

In Brief

New Director of Technical and Operational Support Arrives

Pieter Gaele Winters, who is Dutch, took up duty as the new ESA Director of Technical and Operational Support, based at ESTEC, on 1 June. His previous post was also in the space business, as President and CEO of Fokker Space BV, having had a career in the public sector in the Netherlands. He has always been active in the fields of industrial policy and technology and has been directly associated with the space sector since the early nineties. Mr Winters was also Chairman of ESA's Council from 1993 to 1996.



Umberto Guidoni: First European Astronaut on the ISS

The Earth has him back: ESA-astronaut Umberto Guidoni, from Italy, was the first European astronaut to fly to the International Space Station (ISS). Guidoni and his six colleagues from the USA, Canada and Russia spent 11 days on the ISS to deliver and return the European-developed Multi-purpose Pressurised Logistics Module "Raffaello" (MPLM) and

to attach the Station's new 17-metre Canadian robotic arm.

After a few computer problems in the US Destiny module, things went very smoothly and a satisfied Guidoni landed on Earth aboard the Space Shuttle "Endeavour" at the Edwards Air Force Base in California. "Now the Station can at last begin to be used for its intended research purposes," noted Guidoni. A full article by Umberto Guidoni on his ISS activities and experiences will appear in the next issue of the ESA Bulletin. 



More ESA Astronauts to Fly to the ISS: First Assignment for Roberto Vittori

European astronauts will fly at least one mission per year to the International Space Station (ISS) on Russian Soyuz launchers in the period 2001 to 2006. ESA's Director General Antonio Rodotà and the Director General of the Russian Aviation and Space Agency (Rosaviakosmos) Yuri Koptev recently signed an Agreement on cooperation between the two agencies.

ESA astronauts will perform the duties of flight engineer on "taxi flights" and "increment flights". "Taxi flights" are short-duration flights (7-8 days) to the International Space Station for the purpose of exchanging the Soyuz escape

spacecraft. "Increment flights" are crew exchange flights which may require the astronauts to stay on board the Station for up to 3-4 months.

The Framework Agreement sets the general principles, terms and conditions of the ESA-Rosaviakosmos cooperation while the type of flight, the experimental programme content and the cost of each specific flight will be negotiated on a case-by-case basis. The total package price will include the cost for the training, planning and preparation of the missions, the onboard stay and the uploading and downloading of flight equipment needed for the specific experimental programme. The number of flight opportunities is currently not specified, but it will be in the order of one mission per year.

This agreement represents an important step in the development of operational expertise for the European Astronaut

Corps before the intensive utilisation of the International Space Station for scientific research, Earth observation, technology development, material science and human physiology experiments, with the launch of ESA's Columbus laboratory in 2004. *"The agreement supports the Russian effort in the space arena with the involvement of European professional astronauts, and it shows a further sign of the increasingly strong cooperation between ESA and Rosaviakosmos,"* said ESA's Director General Antonio Rodotà.

The Italian Space Agency ASI has already taken the first option for a flight by an ESA astronaut. Roberto Vittori, an Italian national and a member of the ESA's Astronaut Corps since 1998, will receive his first assignment as flight engineer on the first available Soyuz taxi flight after October 2001.

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Anniversaries and Farewells

This spring was a big season for space news. Biggest of all was of course the re-entry of the Russian space station Mir – everything went smoothly as the veteran station burned up when it re-entered the atmosphere on 23 March. Stargazers in the South Pacific witnessed impressive fireworks of burning parts – some even called it *"the most beautiful brake track in the world."*

The Mir re-entry marks the end of one era and the beginning of another with the occupation of the International Space Station (ISS). Exceeding its expected lifetime by ten years, Mir hosted 105 cosmonauts and astronauts from more than ten countries and a wide range of scientific experiments in its confined space.

Another event that attracted lots of attention (and many space enthusiasts to anniversary parties all over the world) was the 40th anniversary of Yuri Gagarin's trip around the Earth. The first man in space said during his trip, which lasted only 108 minutes, *"I can see the clouds! I can see everything! It's beautiful!"* After his safe landing back on Earth he commented: *"Circling the Earth in the orbital spaceship*



I marvelled at the beauty of our planet. People of the world! Let us safeguard and enhance this beauty – not destroy it"  esa

Foton-M1 Contract Signature

ESA signed a contract on 11 April with Russia's Rosaviakosmos space agency and Central Specialised Design Bureau (TsSKB) to fly a 355 kg payload from ESA, CNES and DLR on Russia's Foton-M1 recoverable spacecraft.

Foton-M1 is an improved version of the Foton/Bion-class satellites that ESA has used since 1987 for experiments. TsSKB builds the spacecraft and their Soyuz launchers. Nine missions have flown so far with ESA payloads, the most recent being Foton-12 in September 1999 (ESA Bulletin No. 101, February 2000). Foton-M1, scheduled for launch in October 2002, will carry ESA's FluidPac/TeleSupport and

Biopan multi-user payloads in orbit for 16 days, complemented by experiments from young researchers in ESA's 'Outreach' programme. ESA has the contractual leadership of this scientific mission, allowing the Agency's investigators to share the CNES and DLR facilities aboard Foton (Ibis and Agat, respectively). ESA's planned 18 experiments cover fluid physics, biology, radiation dosimetry, exobiology, material science and meteoritics.



Mr Jörg Feustel-Büechl (seated, left), ESA Director of Manned Spaceflight and Microgravity, and Mr Viktor Kozlov (seated, right), Head of the Department for Unmanned Spaceflight at Rosaviakosmos, signing the Foton-M1 contract at ESA Headquarters on 11 April. Looking on are Mrs Jeanne Slagmolen, ESA Contracts Officer, and Mr Werner Riesselmann, Head of the Microgravity Payload Division at ESTEC.

Artemis Booked on Early Summer Trip

Artemis, the Agency's new advanced telecommunications satellite, is going to be launched in early summer this year, thanks to an agreement between ESA and Arianespace on 17 May. The multi-purpose satellite – the precursor to new and advanced satellite communication services – will be launched by Arianespace on an Ariane-5 from Kourou on 12 July 2001, sharing its trip with the Japanese BSAT-2b direct-broadcasting satellite.

Artemis is ESA's most advanced telecommunication satellite to date. Its orbital position will be maintained by ion propulsion thrusters, a new technology used for the first time on an ESA satellite. Ion engines generate thrust with very high efficiency and as a consequence require significantly reduced amounts of propellant for orbit inclination control. Artemis will also play a significant part in developing Europe's new worldwide satellite navigation system, new mobile communication services and inter-satellite data relay.

The Artemis mobile communication payload includes an L-band Land Mobile





Gaia Summer School, Les Houches, 14-18 May 2001

Dozens of young scientists from all over Europe gathered in mid-May at Les Houches in Savoy, France, for intensive briefings on ESA's next star-mapping satellite 'Gaia'. The summer school, part

of the prestigious Les Houches series, was organised by Dr Olivier Bienayme (Observatoire de Strasbourg) and Dr Catherine Turon (Observatoire de Paris-Meudon). As the successor to the very successful Hipparcos space-astrometry project, Gaia was approved last year as an ESA Cornerstone mission to be launched around 2010. Engaging the interest and participation of the next

generation of astronomers will be vital for the project's success.

ESA's Hipparcos mission (1989-1993) revolutionised astrometry, the science of star measurement, by fixing the positions, brightnesses, colours and intensity variations of more than a hundred thousand stars in our vicinity far more accurately than ever before. Astrometry was previously a difficult subject of interest to only a few specialists in astronomy. Hipparcos changed all that, with results that are still impacting on every branch of astronomy, from comets to cosmology.

Gaia will be 100 times better than Hipparcos. By charting a billion stars, to very much greater distances than Hipparcos, it will give an unprecedented picture of the positions and motions of stars across most of the Milky Way – our Galaxy's equivalent of the Human Genome Project. Besides mapping the three-dimensional structure of our Galaxy, and transforming the science of stars and galaxies, Gaia will be a top discoverer of asteroids and alien planets.

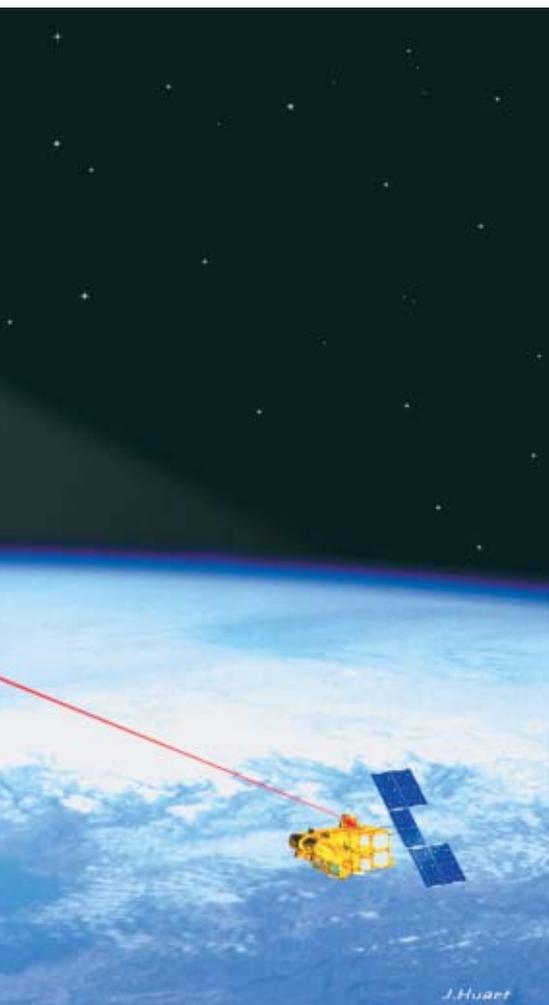
"Gaia will deliver its first results more than ten years from now", notes Dr Michael Perryman, Gaia's Project Scientist. "Key individuals have already devoted half their working lives to conceiving and accomplishing Hipparcos, and to inventing Gaia. Who'll pick up the baton when they retire? With an impressive line-up of front-ranking European astronomers as lecturers, the Summer School undoubtedly succeeded in inspiring many of the bright young minds that will carry this important science into the future."

(LLM) facility, with a wide 'Eurobeam', three spot beams and the ability to handle up to 662 voice channels at any one time. This means the satellite will offer unprecedented new facilities for the development of vastly more sophisticated land and marine mobile communication systems. In addition, the satellite has a unique data-relay payload which will speed up communication between satellites and help to bring Earth-observation images down to their appropriate terrestrial stations faster and more efficiently. First to benefit will be the French Earth observing satellite, Spot-4, using the optical section of this payload for a data-transmission experiment called SILEX (Semiconductor laser Inter-satellite Link EXperiment). After its launch later in 2001, ESA's giant Earth 'watchdog' Envisat will communicate data through the Ka-band section of the Artemis data-relay payload.

The Ariane-5 will place Artemis into geostationary transfer orbit, before ground operators at Fucino, Italy assume control of the spacecraft and fire its onboard liquid apogee engine three times to take Artemis to geostationary orbit.

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ISS Forum 2001

During 5-7 June, Berlin became the focal point for the International Space Station (ISS) when about 800 leaders of industry, government officials and scientists from 22 countries gathered at ISS Forum 2001. This first international conference on Space Station utilisation covered R&D, industrial applications and commercial opportunities, exploring the Station's potential and explaining the opportunities

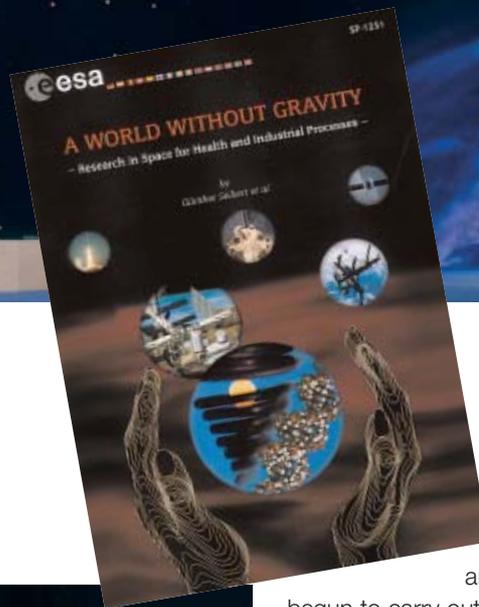


Preparing for business (from left): Prof. Alain Bensoussan, President of CNES and Chairman of the ESA Council; Mr Antonio Rodotà, ESA Director General; Prof. Walter Kröll, Chief of Executive Board, DLR.



Mrs Edelgard Bulmahn, Germany's Minister for Research and Education, opens ISS Forum 2001.

Mrs Bulmahn is presented with copy #1 of ESA's new book on microgravity research by Mr Jörg Feustel-Büechl (right) and Mr Antonio Rodotà.



available to users. With the Station now in orbit, the gateway to R&D and commercial use of space is open. Scientists and companies from around the globe have

begun to carry out research aboard this unique laboratory, the largest research and technology centre available to date in space. Top-level representatives of the five space agencies involved in the Space Station, namely NASA, Rosaviakosmos (Russia), NASDA (Japan), the Canadian Space Agency and ESA, outlined for the first time their approach to commercialisation of the Space Station.

As a key European minister responsible for space, Germany's Minister for Research and Education, Edelgard Bulmahn opened the Forum. Mrs Bulmahn noted, '...we intend above all to focus on projects directed at solving real problems on Earth and having potential for new products and applications. As Research Minister, I give

priority to scientific use of the ISS. But even outside the research domain, many parties have an interest in utilising the ISS in the media, in the entertainment industry, the world of art, marketing. The development and market potential is enormous. That is why I believe we should leave scope for non-scientific commercial ISS utilisation, as long as this does not hinder the scientific effort.'

Mr Antonio Rodotà, ESA Director General, commented that '... this Space Station is a big instrument for scientists, for industrialists. We hope that from the



The Astronaut Roundtable brought together six astronauts to discuss their experiences (from left): Chiaki Mukai (NASDA, on screen), Umberto Guidoni (ESA), Reinhold Ewald (ESA), Bill Readdy (NASA), Julie Payette (CSA) and Frank De Winne (ESA). At far right is Forum moderator Claus Kruesken.

The conference also saw ESA signing its first contract to provide resources to commercial users. Mr Jürgen von der Lippe of Intospace and Mr Jörg Feustel-Büechl, ESA Director of Manned Spaceflight and Microgravity, signed a 2 million Euro contract for the Agency to supply a proportion of its allocation of Station resources. ESA now has an open call for commercial proposals, accessible at <http://www.esa.int/spaceflight/isscommercialisation>



The Roundtable on payload accommodation, integration and processing (from left): Richard Nygren (NASA), Dieter Andresen (ESA), Susumu Yoshitomi (on screen, NASDA), Lawrence Vezina (CSA), Valeri Panchenko (RSC-Energia) and Forum moderator Claus Kruesken.

Station big, big science will come plus new improvements to benefit industry and employment.'

The first crew to have inhabited the Station – Bill Shepherd, Yuri Gidzenko and Sergei Krikalyov – discussed their life and work onboard from November 2000 to March 2001 and led participants on a tour through 'their Space Station' with the help of 3D virtual reality simulation. A live TV link-up with the Expedition 2 crew currently aboard the Station – Yuri Usachev, Jim Voss and Susan Helms – was a highlight of the Forum, and showed potential users the extensive facilities already in orbit.

Participants also met the Station 'builders' – the companies developing the modules and other hardware – and current 'users' – companies in areas ranging from hi-tech to media that are already benefiting from being onboard.

The final day was largely devoted to roundtables on access policy for institutional users and commercial customers, and the handling of payloads.

The next issue of ESA's *On Station* newsletter will be devoted to the Forum.



Thomas Reiter, Sergey Krikalyov and Yuri Gidzenko (on stage, with moderator Claus Kruesken) link up live with the ISS.

The Kids from Mars City

The heart of a city on Mars would be a scientific laboratory. You need water supply tanks and an oxygen factory and straw tubes to transport water and air, you need a windmill of course and a cable car, also a volcano and a rocket launcher...at least that is what a Mars city looks like in the imagination of 32 kids from the Groenhorst Chr. Basisschool in Leusden. They won the Space Kwispel Competition for which Dutch schoolchildren between ten and twelve years of age were asked to design and build a Martian City out of the sponsor's – milk company Melkunie – milk packages. 50 different classes thought up interplanetary football matches (Mars FC vs Jupiter FC), lasers to melt ice caps for water generation, MarsDonalds restaurants, and many other lovable details. The winning class came to ESTEC on 22 March for a Space Day – with space related prizes, real space scientists, engineers and even astronauts Wubbo Ockels and André Kuipers to talk to, satellites, the Space Expo, and the Dutch entertainer Peter Jan Rens – alias Menheer Cactus – as a host.

"It's a great thing for the children," said their teacher Mia Rap while her class – all in T-Shirts with the Mars City logo – explained the set-up of the city and introduced the different working groups they had set up to build their city model (design, information, construction...) to Peter Jan Rens and Wubbo Ockels. *"Normally it is quite a difficult class. Building the Mars City together has shown them how much they can do when they cooperate, and that they even won the competition has given them a good*

experience of co-operation and success. They've done a wonderful job and deserve it well," she added.

In February almost all elementary schools in the Netherlands had received a Space Kwispel competition package with the school milk. The Space Kwispel is a quiz game about space developed by ESA's Education and Outreach Office in collaboration with the Dutch toy company "King International" and ESA's Publications Division.



'Industry Space Days' Foster Collaboration between SMEs and ESA

The "Industry Space Days", held at ESTEC on 9 and 10 May, were a great success. More than 570 participants representing 330 European and Canadian companies attended the ISDs. ESA organises this event to foster exchanges between Space Agencies, established space groups and Small and Medium-sized Enterprises (SMEs). The initiative encourages SMEs to take a more active part in the European space programmes, explaining to them how to do business with ESA and its major industrial partners and giving them the opportunity to meet other potential customers and establish new co-operation schemes.

This year, the ISD 2001 proposed a whole range of conferences tailored to inform SMEs and trained them in different areas related to space requirements and best practices for successful business in general. ESA programmes and their related business opportunities, as well as



the business opportunities within National Agencies and some of the large space groups such as Astrium, Alenia, and Alcatel were also presented. The SMEs displayed their expertise and fields of specialisation in dedicated exhibitions and workshops to discuss business-related subjects.

In addition, in more than 2000 business meetings SMEs and other potential partners discussed business opportunities and possible co-operation. The Industry Space Days, organised by ESA's SME Unit on a two-yearly basis, once more proved to be extremely useful for all participants.



Exploring the Whole of the Moon...

The Lunar Explorers Society (LUNEX), an international organisation founded last year at ESTEC by 200 Moon enthusiasts, held its first Convention, in Paris, from 8 to 10 March. The more than 80 delegates – professionals, amateur space enthusiasts and interested visitors from the public – came together to discuss the Moon in all its facets.

Participants talked about the colonisation of the Moon, its use as a scientific laboratory, e.g. for geology or as an astronomical platform, the knowledge of lunar geography needed to land and move on the surface, the implications of finding water-ice on the Moon and whether this might be detected by forthcoming missions, and the architecture of lunar habitats, to give only a few examples. Would you have thought that the flower most likely to grow on the Moon would be the tulip? Or that the Society thinks that by the year 2040 (with intermediate steps via Moon lander, robotic village and lunar base) there will be a human village on the

Moon? Several groups – among them the Young Lunar Explorers – also presented their outreach activities and gave recommendations for future educational projects involving the Moon. The Society's driving question – whether it will be



possible to transform that barren landscape 384 000 km away into a thriving hub of scientific research and industrialisation – will remain unanswered for the time being, but Bernard Foing, chairman of the LUNEX Society, and the LUNEX members see it as a big step in the right direction.

The Convention was also the main public event in 2001 at which SMART-1 was presented. Due to be launched in 2002, SMART-1 will test solar electric propulsion and other innovative approaches for future deep space probes. It is the first European satellite to be sent towards the Moon. A SMART-1 model was on display at the conference venue, the Palais de la Découverte in Paris.

LUNEX was founded at the end of the 4th Conference on Exploration and Utilisation of the Moon (ICEUM4), organised by ESA and the International Lunar Exploration Working Group (ILEWG) in July 2000. Its aim is to promote the exploration of the Moon for the benefit of humanity, bridging the gap between space agencies and the general public to promote planetary exploration and space.

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...and Flags for the Whole World

10-year old Anna Moloney from Ireland has painted a yellow flag with three clear symbols: blue wavelines for water, a green tree for life and nature, and a red human figure. "The yellow background symbolises the Sun. It is in the background because the Sun is the reason for all life and activity on Earth", Anna explains. She participated in ESA's Earth Flag competition and won the Irish competition. Anna and the 15 other national winners will be at the Paris Air Show at Le Bourget, where the ultimate winner was announced on 17 June. She is 12-year old Anke Hartmanns from Germany (3rd line, leftmost flag), who drew a flower representing the Earth and Envisat watching over it. The winning picture will circle

the Earth on Envisat. As the satellite observes the Earth, the idea was to design a flag that represents the whole of our planet. More than 11000 children from

the ESA Member States and Canada sent in their artwork, accompanied by short texts to explain the layout, colours and symbols.

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14 Experiments on the Busiest Ever Parabolic Flight Campaign

The 30th ESA parabolic flight campaign was the busiest ever. Three flights of 30 parabolas each on the special Airbus A300 Zero-g started from the Bordeaux-Mérignac airport on the mornings of the 15, 16 and 17 May.

ESA organised this campaign to conduct research experiments in almost complete absence of gravity (microgravity) to prepare future experiments for the International Space Station. This 30th campaign since 1984 is the largest ESA campaign ever in terms of number of experiments: fourteen experiments including eight in Physical Sciences, three in Life Sciences, and three experiments proposed by students.

During a parabolic flight the aircraft performs a nose-up manoeuvre to put it

into a steep climb. This creates an acceleration of 1.8 g (1.8 times the acceleration due to gravity on the ground) for about 20 seconds. Then the pilot reduces engine thrust to almost zero, injecting the aircraft into a parabola. The plane continues to climb till it reaches the apex of the parabola, then it starts descending. This condition lasts for about 25 seconds, during which the passengers and all unstrapped equipment in the cabin float in the weightlessness resulting from the free fall of the aircraft. When the angle below the horizontal reaches 45°, the pilot accelerates again and pulls up the aircraft to return to a steady horizontal flight. These manoeuvres are usually repeated 30 times per flight.

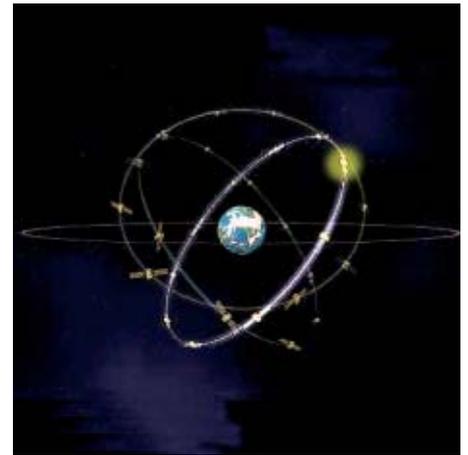
During the weightlessness periods, the scientist on board the aircraft can conduct their experiments. With Europe and its international partners building the International Space Station, parabolic flights are crucial to the preparation of experiments, equipment and astronauts

and allow scientists to have their experiments tested before they are actually flown on a space mission.

The next ESA parabolic flight campaign (the 31st) is scheduled for October 2001. This campaign will have a mixed complement of experiments in Life and Physical Sciences, again with student-proposed experiments.



Galileo Approved at EU Level



The Transport Ministers of the European Union approved the Galileo programme on 5 April at the Council meeting in Luxembourg. They agreed to go ahead with the development and validation phase for Galileo and make available 100 million Euros. The European satellite navigation system will provide a highly accurate global positioning service under civilian control. It will be inter-operable with the two other global satellite navigation systems GPS and GLONASS. The 30 Galileo satellites are scheduled to be in their circular orbits some 24 000 km above the Earth by the year 2008, delivering positioning accuracy down to four metres. The 2900 million Euro project will be financed through a public/private partnership between the European Commission, ESA and private industry. At their next meeting in December, the Ministers are expected to release another 450 million Euros and approve the creation of a programme management. At their meeting on 5 April they also agreed to take the formal decision on the deployment of the full Galileo constellation by the end of 2003.



5 Years of Discoveries with SOHO

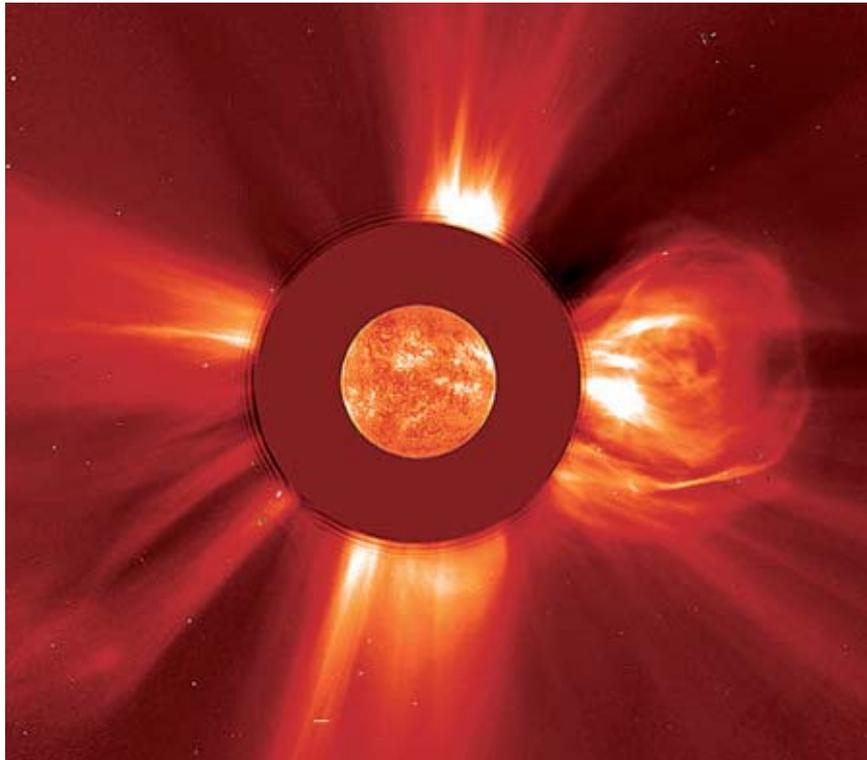
What an appropriate day for the anniversary of a spacecraft that watches the sun: SOHO's 5th anniversary on 27 April coincided with the celebration of Sun-Earth Day 2001, by the European Space Agency, NASA and other agencies. In April 1996 the European-built SOHO was commissioned, and the observations with a dozen sets of clever solar instruments formally started at that time. The day also marked the opening of the observations of SOHO's SWAN and MDI instruments to the public. One sees ultraviolet rays sweeping like a beam across interplanetary gas beyond the Sun, while the other locates hidden sunspots and their active regions. Both watch the far side of the Sun and help predict active regions and eruptions from the Sun a week before it turns towards Earth. Scientists from 62 institutes in 15 countries work in the teams that provide and operate SOHO's instruments. Weighing 1.85 tonnes at launch, it was dispatched by a NASA rocket on 2 December 1995, and transferred to the vicinity of Lagrange Point No. 1, where it now hovers, 1.5 million kilometres from the Earth.

In its five years of gathering solar data, the observations made and conclusions drawn form a long story of success. SOHO examines the Sun from a vantage point 1.5 million kilometres out, on the sunward side of the Earth. Its instruments probe the Sun from its nuclear core, through its turbulent interior and stormy atmosphere, all the way out to the Earth's orbit and beyond, where a non-stop stream of atomic nuclei and electrons travels outwards as the solar wind. To the naked eye the Sun looks calm and unchanging, but for SOHO it has performed a dramatic striptease. Here are a few of the revelations:

- Currents of gas far beneath the visible surface speed up and slacken again every

16 months - a wholly unexpected pulse-rate. It was detected by combining data from SOHO and a US-led network of ground stations called GONG.

- Watching minute by minute and year by year, SOHO has seen the Sun brighten, as expected, by 0.1 percent while the count of sunspots increased during 1996-2000. By studying the variations in detail, scientists estimate that high-energy ultraviolet rays from the Sun have become 3 percent stronger over the past 300 years.
- Most of the explosive outbursts of gas



from the Sun, called coronal mass ejections, miss the Earth. Only SOHO can reliably identify those heading in our direction, by linking expanding haloes around the Sun to shocks seen in the Earth-facing atmosphere. Engineers then have 2-3 days warning of possible effects in the Earth's vicinity.

- A reason why the Sun's atmosphere is far hotter than its visible surface is a non-stop succession of small explosions, observed by SOHO. They result from a continual rearrangement of tangled magnetic fields.
- SOHO sees gas leaking from the corners of a magnetic honeycomb of gas bubbles, mainly in polar regions, to supply a fast solar wind. Nearer the Sun's equator, a slow wind escapes from the edges of wedge-shaped features called helmets.
- Charged atoms feeding the fast wind

gain speed very rapidly – evidently driven by strong magnetic waves in the Sun's outer atmosphere. Similar magnetic waves may accelerate the slow wind too, although many mass ejections also contribute to it.

- SOHO detected phosphorus, chlorine, potassium, titanium, chromium and nickel for the first time, and previously unseen isotopes of six commoner elements. These give clues to conditions on the Sun, and also to Solar-System history.
- After a solar flare, SOHO sees waves rushing across the Sun's visible surface,

like the ripples seen when a stone falls into a pond. One such event was judged to be 40 000 times more energetic than the San Francisco earthquake of 1906.

- SOHO has discovered tornadoes as wide as Africa, with hot gas spiralling outwards from the polar regions of the Sun. Typical wind speeds of 50 000 kilometres per hour can become ten times faster in gusts.
- A wind of gas from the stars blows through the Solar System, and the solar wind fights it. SOHO has fixed its direction

(from the Ophiuchus constellation) and its speed (21 km/s) more accurately.

More than 3600 coronal mass ejections from the Sun have been observed by SOHO's LASCO instrument, making an average of two per day during SOHO's five years of observations. It saw the biggest solar flare that has ever been recorded on 2 April this year – it hurled a coronal mass ejection into space at 72 million kilometres per hour. SOHO is also by far the most prolific discoverer of new comets in the entire history of astronomy. By mid-April 2001 the number stood at 304, most of them being small comets that fall into the Sun. Amateur astronomers around the world examine SOHO's pictures via the Internet, and have been first to spot more than 200 of the SOHO comets.

Watch that Debris

If you are concerned about the more than 8000 pieces of space debris – some of them as big as a car – that are orbiting the Earth, the third European Conference on Space Debris from 19 to 21 March at ESOC, ESA's European Space Operations Centre in Darmstadt, Germany, would have been the place for you. It drew over 200 experts on space debris from all over the world to discuss a large number of topics related to the inactive spacecraft, ejected boost motors, fragments of satellite and rocket stage breakup, and all the other metallic bits of shields, booms, covers and caps that are floating in space.

ESA hosted the conference, while the British, French, German and Italian space agencies (BNSC, CNES, DLR, ASI), the Committee on Space Research (COSPAR), and the International Academy of Astronautics (IAA) co-sponsored it.

While the use of space is expanding in nearly all areas – e.g. telecommunication, navigation, Earth observation, science – space debris is of growing concern as a threat to both manned and unmanned



spaceflight. The purpose of the conference was to provide a forum for presentations of results on research topics ranging from ground- and space-based techniques for detection of orbital debris, trends in the orbital debris environment in Low Earth Orbit and the geostationary ring, the design of protective shields, to the removal of debris by tethers. The

aspects discussed included methods and computer tools to predict the growing number of man-made objects in space, analysis of material returned from space, risks run by satellites in low-Earth and geostationary orbit, risks on the ground from reentering objects, standards addressing safety and mitigation of space debris, and legal issues.



New Building Inaugurated at INTA-Spasolab

INTA-Spasolab, ESA's external laboratory for solar-cell qualification and testing in Madrid, has a new building that was formally inaugurated on 17 May. The new building considerably increases the capabilities of Spasolab (Space Solar Cell Test Laboratory), formally set up at INTA (Spain's Instituto Nacional de Tecnica Aeroespacial) in 1989. INTA is one of the technological institutes of the Spanish Ministry of Defence with a long tradition and experience in space activities in European and Spanish projects.

The inauguration started with a general presentation on INTA and its technical capabilities and ended with a guided tour of the new facilities. Representatives from ESA and the national space agencies (CNES, DERA), space industry (Astrium, Fokker, CASA, ASE, CESI, ENE, Rimsa, CRISA, etc), photovoltaic R&D institutes (IES, Ciemat, Fraunhofer-ISE) and

terrestrial photovoltaic industry (BP Solar, Isofoton, Censolar) had the opportunity to study the new facilities first hand. One of the main testing areas in this new building was named "Bogus/Larue" as a tribute to ESA staff members Klaus Bogus and Jean-Claude Larue, who have been involved in the setting-up of Spasolab since the early eighties.

Spasolab carries out qualification of solar cells for specific space missions and characterises space solar cells under development by industry and photovoltaic research institutes. Spasolab also performs electrical and environmental characterisation of solar coupons and panels, as well as research and development on testing methods for new types of space solar cells.

