over conventional optical procedures: radar can "see" both at night and through cloud cover, so that a complete survey of the Earth's surface can be made in just a few days.

Topographic data and digital surface models obtained from the Shuttle Radar Topography Mission will pave the way for a wealth of applications. Digital altitude records will serve to improve processed products based on data delivered by other European environmental monitoring satellites and are a prerequisite for extremely precise cartographic products. Records of this kind can also be helpful in the extension of cellular telephone networks, above all in identifying optimum locations for transmitting masts.

Finally, disaster control management (e.g. in the case of flooding) also depends on such data for information on the situation in the areas affected. Weather forecasting and climate modelling will also benefit from exact topographic data.

The six astronauts onboard the Shuttle will have the difficult task of precisely extending the telescopic mast and aligning it with the antenna. They will also control the data recordings, a volume of almost 3000 Gb, that will provide an almost complete survey of the Earth's surface.

SRTM is a joint project of NASA, NIMA (National Image and Mapping Agency), DLR (German Aerospace Centre) and ASI (Italian Space Agency). NASA's Jet Propulsion Laboratory (JPL) is responsible for the development of the C-Band Radar Interferometer System, DLR for development of the X-Band Radar System. Dornier Satellite System, a subsidiary of Daimler-Benz Aerospace (Dasa, Munich), is the main industrial contractor for development of the X-SAR radar system. esa

A New Look for ESA's Space Science Web Site

http://sci.esa.int/

This web site is a key part of the ESA Science Directorate's outreach policy. The role of the site is to promote ESA's space science missions, their scientific benefits and latest findings. It also aims to encourage interest and participation from scientists, industry, the media and the public. During the coming months, the look and tone of the site is set to change and what you see now is just the start of this transformation.

Part of the task is to make the site easier for people to use, helping them to learn more about ESA's work. The news and images are presented in a fresh, bold and consistent style, giving even the most unscientific of users a feel for the latest discoveries in space science.

From this web site, you can obtain information on:

- satellites in orbit: Hubble Space Telescope (HST), Ulysses, Infrared Space Observatory (ISO), Solar and Heliospheric Observatory (SOHO), Cassini/Huygens
- satellites under development: XMM, Cluster-II, Integral, Rosetta, First/Planck
- future Cornerstone studies: GAIA, IRSI, Lisa, Mercury Orbiter. esa

Integral Space Observatory Presented to the Media

On 22 September, media representatives were given a unique opportunity to inspect the full-size Structural Thermal Model of ESA's International Gamma-Ray Astrophysics Laboratory (Integral), in the Agency's Test Centre at ESTEC in Noordwijk (NL). Journalists, photographers and television crews were invited by the Agency to view the 5 m-high spacecraft, which weighs more than 4 tons. To be launched from Baikonur in 2001 on a Russian Proton vehicle, Integral has been designed to help scientists to decipher the processes of the Universe's alchemy which fabricate the elements of stars and galaxies, as well as the end points of stellar life.

The industrial Prime Contractor for the Integral spacecraft is Italy's Alenia Aerospazio in Turin. The Principal Investigators responsible for the provision of the scientific instruments to be flown and for the scientific data's pre-processing and distribution are listed below (box).

Why gamma-ray astronomy from space?

Being a million times more energetic than visible light, gamma-rays are the most powerful form of electromagnetic radiation known. Consequently, gamma-ray astronomy can be used to explore the most energetic phenomena occurring in nature and to address some of the most fundamental problems in physics. It can provide us with novel information about the stupendous physical events that made the Universe habitable. We now know, for instance, that most of the chemical elements in our bodies come from long-dead stars, but how were these elements formed?

However, gamma-rays cannot be detected from the ground because the Earth's atmosphere shields us from such high-energy radiation. Space technology provides the answer by allowing observatories like Integral to operate from outside the Earth's radiation belts, at an orbital altitude of more than 40 000 km.

One of the Integral mission's most important scientific objectives will be to study such compact objects as neutron stars or black holes. Besides stellar black holes, there may exist much bigger specimens of these extremely dense objects. Most astronomers believe that in the heart of our Milky Way, as in the centres of other galaxies, there may lurk giant black holes. Integral should be able to find evidence of these exotic objects.

Even stranger than the energetic radiation coming from the centres of distant galaxies are flashes of extremely powerful radiation that suddenly appear somewhere in the gamma-sky and disappear again a short time later. These gamma-bursts seem to be the biggest observed explosions in the Universe, but nobody yet knows their source. Integral will help to solve this long-standing mystery also.

ESA, the pioneer in gamma-ray astronomy

ESA pioneered gamma-ray astronomy in space with its Cos-B satellite, launched in 1975. Both Russia and the United States subsequently followed ESA's lead, with the Soviet's Granat (in 1989) and NASA's Compton GRO (in 1991), respectively. Integral will keep Europe in the forefront of this exciting area of science.

Integral carries two primary scientific instruments: an Imager, which will provide the sharpest gamma-ray images yet of distant objects by exploiting so-called 'coded-mask' technology, and a Spectrometer, which will be able to gauge gamma-ray energies extremely precisely. The latter, designed to operate at a temperature of -188ºC, will be 100 times more sensitive than the previous highest-spectral-resolution space instrument.

These two primary instruments will be supported by two monitoring instruments that will play a crucial role in the detection and identification of the gamma-ray sources. An X-Ray Monitor will observe X-rays, which are still extremely powerful but less energetic than gamma-rays, while an Optical Monitoring Camera (telescope) will observe the visible light emitted by the various energetic objects.

The Integral Science Data Centre, which will pre-process and distribute the scientific data from this unique mission, will be sited in Switzerland.

esa

Imager	P. Ubertini (IAS, Frascati, Italy)
Spectrometer:	G. Vedrenne (CESR, Toulouse, France) V. Schoenfelder (MPE, Garching, Germany)
X-Ray Monitor:	N. Lund (DSRI, Copenhagen, Denmark)
Optical Monitoring Camera:	A. Gimenez (INTA, Madrid, Spain)
Integral Science Data Centre:	T. Courvoisier (Genova Observatory, Switzerland).

ESA at Farnborough International '98

The Agency's presence at this year's Farnborough International air and space show, from 7 to13 September, included a high-fidelity full-scale model of the Envisat environmental monitoring spacecraft, to be launched in the year 2000. The 24.8 m high, 8200 kg spacecraft is the largest environmental satellite ever built.

Once in orbit, Envisat will constantly monitor the Earth's environment, its sophisticated sensors observing the atmosphere, oceans, land surfaces, ice cover, etc., with unprecedented accuracy. In addition to helping us to achieve a much better understanding of the processes of change that are affecting on our planet, Envisat will hopefully also guide us in how we might repair some of the long-term damage already being done to our planet and how we might be able to forestall major environmental catastrophes in the future.

The importance of Earth observation from space, and of the role of ESA's Envisat mission, were highlighted in a speech made by Lord Sainsbury, the newly appointed UK Minister for Science, at the Farnborough '98 Press Conference. Extracts from Lord Sainsbury's speech are reproduced in the accompanying panel.

Earth observation was also the main topic at ESA's own Press Conference at Farnborough, on 8 September. With the theme 'Envisat and Beyond: Making the Planet a Better Place to Live', several ESA specialists gave presentations both on this programme (G. Duchossois and S. Bruzzi) and the Agency's new Living Planet Programme (D. Southwood) for the next millennium. esa

Right: ESA Director General, Antonio Rodotà, and Lord Sainsburry, in front of Envisat

Below, from left to right: Antonio Rodotà, Derek Davis, Director of the British National Space Centre (BNSC) and David Southwood, ESA's Head of Earth Observation Strategy

This is the first opportunity I have had to make a statement on space policy. I am very pleased to have the responsibility within Government for this important subject, which brings together research and industry. The sector is at the cutting edge of developing new technology and its uses. Even so, there is a healthy commercial market. The BNSC's survey shows UK industry turnover of £800 million and employment of 6500 people in high-grade jobs.

So, from origins in science-oriented research, space has developed into a multi-billion dollar industry. It is a truly global market in every sense. To stay in that market, British and European industry must remain competitive. The European Space Agency (ESA) has an outstanding record in establishing the industry and a European presence in space.....

I am delighted that Antonio Rodotà, the Director General of ESA, is present today to hear what I have to say. Mr Rodotà came to ESA from a career in the space industry. He therefore recognises the importance of pursuing the major business opportunities in a fast-growing market, of developing new commercial space applications to generate wealth, and of the need to be industrially competitive.

Mr Rodotà is overseeing the development of a new management approach in ESA. He will shortly be proposing a new system for Member States to monitor the Agency through performance measures. More importantly, I expect him to propose specific targets which it will be his objective to achieve against each of those measures. Coming from a commercial background myself, I find this approach perfectly natural. But I recognise that for an International Organisation to be managed on this basis is radical, and all the more welcome for that.

.....However, I do want to emphasise the positive initial steps which the Agency has (already) taken and respond to them by announcing the UK's commitment to two of the new ESA programmes to which I just referred. These are in the fields of navigation and Earth observation.

On navigation, the UK is now committing £5 million to take a 25 percent share of a programme to prepare for the next generation global satellite navigation system. ESA is working closely with the European Commission. This programme has been designed to support the Commission's negotiations at a political level with the US and with other operators of first-generation systems. It is a practical application of the EU-ESA co-operation we have sought. The UK will be equal largest contributor to this programme, along with France and Germany.

.....In the second area, Earth observation, the UK is committing £4 million and taking 20 percent of the first phase of the Living Planet programme in ESA. This programme has three main objectives: developing our knowledge of the Earth, preserving the Earth and its environment, and managing life on Earth in a more efficient way..... .The UK will be the second largest contributor to this phase of the programme, ahead of France and all other Member States apart from Germany.

In addition to these direct investments in ESA programmes, I am also announcing today a £1.65 million investment to be made here at Farnborough in a Processing and Archiving Centre, or 'PAC', to handle data from the ESA satellite Envisat. Yesterday, Mr Rodotà opened the ESA/BNSC stand, which features a full-scale model of Envisat, the environmental monitoring satellite. I hope you will take time to see it. The PAC will convert satellite data into usable form for potential customers and researchers. They in turn will process it into information and develop knowledge which will have scientific and, in many cases, commercial value.....

..... I would like to close by emphasising that space is an example of what the Government aims to achieve in its science policy generally: it creates a flow of world-class scientists and engineers; brings innovation into industry; boosts competitiveness; and leads to the development of new companies on the back of research departments.....

Lord Sainsbury
UK Minister for Science

Research Using Earth Observation in the 21st Century – A New Report

A newly issued Agency publication, ESA SP-1227, entitled *'Earth Explorers - The Science and Research Elements of ESA's Living Planet Programme'*, presents the plans for the Earth Explorer element of the European Space Agency's new *'Living Planet'* Programme for Earth Observation. *Living Planet* marks a new era for European Earth Observation based on smaller, more focussed missions and a programme that will be user-driven. The users envisaged for the Earth Explorer spacecraft are the Earth Science community in Europe, a community that has cut its teeth on the big multi-user spacecraft ERS-1 and ERS-2 and now looks forward to Envisat's launch in 2000. This community will now be able to look forward to a programme of more frequent, but smaller and more focussed missions directed at the fundamental problems of Earth system science.

The research objectives for the Earth Explorer missions (Part A of SP-1227) have been drafted by the ESA Earth Science Advisory Committee (ESAC), chaired by Prof. G. Mégie, supported by members of the ESA Executive. The programme grows out of European scientific heritage in Earth Observation, as exemplified by the Meteosat, Spot and ERS satellites. All of these, in their different ways, were trail blazers and have established European competence. The tradition continues with the missions currently under construction, namely Meteosat Second Generation, Metop and Envisat.

Part B of SP-1227 describes the implementational and financial aspects of the Earth Explorer missions.

The Agency's overall strategy for Earth Observation in the coming decade was endorsed by the ESA Council in March 1998. The *Living Planet Programme* follows on from Envisat, which is to be launched early in 2000. It is intended to cover the whole spectrum of user interests, ranging from scientific research through to applications. The research-driven Earth Explorer missions will be paralleled by applications-driven Earth Watch missions, designed to focus on specific Earth Observation applications and service provision.

In the long run, Earth Watches are expected to become free-standing services outside the Agency. The *Living Planet Programme* also covers exploitation and technological development elements whose purpose is to underpin market development and ensure cost-efficient implementation both of Earth Explorer and Earth Watch spacecraft.

The plan described in SP-1227 has been drawn up following extensive consultation with the Earth Observation community in the ESA Member States (as well as Canada, which has long closely co-operated with ESA in Earth Observation). It is intended to reflect not only their ideas and aspirations but also to be a response to concerns about climate change and man's impact on it. Many of the areas identified in the programme directly relate to the work of the Intergovernmental Panel on Climate Change (IPCC) which was established, under the auspices of the United Nations, to advise governments on the state of knowledge of climate change and its implications.

Furthermore, the proposed work has to be seen as underpinning European interests in monitoring the Earth and its environment. This reflects not only Europe's role in defining, monitoring and verifying international conventions made in response to global concerns, but also its role in providing the information needed to better understand and manage the environment at the regional and European level. In this regard the Agency has remained in close touch with both the European Commission (EC) and the European Organisation for the Exploitation of Meteorological Satellites (Eumetsat) in all its planning for the new programme.

Copies of ESA SP-1227 are available (price 50 DFl) from the ESA Publications Division Bookshop:

Tel. (31) 71 5653405
Fax. (31) 71 5655433
E-mail: fdezwaan@estec.esa.nl

First Spanish Astronaut Rides into Orbit

The Space Shuttle Discovery performed a perfect lift-off on Thursday 29 October, carrying ESA astronaut Pedro Duque among its international 7-member crew, including space pioneer John Glenn who made his return to space 36 years after he became the first American to orbit the Earth.

Glenn is not the only member of this crew to go into the record books. Duque does too, as the first Spaniard to travel into space. Born in March 1963, over a year after John Glenn's epic flight, he was also the youngest member of the crew.

"For me it is a great honour not only to represent my own nation and the rest of Europe, but also to have the privilege of working alongside John Glenn."

"I'm looking forward to the flight itself, experiencing life in microgravity and being able to look down on the Earth. It is a great adventure but it will also be a time of intense hard work and activity," said Duque during a pre-launch interview.

"We're learning a lot about international cooperation and this will be a final check for some of the ESA science facilities to make sure they and the ground teams will work efficiently on the International Space Station," he added.

Duque was cheered on his way by thousands of spectators at the launch site, including his wife and three young children.

Astronauts Pedro Duque (left) and Steven W. Lindsey take a break from busy experimentation onboard the Space Shuttle Discovery during Flight Day 7.

During the launch phase, Duque monitored the overall performance of Discovery and its systems, looking out for any anomalies or malfunctions. On reaching orbit, his responsibilities included working with the team that deployed the communications antennas and opened Discovery's payload bay doors to let surplus heat out of the Shuttle into space.

Duque's tasks during the nine-day flight included supervising five advanced scientific experiment facilities installed in the Spacehab module, located in the payload bay. Scientists from eight European countries – Belgium, France, Germany, Italy, Spain, Sweden, Switzerland and the United Kingdom – had experiments on the flight to study the effects of weightlessness on various materials and substances.

"The ESA facilities are advanced and largely automatic, so it was more a question of periodic checks and ensuring that data was routed to the correct place," said Duque. *"This kind of operation is typical of what work will be like on the International Space Station, where crew time will be at a premium."*

Duque was also the mission's laptop troubleshooter. He looked after a record number of 19 laptop computers being carried by Discovery to help run the Shuttle's systems and the experiments.

The day after the international crew's safe landing at the KSC Shuttle Landing Facility on 7 November, Flight Commander Curtis L. Brown Jr. told press that Pedro Duque had done an excellent job during the mission and that he was a 'natural' in adapting to Shuttle working and living conditions.

esa

The international Shuttle crew takes a break from its training schedule to pose for the STS-95 pre-flight portrait. Seated are astronauts Curtis L. Brown Jr. (right), mission commander; and Steven W. Lindsey, pilot. Standing, from the left, are Scott F. Parazynski and Stephen K. Robinson, mission specialists; Chiaki Mukai, payload specialist representing Japan's National Space Development Agency (NASDA); Pedro Duque, mission specialist representing ESA; and US Sen. John H. Glenn Jr., payload specialist.

'International Organisations and Space Law: Their Role and Contributions' – An International Colloquium

ESA and the European Centre for Space Law (ECSL) are in the process of organising the Third ECSL International Colloquium, which will be devoted to the above topic. The meeting, co-organised with the University of Perugia and the Italian National Research Council (CNR), will take place at the Palazzo Cesaroni in Perugia, Italy on 6 and 7 May 1999.

To be seen as a precursor to the UNISPACE III Conference in Vienna in July 1999, this Third ECSL International Colloquium will focus on the growing problems and policy issues faced by International Organisations involved in conducting and regulating activities in space. All of the major European players are expected to participate, including the European Union, Eumetsat, Eutelsat, Intersputnik and Eurocontrol, as well as many of the UN family of organisations, Inmarsat, Intelsat, ITU, ICAO and WIPO.

Day 1 of this unique Colloquium will cover the implementation of Space Law in the context of International Organisations, including the problems arising from the privatisation of international space organisations. Day 2 will focus on the contributions that the International Organisations themselves can make to the future development of Space Law, for example through the concluding of international Treaties and Agreements. Acknowledged experts and practitioners in Space Law will address the latest developments in the field and ample opportunity for discussion will be scheduled after each session.

Further information regarding the final programme and eventual participation in the Colloquium can be obtained from:

Mr Thierry Herman/ Mrs Mireille Jay
ECSL Secretariat
European Space Agency
8-10 rue Mario Nikis
75738 Paris Cedex 15

Tel. 33.1.5369.7605 / 7163
Fax. 33.1.5369.7560 / 7510
E-mail: ecsl@hq.esa.fr or mjay@hq.esa.fr

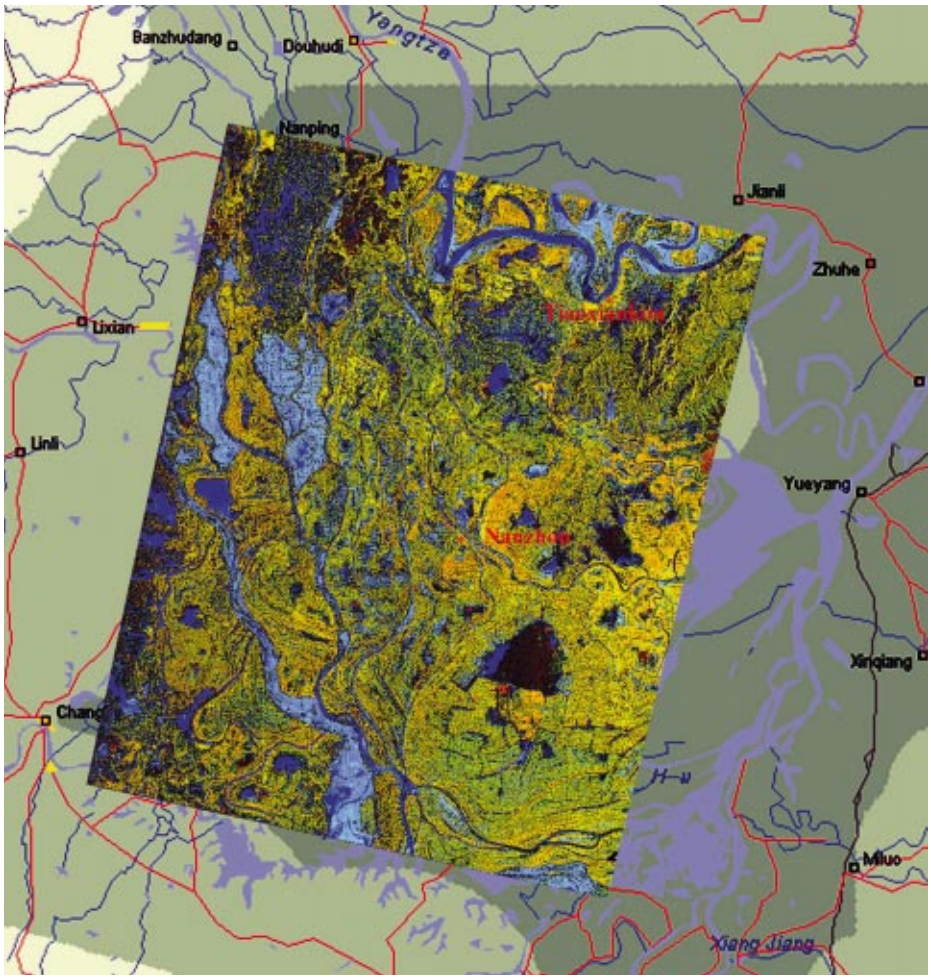
The Proceedings of the Colloquium will be published in June 1999 as ESA Special Publication SP-442, and will be available from ESA Publications Division. esa

Flood Monitoring in China

The quick and accurate identification and monitoring of inundated areas during severe floods is of critical importance for the minimisation of risk to human life, for the mounting of rescue operations, and for damage assessment and limitation.

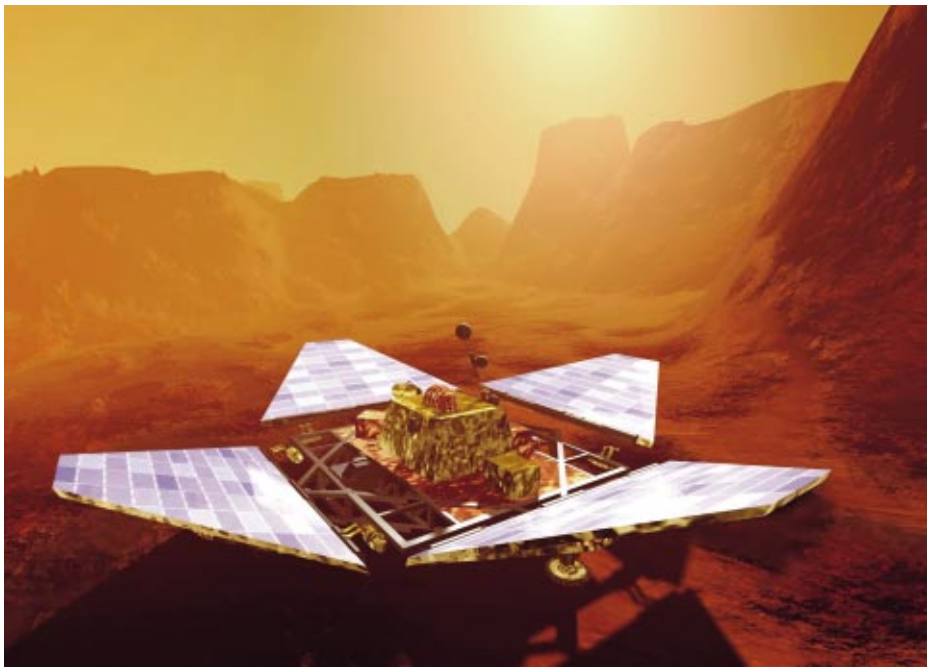
ESA's Earth-observation satellites, ERS-1 and ERS-2, orbiting the Earth at an altitude of 780 km once every 100 minutes, monitor our planet day and night in all weather conditions. Their radar imagery provides invaluable help in forestalling and coping with environmental threats, as well as helping us to achieve a much better understanding of our planet as a living system.

The accompanying image shows an area located about 200 km southwest of Wuhan, one of the cities most damaged by the floods along the Yangtze River in China. The image was obtained by geocoding and superimposing an ERS SAR multi-temporal data set (processed by DLR) onto a topographic map of the area. The ERS data used for the multi-temporal image were acquired by Ulan Bator ground station on 9 June 1993 (reference frame) and 1 August 1998 (during the flood event). Flooded zones are shown in light blue tones. Areas normally covered by water such as lakes, artificial basins and swamps are visible in dark blue or black. esa



ERS-2 multi-temporal image showing extensive flooding along the Yangtze River in China (ESA image processed by DLR)

‘Mars Express’ Wins Unanimous Support



All fourteen national delegations in ESA's Science Programme Committee have backed the project to send a spacecraft to Mars in 2003. Support for Mars Express, as this exciting mission is called, is qualified by concern about the long-term budget of ESA's Science Programme. At its meeting in Paris on 2 and 3 November, the Science Programme Committee made its approval of the implementation of Mars Express conditional on sufficient funding for the Science Programme and no impact on previously approved projects.

"*The green light for Mars Express shows that Europe is perfectly capable of seizing special chances in exploring space,*" said Roger Bonnet, ESA's Director of Science. "*At a cost to ESA of 150 million ECU, Mars Express is the cheapest Mars mission ever, yet its importance and originality are far greater than the price tag suggests.*"

Roger Bonnet continued, "*Mars Express has been advertised by the Science Programme Committee as a test case for new approaches in procuring and managing future science projects, with a view to achieving major savings. In the international arena, Mars Express will confirm Europe's interest in a major target for space research in the new century, when we make our forceful debut at the Red Planet. In fact, Mars Express is designed to be a pivotal element of an international multi-mission, global effort for the exploration of Mars.*"

Development of the spacecraft will now proceed swiftly, to meet the deadline of an exceptionally favourable launch window early in June 2003. Mars Express will go into orbit around Mars at Christmas 2003.

Seven scientific instruments on board will include a high-resolution camera, a range of spectrometers, and a radar to penetrate the Martian surface. For the first time in the history of the exploration of the Red Planet, scientists can hope to detect sub-surface water, whether it exists in the form of underground rivers, pools, glaciers or permafrost.

Signs of life on Mars, whether extinct or continuing today, may reveal themselves to a lander carried by Mars Express. This is Beagle 2, a project led by the Open University in the United Kingdom, with contributions from many other European countries. The lander also promises invaluable information about the chemistry of the Martian surface and atmosphere. Beagle 2 is to be independently funded. Some of the necessary funds have already been raised and ESA has agreed with the principal investigator to keep a place for Beagle 2 aboard Mars Express. The financial situation will be verified at a date to be agreed with the mission's prime contractor.

For more details about the mission visit the Mars Express web site at:
http://sci.esa.int/marsexpress/ esa

SOHO Gets Back to Work!

Brilliant new pictures of the Sun from ESA’s Solar and Heliospheric Observatory (SOHO) show that its ordeal since contact was lost in June has come to a happy ending. The last of the 12 scientific instruments once again began routinely sending back data in November, completing the long saga of recovery.

Roger Bonnet, ESA’s Director of Science commented, "*Scientists on both sides of the Atlantic have waited anxiously for the recovery of SOHO. Thanks to the extraordinary determination and skill of ESA and NASA personnel, with industrial contractors and scientific teams also playing their part, the world has recovered its chief watchdog on the Sun. SOHO is needed more than ever, because the Sun is rapidly becoming stormier with a mounting count of sunspots.*"

Following launch on 2 December 1995, SOHO revolutionised solar science by its special ability to observe simultaneously the interior and atmosphere of the Sun, and particles in the solar wind and the Sun's outer atmosphere. It had returned about two million images when, on 25 June 1998, during routine maintenance operations, ground controllers at NASA Goddard Space Flight Center in Maryland, USA lost contact and the spacecraft went into Emergency Sun Reacquisition mode.

The immediate efforts to re-establish nominal operations did not succeed and telemetry was lost. A joint team was formed at NASA Goddard under the direction of ESA’s Francis Vandenbussche, the ex-SOHO System Engineering Manager. The team comprised ESA, Matra Marconi Space (spacecraft prime contractor), NASA and Allied Signal staff.

Bistatic radar measurements by the 300 m Arecibo antenna and a 70 m dish of NASA’s Deep Space Network (DSN) on 23 July found that SOHO was still in its

nominal halo orbit, near the L1 Lagrangian point, and turning at roughly one revolution per minute.

Contact was re-established with SOHO on 3 August following 6 weeks of silence. Signals sent through the DSN station at Canberra, Australia, were answered at 22:51 UT in the form of bursts of carrier signal lasting from 2 s to 10 s. These signals were recorded both by the NASA station and the ESA Perth station.

Command sequences were uplinked to divert the available solar array power into a partial charging of one of the onboard batteries. After 10 h of charging, the telemetry was commanded on and seven full sets of telemetry frames giving the spacecraft's status were received on 8 August at 23:15 UT. Further onboard information was obtained the following day in two subsequent telemetry acquisitions lasting 4 min and 5 min. Data gathered included information on the temperature of the scientific instruments.

After both batteries were fully charged, thawing of the hydrazine fuel in the tank was started on 12 August at 22:39 UT. It was interrupted several times during the week in order to recharge the batteries, necessary because the power data revealed a slightly negative power balance.

Thawing of the hydrazine in the tank was completed on 28 August after 275 h of heating. After 36 h of recharging the batteries, heating of the first of four fuel pipe sections connecting the tank to the thrusters began at 12:30 UT on 30 August.

On 31 August, the SOHO Mission Interruption Joint ESA/NASA Investigation Board released its final report (http://sohowww.estec. esa.nl/whatsnew/SOHO_final_report.html). It concluded that the chain of events leading to the loss of contact described in its preliminary report was correct, and it recommended, in order to prevent similar mishaps in the future, that ESA and NASA review and correct the spacecraft ground procedures, the procedure implementation, the management structure and process, and the ground systems. No fault on the spacecraft contributed to the mishap.

As the fuel pipes were slowly thawing, attitude recovery was planned beginning in early September. Owing to the precarious power balance, it took until 10 September to thaw one of the two redundant branches of the fuel pipes. After this, the batteries were recharged and the propulsion system temperature was maintained in preparation for the attitude recovery manoeuvre.

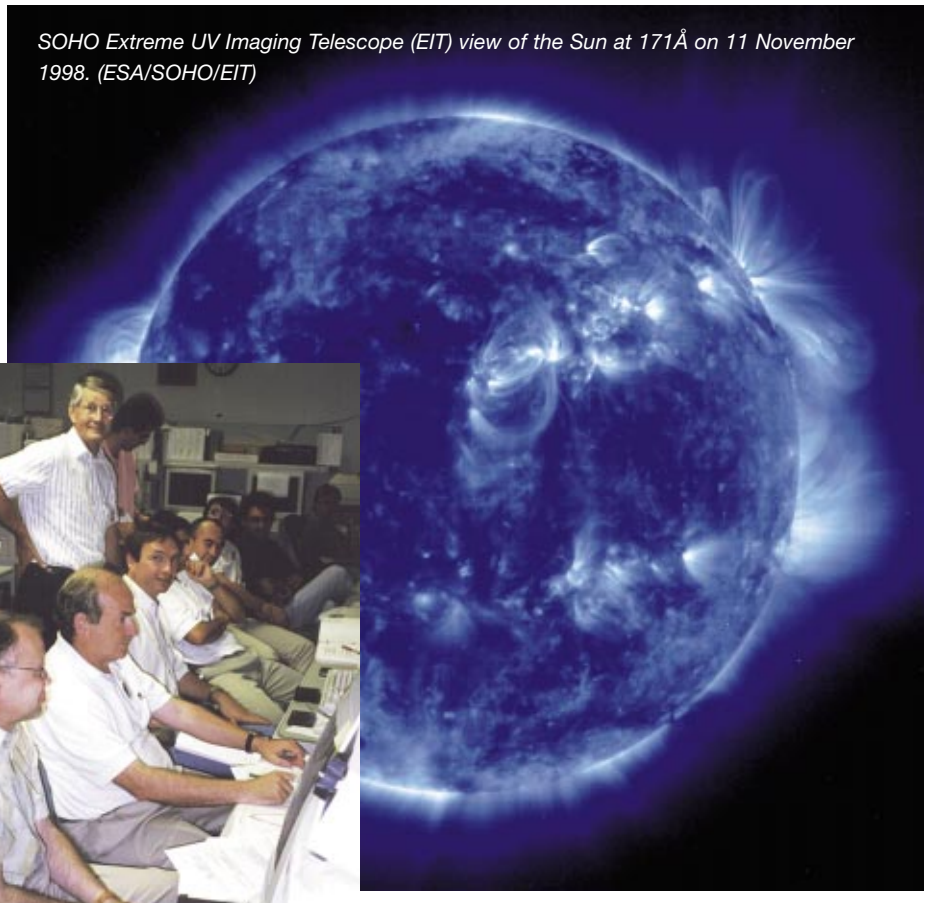
The verification of the procedures for attitude recovery was completed on 14 September and a rehearsal of the attitude recovery manoeuvre was carried out the next day.

Finally, on 16 September, the first but important step in the full recovery of SOHO was successfully completed. Sun pointing (without roll control) was achieved at 18:30 UT, after a gradual despin of the spacecraft followed by a planned Emergency Sun Reacquisition. All operations went according to plan. The experiment substitution heaters were switched on 42 min after the ESR was triggered.

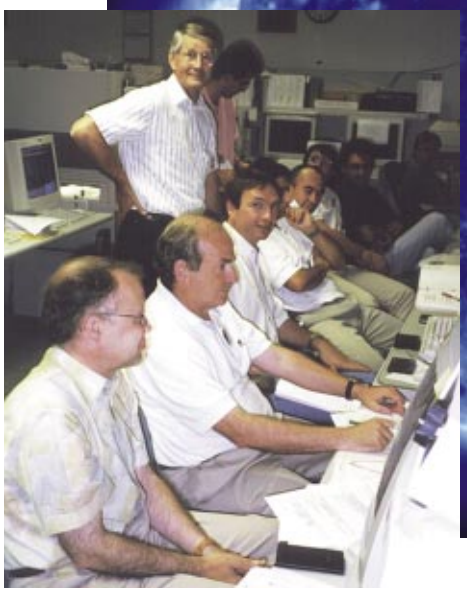
After a busy week of recommissioning activities for the various spacecraft subsystems and an orbit correction manoeuvre, SOHO was finally brought back to normal mode on 25 September at 19:52:58 UT.

Instrument switch-on began on 5 October 1998 with the SUMER instrument, followed by VIRGO on 6 October, GOLF on 7 October, COSTEP and ERNE on 9 October, UVCS on 10 October, MDI on 12 October, LASCO and EIT on 13 October, CDS on 17 October, SWAN on 18 October and CELIAS on 24 October. No signs of damage due to thermal stress during the deep freeze were detected. With SUMER completing its recommissioning on 4 November, all 12 science instruments were back to normal. A diary account of the recovery can be found at: http://sohowww.nascom.nasa.gov/operations/Recovery/updates.html

Further SOHO information, including links to the latest images, can be found at: http://sci.esa.int/missions/soho/ esa



SOHO Extreme UV Imaging Telescope (EIT) view of the Sun at 171Å on 11 November 1998. (ESA/SOHO/EIT)



SOHO ground controllers work towards regaining Sun pointing on 16 September. Recovery team leader Francis Vandenbussche is seated second from the left

The History of the European Space Agency – An International Symposium

This Symposium, which was co-organised by ESA and the Science Museum in London (11-13 November), brought together some of the leading personalities from European governments, industry and the academic world who have made significant contributions over the years to the development of the European space programme. Many of the speakers addressed the context in which the key developments took place and all of the major policies and programmes undertaken by the Agency and its predecessors (ESRO and ELDO) since the sixties. Speakers included former Government Ministers such as Mr Michael Heseltine of the United Kingdom, Mr Hubert Curien of France, and Mr Antonio Ruberti of Italy.

Speaking at the Science Museum during the opening of the Symposium, UK Science Minister Lord Sainsbury of Turville noted that *"a sense of history is important for any organisation: it both binds members together and helps to identify where we are heading….The key role that ESA has played since its inception in 1975, and above all its ability to adapt to changing circumstances, stand the Agency in good stead to play a key role in this future".*

ESA's Director General, Antonio Rodotà, pointed out that historically European space cooperation had often been accompanied by uncertainty, yet Europe's space programme continued to be pursued with a large measure of success. *"Projects such as Ariane have come to symbolise the value of excellence and of true European collaboration in high technology. The latest example is the flawless final qualification flight of Ariane-5 on 21 October,"* he said. Mr Rodotà also made the point that the European space programme can make a major contribution to improving Europe's competitiveness and economic performance on the world stage, whilst also contributing to British Prime Minister Tony Blair's vision of a 'people's Europe'. *"We need to convince Europeans that they have reason to be proud of themselves and of what they can achieve through the pooling of their talents and resources"*, Mr Rodotà said.

Also speaking during the Symposium's Opening Session, Sir Neil Cossons, Director of the Science Museum, spoke of the importance of space both to the Museum's visitors and to its research community. *"Space is the most popular topic of science amongst our visitors"*, he said, and *"Understanding the history of the European Space Programme is vital to our presentation of achievements and aspirations in space exploration".*

During an enthusiastically received after-dinner speech during the Symposium,

Mr Karl-Egon Reuter, ESA's Head of Cabinet and organiser of the Symposium, giving his introduction

Mr Michael Heseltine, former UK Government Minister

Mr Peter Creola, Head of the Swiss Delegation to ESA and Chairman of ESA's Long-Term Space Policy Committee (LSPC)

Mr John Krige, leader of the ESA History Project, and Dr Hermann Strub (seated) former ESA Council Delegate

one of Europe's foremost space advocates and pioneers Sir Hermann Bondi, Director General of ESRO from 1967 to 1971, also emphasised the importance of communication as a key to successful cooperative endeavours in space, or indeed in any other major undertaking.

The London Symposium represented the culmination of the ESA History Project, which has for the past eight years researched the history of European space initiatives between 1964 and 1987. The Symposium Proceedings will be published at the end of the year by ESA Publications Division, as ESA Special Publication SP-436. The history of ESA and its numerous programmes and projects is documented in a series of 23 individual History Reports (two more are currently in preparation) produced by the ESA History Team (John Krige, Arturo Russo and Lorenza Sebesta), which have also been published by and are available from ESA Publications Division. There is also a hard-bound monograph available which documents the earliest history of European endeavours in space, titled 'Europe in Space, 1960 – 1973' (ESA SP-1172).

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Reports in the ESA History Series

HSR-#	Date	Title	Author
1	July 1992	The Prehistory of ESRO 1959/60	J. Krige
2	October 1992	ESRO's First Scientific Satellite Programme 1961-1966	A. Russo
3	November 1992	Choosing ESRO's First Scientific Satellites	A. Russo
4	January 1993	The Early Activities of the COPERS and the Drafting of the ESRO Convention (1961/62)	J. Krige
5	March 1993	Europe in Space: Edoardo Amaldi and the Inception of ESRO	M. de Maria
6	March 1993	The Definition of a Scientific Policy: ESRO's Satellite Programme in 1969 – 1973	A. Russo
7	March 1993	The Launch of ELDO	J. Krige
8	May 1993	Europe into Space: The Auger Years (1959 - 1967)	J. Krige
9	May 1993	The Early Development of the Telecommunications Satellite Programme in ESRO (1965 - 1971)	A. Russo
10	September 1993	The History of ELDO Part 1: 1961 - 1964	M. de Maria
11	January 1994	Reflections on Europe in Space	J. Krige & A. Russo
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13	February 1994	ESRO's Telecommunications Programme and the OTS Project (1970 - 1974)	A. Russo
14	July 1994	United States - European Cooperation in Space During the Sixties	L. Sebesta
15	February 1995	United States - European Cooperation in the Post-Apollo Programme	L. Sebesta
16	February 1995	The Scientific Programme Between ESRO and ESA: Choosing New Projects (1973 - 1977)	A. Russo
17	February 1996	The Aeronautical Satellite System: An Example of International Bargaining	L. Sebesta
18	September 1996	The Availability of European Launchers and Europe's Decision 'To Go It Alone'	L. Sebesta
19	August 1997	Big Technology, Little Science The European Use of Spacelab	A. Russo
20	September 1997	The Definition of ESA's Scientific Programme for the 1980's	A. Russo
21	October 1997	Spacelab in Context	L. Sebesta
22	March 1998	The European Meteorological Satellite Programme	J. Krige
23	September 1998	The Third Phase of the Telecommunications Programme ECS, Marecs and Olympus	A. Russo

Dawn of the International Space Station

The first module for the new International Space Station was successfully launched at 06:40 UT on 20 November aboard a Russian Proton rocket from the Baikonur Cosmodrome in Kazakhstan. The rocket blasted off under overcast skies and strong winds, and disappeared behind the clouds within 40 seconds.

The 12 m-long Zarya module reached orbit less than 10 minutes after liftoff. It will provide propulsion, power and communications during the early stages of station assembly. When completed in 2004, the complex will be the largest-ever structure in space, stretching over 100 m and spanning an area the size of a football field.

ESA Director-General Antonio Rodotà, who watched the launch at Baikonur, said, *"This is the largest technological project to be undertaken jointly by the nations of the world in the history of mankind. For Europe, it is the start of an exciting new era in space exploration."*

The International Space Station will serve as an orbital home for astronauts and cosmonauts for at least 15 years. As one of five international partners (together with the United States, Russia, Japan and Canada), ESA is contributing two major elements: the Columbus laboratory and the Automated Transfer Vehicle.

Europe will take part in 19 of the 45 flights planned during the 5-year assembly phase and is also supplying scientific and technical equipment to NASA and the Russian Space Agency. Once the Station is in operation, European astronauts will be regular visitors.

At the time of going to press, NASA's Space Shuttle was planned for launch on 3 December carrying the Station's second element: the 'Unity' Node-1. Attached to Zarya, this will serve as the central building block for the Station.

On the day of Zarya's launch, ESA announced that it has begun soliciting microgravity research proposals in physical sciences and biotechnology to be conducted on the Station.

"The foundation stone for this unique international research and test centre in space has been laid today. Now it is important that Europe's best scientists and engineers make good use of it," declared ESA Director of Manned Spaceflight and Microgravity, Jörg Feustel-Büechl. He explained that, *"besides fundamental research, scientists are encouraged to consider projects that have industrial applications perspectives, and researchers from European industry are particularly welcome to apply."*

The new Announcement of Opportunity for Microgravity Research Programmes and related Applications in Physical Sciences and Biotechnology is available on the Internet at :

http://www.estec.esa.int/spaceflight.

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Zarya's launch has inaugurated the 5-year construction phase of the International Space Station (ESA/D. Ducros)