

## ESA's Evolution as Envisaged by The Three 'Wise Men'

As reported in ESA Bulletin No. 103 (August 2000 issue), in March 2000 ESA's Director General, Antonio Rodotà, asked a committee of three 'Wise Men' to provide him with an independent assessment of the future evolution of the Agency. The committee was made up of Carl Bildt (Chairman), former Swedish Prime Minister and UN Envoy to the Balkans, Jean Peyrelelade, President of Crédit Lyonnais, and Lothar Späth, Chief Executive Officer of Jenoptik, together representing a formidable combination of high-level political, economic and industrial expertise.

## In Brief



From left to right at the Paris Press Conference: Lothar Späth, Jean Peyrelelade, Carl Bildt, Antonio Rodotà and Jean-Jacques Dordain

The three examined the organisation of the public space sector in Europe and the role of ESA in that sector, the institutional relationship between ESA and the European Union, and the associated potential for synergies between civil and defence programmes. They also analysed the potential for enlargement of ESA to include more countries, and the market opportunities available to ESA Member States in the space domain.

On 9 November, commensurate with the calendar for the European space strategy being prepared jointly by ESA and the European Union, the Wise Men presented their recommendations at a Press Conference at the Agency's Headquarters in Paris, hosted by Antonio Rodotà and Jean-Jacques Dordain, ESA's Director of Strategy and Technical Assessment.

## ESA and the European Union Adopt a Common Space Strategy

On 16 November, Ministers representing the 15 ESA Member States, gathered in Brussels for an Extraordinary Meeting of the ESA Council, adopted a Resolution that accompanies a joint ESA/EC document on a European Strategy for Space (the Wise Men's Report – see previous news item). A parallel Resolution, based on the same document, was also endorsed by the European Research Council in Brussels on the same day.

This was the first time that the Councils of ESA and the European Union had met on the same date and in the same place to adopt Resolutions that will constitute a common framework within which all European players involved in space activities will develop their respective plans of action.



Further information on the content and availability of the Report can be obtained from:

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*“Through these resolutions, European space policy takes a first step into a new phase in which space systems become an integral part of the overall political and economic efforts of European States – whether members of ESA or the EU – to promote the interests of European citizens”,* said ESA’s Director General, Antonio Rodotà.

The European Strategy for Space identifies three lines of action:

- a. strengthening the foundations for space activities
- b. enhancing scientific knowledge
- c. reaping the benefits for society and markets.

The first line encompasses broadening space technology and guaranteeing access to space through a family of launch vehicles. The second sees Europe continuing to pursue cutting-edge themes in space science and space contributions to the understanding of our planet’s climate. It includes human spaceflight and

optimisation of the use of the International Space Station as an infrastructure for European research in all disciplines of space science. The third line of action has the objectives of seizing market opportunities and meeting the new demands of our society. It has a bearing on satellite communications and the information-technology sector, satellite navigation and positioning (Galileo), and systems monitoring the Earth for environmental and security purposes. This is where close cooperation between ESA and the EC will be most instrumental in putting space systems at the service of European policies responding to citizen’s expectations.

The European Space Strategy also covers industrial aspects and pays specific attention to Small and Medium-sized Enterprises (SMEs). In the document, public/private partnerships are seen as a model for committing the public sector, along with the complete industrial chain, to an operational project.

The two Resolutions adopted on 16 November endorse the setting up of a cooperative structure that will bring together the ESA Executive and the European Commission. An interim high-level joint Task Force is being set up to make proposals for the continuing development of the European Space Strategy and its implementation.

In addition to being a partner in the setting up of joint programmes responding to political initiatives of the European Union, ESA will act as the implementing organisation for the development and procurement of the space and ground segments associated with such initiatives.

The Ministers invited ESA’s Director General to prepare Programme Proposals on the basis of this strategy and to submit them to the ESA Council Meeting at Ministerial Level scheduled for November 2001.



## Ariane-4 – 100 Launches and Counting!

Not so much an anniversary, more a consecration. On 29 October Ariane-4 carried the Europe\*Star-1 communications satellite safely into Geostationary Transfer Orbit (GTO) with the precision that has become Ariane’s hallmark. So much so in fact that the lift-off could have gone almost unnoticed, but for the fact that this was the 100th launch of the Ariane-4 generation of vehicles. For this particular launch (V134), the Ariane-44LP was equipped with two solid-propellant and two liquid-propellant strap-on boosters.

Just two weeks later, on 15 November, Ariane was at work again, lifting off from the Guiana Space Centre in Kourou, French Guiana, to put the PAS-1R telecommunications satellite into GTO, together with a radio-amateur satellite, AMSAT P-3D, and two technology microsattellites. On this flight (V135), however, it was an Ariane-5 launcher providing the ride.

The 136th Ariane launch (V136) took place successfully less than a week later on 22 November 2000. This time another Ariane-4 – a 44L fitted with four liquid-propellant strap-on boosters – put the



Anik-F1 telecommunications satellite into GTO for Canadian operator Telesat.

The next Ariane-4 launch (V137), originally scheduled to lift the Eurasiasat-1 telecommunications satellite for Turkey into orbit on 8 December, was subsequently postponed until the new year.

The 138th Ariane launch (V138) took place successfully on 20 December. This time, another Ariane-5 launcher (V508) placed the Astra-2D and GE-8/Aurora-III telecommunications satellites safely into orbit for GE Americom (USA), along with the LDREX experimental payload belonging to the Japanese Space Agency (NASDA).

Ariane-4 was in action again on 8 February (V139). This time an Ariane-44L equipped with four liquid strap-on boosters lifted-off from Kourou to launch two European military communications spacecraft into GTO – Sicral for Italy and Skynet-4F for the UK.

The next Ariane launch, an Ariane-5, is currently scheduled for Friday 2 March, carrying two more telecommunications satellites, Eurobird and BSAT-2A.



## Portugal Officially Fifteenth ESA Member State



On 14 November 2000, Portugal deposited its instrument of accession to the ESA Convention with the French Government, thereby completing the legal formalities making it the fifteenth Member State of the European Space Agency.



## Memorial Symposium in Honour of Prof. Henk van de Hulst

Professor Henk van de Hulst, who died on 21 July 2000 at the age of 81, was not only one of the greatest Dutch astronomers of the last 150 years, but also one of the founding fathers of ESA – and indeed in no small way responsible for ESTEC being situated in Noordwijk (NL). To mark his contribution to ESA and ESTEC, the ESA Science Directorate organised a Memorial Symposium in his honour at ESTEC on 6 November, which was attended by many eminent Dutch and international scientists, as well as Prof. van de Hulst's widow and family.

The afternoon began with the planting of a chestnut tree just outside the ESCAPE building by Mrs van de Hulst. Henk Olthoff (ESA) explained that once the roots of the tree are firmly settled, a bench will be built around it so that the staff at ESTEC can enjoy its shade – something Henk van de Hulst himself would certainly have approved of.

The Symposium proper was held in the ESTEC Conference Centre with Prof. van

de Hulst's central role in the setting up of ESRO and ESA as the theme. Prof. Harm Habing from Leiden University gave the opening talk on 'The Self-evident Importance of Quality: Some Remarks on the Life of Henk van de Hulst'. In 1958, Prof. van de Hulst became the first President of COSPAR, then a new international organisation for the peaceful exploration of the Universe, out of which came the European Space Research Organisation (ESRO), and later ESA. This was reflected in the talk given by Prof. Reimar Lüst on 'Henk van de Hulst and the Build-up of European Co-operation in Space Research'. Prof. Sir Hermann Bondi spoke on the 'Changes in Governmental Attitudes to Space' during this period.

The emphasis then moved to Prof. van de Hulst's scientific work with ESRO and ESA – Prof. Livio Scarsi (Palermo) explained the pivotal role played by Henk van de Hulst in the Cos-B project, and Prof. Malcolm Longair (Cambridge) discussed Prof. van de Hulst's work on the Hubble Space Telescope.

The day was rounded off with a dinner in the ESTEC Restaurant, where Prof. Roger Bonnet, ESA Director of Scientific

## Agreement Signed with Greece

On 17 January, ESA's Director General, Antonio Rodotà, signed a framework Cooperation Agreement with the Greek Minister for Development, Mr Nikos Christodoulakis, in Athens. The areas considered as offering potential for future cooperation include: space science, Earth-observation research and applications, telecommunications, satellite navigation, microgravity research, and ground-segment engineering and utilisation. In the next phase, projects of mutual interest will be identified and they will be defined in specific implementing arrangements once the Cooperation Agreement enters into force.



Programmes, gave the After-Dinner Speech, reflecting on how Prof. van de Hulst's work has paved the way for a number of the Science Directorate's future programmes.



*Mrs van de Hulst planting the chestnut tree outside ESCAPE*

*Prof. Reimar Lüst addressing the family and assembled guests*



## Green Light for Small Launcher and Advanced Solid Booster

The Vega Small-Launcher Development Programme and the P80 Advanced Solid Propulsion Stage Demonstrator Programme were formally approved on 15 December by the Participating States. Belgium, Italy, the Netherlands, Sweden and Switzerland decided (with Spain's decision still pending) to proceed with full development of the Vega small launcher.

Developed and manufactured by European industry, Vega will complete the range of European launch services by offering on the international market a competitive vehicle for small payloads of up to 1500 kg (primarily polar Earth-orbiting missions at around 700 km altitude).

Belgium, France, Italy and the Netherlands also decided to finance the P80 Advanced Solid Propulsion Stage demonstrator. This development programme is designed to:

- demonstrate most of the technologies required to improve Ariane-5 solid-propellant booster performance and competitiveness
- develop and ground-qualify an advanced-technology first stage for the Vega launcher.

The development milestones for the P80 are consistent with the schedule for developing Vega, whose maiden flight is planned for end-2005.



## ESA Satellite Supports Rescue Efforts in El Salvador

Responding quickly to support rescue efforts converging on El Salvador, member space agencies of the International Charter on Space and Major Disasters dispatched their Earth-observation satellites to capture images of the devastation caused by the mid-January earthquake. The satellites involved were ESA's ERS-2 radar satellite, Canada's Radarsat-1 satellite, and France's SPOT optical series, and together they provided the emergency rescue crews with support based on images captured day and night and in all weather conditions after the quake. Up-to-date maps and information obtained from these specially acquired images and existing archived images were forwarded to the rescue authorities as soon as they were available. Satellite positioning and operation and image capture were coordinated by the International Charter partners.

ERS-2 circles the Earth at a height of 800 km and completes an orbit every 100 minutes, crossing both poles and covering the entire globe in just three days. It will be followed this year by ESA's

new-generation environmental satellite, Envisat, due to be launched in July.

The International Charter on Space and Major Disasters is the expression of a collective resolve to put space technology at the service of rescue authorities in the event of major disasters. Its current signatories are ESA, the French space agency (CNES) and the Canadian Space Agency (CSA).

The Charter, set up in the context of the United Nations UNISPACE III Conference in 1999 and in force since 1 November 2000, remains open for signature by other space agencies and satellite operators anywhere in the world.

Further information can be obtained from:

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## Envisat Nearing Launch

A Media Information Day at ESTEC in Noordwijk (NL) on 1 February provided the last opportunity for the press and media to take a look at the impressive 10 metre-tall Envisat Earth-observation spacecraft before launch. All ten instruments were installed on the spacecraft and the large Advanced Synthetic Aperture Radar (ASAR) antenna was deployed.

The leading international scientists involved in the design of Envisat's instruments, top managers from the Astrium industrial consortium that has built the spacecraft, and the ESA Project Team that has managed the satellite's design and construction, gave comprehensive background briefings on the mission objectives for this unique spacecraft, its sophisticated instruments, and the work scheduled between now and the start of its operational life in polar orbit.



Envisat, the largest and the most sophisticated European Earth-observation satellite ever built, will complete its final test sequences at the ESTEC Test Centre over the coming weeks before being shipped to Kourou in French Guiana for the three-month campaign leading up to its planned Ariane-5 launch in the second half of July.

The next issue of the ESA Bulletin – No. 106, May 2001 issue – will be dedicated to the Envisat mission.



## ESA Takes Further Steps in Caring for the Earth

At the end of November, the Agency took further steps to enhance Europe's capacity to predict the evolution of the Earth's environment, under the influence of both natural variability and man's activities: it selected five new candidate Earth-observation space missions to undergo preliminary feasibility studies. This move reflects the importance of Earth observation from space in providing the globally coherent data that are the essential complement to ground-based, airborne and shipborne measurements.

To be at the forefront of these activities, in 1999 ESA launched the Living Planet Programme, which funds many of the Agency's Earth-observation activities, including the Earth Explorer missions. These are research/demonstration missions intended to advance our understanding of the Earth's environment, which can also be used to demonstrate new observing techniques. There are two complementary types of Earth Explorer Mission:

- *Earth Explorer Core Missions*, which are large ESA-led research/demonstration missions
- *Earth Explorer Opportunity Missions*, which are smaller research/demonstration missions that are not necessarily ESA-led.

In June 2000, ESA issued a Call for Ideas for the next Earth Explorer Core Missions. Ten proposals were received, spanning the interests of the whole Earth-science community and involving some 180 scientists from ESA Member States and Canada, plus countries such as Japan and the USA. The ten missions proposed were:

- ACE – atmospheric chemistry explorer
- CARBOSAT – a mission dedicated to monitoring the carbon cycle
- CLOUDS – a cloud, aerosol, radiation and precipitation explorer
- EarthCARE – Earth clouds aerosol and radiation explorer
- GeoSCIA++ – a passive remote-sensing experiment assessing the impact of regional tropospheric pollution on global change
- LICODY – laser interferometry experiment for core and ocean dynamics
- SPECTRA – surface processes and ecosystem changes through response analysis

- WALES – water-vapour lidar experiment in space
- WATS – water vapour and wind in atmospheric troposphere and stratosphere
- W\_WISE – atmospheric windows and clouds, water vapour, ozone, carbon dioxide, infrared spectral radiation explorer.

The ten proposals were evaluated by the Earth Sciences Advisory Committee, who assessed them and selected five for preliminary studies, but also made specific recommendations to ESA for furthering all ten missions. The five proposals retained were (in alphabetical order): ACE, EarthCARE, SPECTRA, WALES and WATS.

On 20 November 2000, ESA accepted the recommendations of the Earth Sciences Advisory Committee and work has now started on all five missions in anticipation of a Workshop to be held in Granada (E) in October 2001. During that meeting all five missions will be presented to the user community for comment and reaction as a prelude to their further assessment, to decide which should go forward for further studies and implementation.

These proposals follow four other studies that were completed in late 1999 and led to the selection of the first two Earth Explorer Core Missions to be implemented: the Gravity Field and Steady-State Ocean Circulation Mission, which will help to advance knowledge of the Earth's interior structure and provide a much better reference for oceanographic and climate studies, and the Atmospheric Dynamics Mission, which will provide the first direct observations on a global scale of atmospheric wind profiles over the depth of the atmosphere.

In parallel with its work on the Earth Explorer Core Missions, ESA has also initiated considerable activity on the Earth Explorer Opportunity Missions front. A Call for Proposals in July 1998 resulted in 27 proposals, which were subjected to peer review by the Earth Sciences Advisory Committee and consideration by the Earth Observation Programme Board.

The first Earth Explorer Opportunity Mission selected for launch is Cryosat in 2003, to be followed by SMOS 2005. Cryosat will measure the variations in the thickness of the polar ice sheets and the

thickness of floating sea ice. Its data will be used to study the mass balances of the Antarctic and Greenland ice sheets, to investigate the influence of the cryosphere on global sea-level rise and to provide important observations of sea ice thickness for use in Arctic and global climate studies. Cryosat is scheduled for launch in 2003. SMOS is intended to demonstrate the observation of two key Earth-system variables, namely soil moisture over land and salinity over oceans, to advance the development of climatological, meteorological and hydrological models. It should also provide new insights into snow and ice structure, so helping to advance our understanding of the cryosphere.



## Compatibility Testing of ATV Transponders Successfully Achieved

An important milestone in the development of the communications system for ESA's Automated Transfer Vehicle (ATV) was achieved at the end of 1999 with the successful compatibility testing of the Vehicle's S-band transponders by Alcatel Espacio (E). The objective of this test, performed with the participation of ESA, NASA and Astrium SAS representatives, was to verify the transponder's ability to communicate with the Ground Control Station via the TDRSS data-relay satellite network.

The test involved sending data and ranging information from the TDRSS transponder located at Alcatel Espacio's laboratory in Madrid, via the TDRSS satellites, to the Ground Control Station located in White Sands (USA), and vice-versa. All of the tests were made simulating normal operational modes, making it possible to check and confirm that the TDRSS transponder receives and demodulates the signals as required, as well as that the signals sent by it are properly received at the Control Station.

The work performed under ESA contract by Alcatel Espacio in the design, development, manufacture and testing of this new equipment has positioned the company as the sole European supplier for TDRSS S-band-compatible transponders.



## Scientists, School Teachers and Students Conduct Physical- and Life-Sciences Studies on ESA Parabolic Flights

ESA's 29th Parabolic-Flight Campaign was conducted from Bordeaux-Mérignac airport in France, from 21 to 23 November, using the specially adapted 'Zero-g' Airbus A300. This particular campaign included 11 different experiments: four in physical sciences, four in life sciences, two experiments proposed by students and one serving educational purposes for the general public. 30 microgravity-simulating parabolas were flown by the A300 on each of the three days.

Parabolic flights are practically the only means on Earth of reproducing weightlessness with human operators on board. During a parabolic flight, the Airbus pilot – flying at an altitude of approximately 6000 m, usually in a specially reserved air-corridor above the Gulf of Gascogne – first performs a nose-up manoeuvre to put the aircraft into a steep climb (7600 m). This generates an acceleration of 1.8g (1.8 times the acceleration due to gravity on the ground) for about 20 sec.

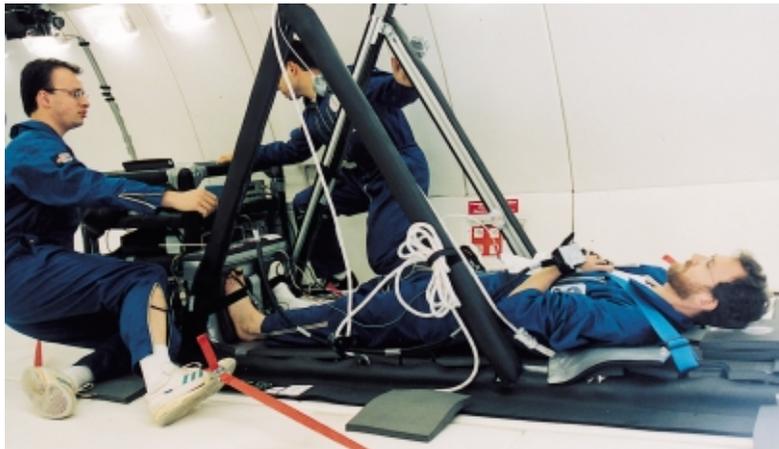
Then, the pilot throttles back to inject the aircraft onto a parabolic flight path. The plane continues to climb until it reaches the apex of the parabola (8500 m) and then starts descending. This condition lasts for about 20 sec, during which time the passengers in the cabin float in the weightlessness resulting from the aircraft's free fall. When the angle below the horizontal reaches 45°, the pilot opens the throttles again and pulls the aircraft up to return to steady horizontal flight. These manoeuvres are repeated 30 times per flight.

With Europe and its international partners now building the International Space Station, on which research and experiments will be carried out for the next 15 years, 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 four physical-sciences experiments were related to fluid physics and investigated electrostatic effects in boiling liquids, particle motion in aerosols, annular liquid flows and plasma states:

- Study of the effect of an imposed electrostatic field on pool boiling heat transfer and fluids management, provided by Prof. W. Grassi and Dr P. Di Marco (Univ. of Pisa, I).
- Three-dimensional tracking by digital holography of particle motion in non-equilibrium aerosols, provided by Prof. J.C. Legros and Dr A. Vedernikov (Univ. of Brussels, B) and Prof. F. Prodi (ISAO-CNR, Bologna, I).
- Annular flow film thickness and pressure drop measurements in microgravity, provided by Prof. K. Rezkallah (Univ. of Saskatchewan, CDN) and Dr C. Colin (Inst. of Fluid Mechanics, Toulouse, F).



- Preliminary tests for the International Microgravity Plasma Facility, provided by Prof. G. Morfill and U. Konopka (Max-Planck Institute, Garching, D).

In life-sciences, two physiology experiments studied the cardiac system and two biology experiments investigated plant gravitaxis and cell and particle motion by ultra-sound:

- An assessment of the feasibility and effectiveness of a method of performing cardiopulmonary resuscitation during microgravity, provided by S. Evetts (School of Biomedical Sciences, King's College London, UK) and Prof. T. Russomano (Univ. do Rio Grande do Sul, Porto Alegre, Brazil).
- Acute heart response to weightlessness conditions during parabolic flights, provided by Prof. A. Aubert, Dr. F. Beckers and Dr. D. Ramaekers (Univ. of Leuven, B).

- Investigation of physiological parameters of gravitaxis in *Euglena gracilis*, provided by Prof. D-P. Häder (Univ. of Erlangen-Nuremberg, D).
- Ultrasonic particle and cell manipulation in microgravity, provided by Dr. L.G. Briarty (Univ. of Nottingham, UK).

Two experiments were proposed by students and selected after two international competitions, one in a medical field and the other in space technology:

- Pulse transit time for the non-invasive determination of arterial wall properties, provided by P.F. Migeotte, T. Dominique and R.C. Sá (Univ. of Brussels, B).
- Globular Cooking Facility, provided by S. Podhajsky and G. Grillmayer (Univ. of Stuttgart, D).

The eleventh experiment was flown for promotional and educational purposes. Several secondary-school teachers,

attached to the Euro Space Centre in Transinne, Belgium, conducted simple classroom experiments in physics and chemistry, emphasizing the role of gravity's absence during parabolic flights. These experiments were recorded and will be shown later to the general public and schools attending space classes at the Centre to promote

early awareness of the characteristics and possibilities of the space and microgravity environment. Springs, yo-yos, gyroscopes, magnetic balls, pendulums, and simple foods (sweets, bananas, grapes) in microgravity will be used to explain their different behaviours in weightlessness and the difficulties that astronauts encounter in their everyday lives in orbit.

ESA's next parabolic-flight campaign is scheduled for May 2001 and will carry a mixed complement of life- and physical-sciences experiments, again including student-proposed experiments.

More information on ESA parabolic flights can be found at:

[www.estec.esa.nl/spaceflight/parabolic](http://www.estec.esa.nl/spaceflight/parabolic)

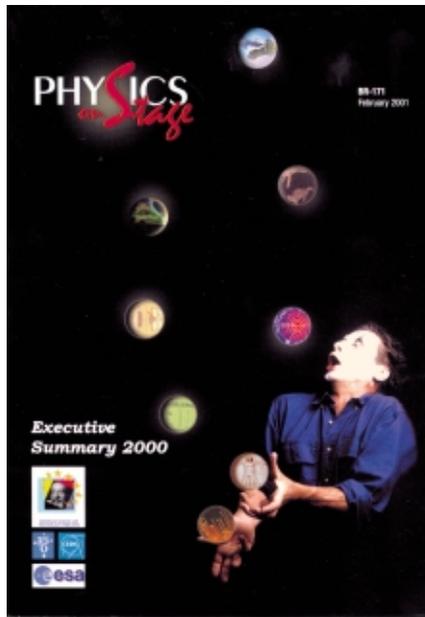


## The 'Physics on Stage' Festival

A screeching noise emanates from one of the 22 stands at the fair: the Irish delegates are demonstrating with a violin bow, a metal plate and some sand, how sound waves propagate through a metal plate. New patterns form in the sand depending on where the bow is struck. A few metres away, in CERN's main auditorium, 400 physics teachers and physics popularisation experts are tossing small wooden blocks into the air to find out about which axis they rotate in a stable manner. Two young Germans – one dressed as a talk-show host, the other as a confused scientist – have captured their audience's attention with their performance. A few doors down the hall, a workshop group of some 30 delegates are sitting deep in discussion over how physics should best be taught in secondary schools to motivate the youth of today to become the scientists and engineers tomorrow.

'Physics on Stage' took place at CERN in Geneva from 6 to 10 November and was a great success. It was the brainchild of three international organisations: CERN (European Organisation for Nuclear Research), ESA, and ESO (European Southern Observatory). It was a unique initiative that had a significant impact on the public understanding of physics and on the teaching of physics in Europe's schools. The European Commission supported the project as part of its 5th Framework Programme.

The five-day festival in Geneva was the climax of the year-long 'Physics on Stage'



ESA BR-171, February 2001

programme and it brought together over 400 experts on physics teaching and popularisation, including high-school physics teachers, university lecturers and researchers, curriculum developers and scientific and educational journalists. Delegates from 22 European countries presented their ideas and techniques for making physics a fascinating subject for schoolchildren and the public alike. The range of ideas was as wide as it could be – experiments with electricity, light, sound, speed, chaos theory, toys, free fall and the Big Bang – and the ways in which these ideas were presented were highly creative and original.

The festival in Geneva was the culminating event in a year of wide-ranging activities in each of the

participating countries. The national programmes organised by the National Steering Committees played a crucial role in the 'Physics on Stage' programme.

Thanks to the enthusiasm and commitment of all delegates, the main objectives of 'Physics on Stage' have been successfully realised:

- A debate on physics teaching amongst educators, the media and politicians has been catalysed.
- The most effective and innovative methods for teaching physics have been identified, incorporating demonstrations, lectures, innovative teaching materials, hands-on-activities, theatre, video, web applications, etc.

A colourful highlight of the 'Physics on Stage' festival was the physics teaching fair, where all countries had the opportunity to present their methods, ideas, experiments, books, and brochures. It was buzzing with life, sound, conversation and surprises at every turn. It was so much of a real fair that there were even gingerbread hearts (stamped, of course, with  $E = mc^2$  !) and heart-shaped helium balloons proclaiming 'Physics is at the Heart of Everything'.



The French performance

The Physics Fair



The Dutch presentation



The Plenary presentations and special performances were all well-attended



Workshop group

motivation and inspiration for the educational community, as well as for the organising team. The European Commission and the European Science Organisations demonstrated strong political support to the 'Physics on Stage' Festival and its outcome.

*This crisis will have a major impact on the cultural identity of Europe. A frightening trend is underway in terms of the lack of interest in physics among the general public (particularly young people) and the diminishing number of physics teachers in Europe. Together, these points indicate that, if action is not taken now, Europe will enter a dark age of knowledge.*

Other important components of the festival were the Plenary presentations, which were of outstanding quality, and the special performances, which brought theatre and physics to the stage hand in hand, and more than once made the audience roar with laughter or go silent with astonishment.

The visit of the Directors General of ESA, ESO and CERN and the active involvement of the European Commissioner for Research, Dr. Philippe Busquin, during the Festival were an important source of

Throughout the Festival, participants met in small groups to discuss various themes close to the heart of physics education. These Workshops, with titles such as 'Mapping the Crisis', 'Women in Physics' and 'Curriculum Developments', provided a forum for the delegates to suggest actions that could be taken to improve the current state of physics literacy in Europe. From a total of 74 recommendations emanating from 'Physics on Stage', the present crisis in the teaching of physics has been clearly identified:

ESA, ESO and CERN had discussions in Geneva with the educational community regarding what role the three European organisations could play in the future of physics education.

To close the Festival, there was a voting session involving all participants to establish priorities in the list of recommendations. The results of this vote represent a good statistical assessment of the will of the European physical teaching community.

It was a wonderful week: many contacts were established across European frontiers and the 'Physics on Stage' participants are eagerly looking forward to putting some of the new ideas into practice.

*Clovis de Matos, Helen Wilson,  
Barbara Warmbein*



For more information about the 'Physics on Stage' project, visit the following web sites:

[www.estec.esa.nl/outreach/pos](http://www.estec.esa.nl/outreach/pos)  
or  
[www.cern.ch/pos](http://www.cern.ch/pos)

*Entering into the spirit of 'Physics on Stage':  
Dr. Philippe Busquin (centre)*

## ESA Helping to Develop the Next Generation of the World Wide Web

With the World Wide Web (WWW) being used by more and more people, its limitations in dealing with huge amounts of data are becoming ever more apparent. Its successor, 'The Grid', should comprise computing resources in which super-computers, processor farms, disks, major databases, informatics, collaborative tools and people are linked by a high-speed network.

The DataGrid initiative originated in the framework of the European Summit in Lisbon, Portugal, in March 2000, when the idea of a dedicated network for European science applications research was put forward. The objective is to develop and demonstrate an informatics architecture geographically distributed throughout Europe with high-data-rate transmission links. The project was submitted to the European Union in May for funding through its Fifth Framework Programme for Research and Technological

Development. Funding of 9.8 MEuro over three years was authorised at the end of December and a contract has been awarded to CERN as project leader.

ESA, through its ESRIN establishment in Italy, is one of six partners\* in the DataGrid Project and will demonstrate use of the distributed infrastructure for Earth-observation applications. The novel distributed-computing environment, specifically designed to analyse and move vast amounts of data, will be developed and deployed using emerging technologies and 'open source' code to create a new worldwide data and computational facility on a scale not previously attempted.

The resources will be made available transparently to a wide community using new 'middleware' between the computer operating systems and applications that enables and facilitates collaborative working in new ways. This 'middleware' – to be developed in collaboration with some of the leading centres in Grid technology, thereby leveraging practice and experience from existing Grid activities in Europe and elsewhere – will subsequently

be made available to industry, potential partners and research bodies.

The DataGrid Project will provide scientists around the world with flexible access to unprecedented levels of computing resources, and will therefore usher in a new era of e-science. It will enable next-generation scientific exploration using shared databases of up to a petabyte (equivalent to a pile of CD-ROMs standing over a kilometre high), across widely distributed scientific communities. International connectivity will be achieved through an advanced research networking infrastructure, which is the subject of another EC initiative.

Further information can be found at:

The DataGrid website:  
[www.cern.ch/grid](http://www.cern.ch/grid)  
*The DataGrid Earth Observation Science Application:*  
<http://tempest.esrin.esa.it/~datagrid>

\* The other partners are: CERN (CH), CNRS (F), INFN (I), NIKHEF (NL) and PPARC (UK). 

## Opening Event of ESA 'Mars City Competition'

Ex-astronaut Wubbo Ockels arrived at his old primary school in Brielle, Holland, in a school milk truck with the very first 'Mars City Competition' package on Friday 2 February.

Over 2000 of these packages have been delivered to Dutch primary schools with their Melkunie school milk. The packages contain a Space Kwispel game, developed by ESA's Education & Outreach Office in collaboration with the Dutch toy company 'King International' and ESA Publications

Division. Children 10 -12 years old will use the Space Kwispel in their search for information to help them design and build a Mars City from school milk cartons.

The children in Meester Eewoutschool in Brielle built an enormous, glittering and inventive Mars City from the school milk cartons that they had been collecting. The model, which they had just two hours to complete, included a meteorite gun for

protection, oxygen generators, a greenhouse, a burger and pizza café, and even a soccer pitch for the future soccer team, the 'Mars Maniacs'.

Other classes from schools around Holland will submit photographs of their 'Mars City', along with design data, in order to enter the competition. The winning team will be treated to space-related prizes and a 'Space Day' at ESTEC to



see satellites and astronauts first hand and to show off their design work to real space scientists and engineers. The competition ends on 16 March.

For more information, visit:  
[www.estec.esa.nl/outreach/kwispel](http://www.estec.esa.nl/outreach/kwispel)

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## Our Galaxy – In Three Dimensions !

Measuring the distances to the stars accurately is one of the great challenges that continues to face experimental astronomy. Hipparcos was an original and highly successful scientific mission, conducted by ESA in collaboration with European space scientists between 1981 and 1997. Its goal was to create a map of the stars with unprecedented precision.

New techniques allow the projection of the sky in three-dimensions, precisely as measured by Hipparcos. On 8 February, Michael Perryman of ESA's Space Science Department showed some of the 3D results to a packed audience in the Newton Conference Auditorium at ESTEC in Noordwijk (NL). Using an elaborate projection system based on polarised-light images, the audience was able to view a number of 3D movies using polarising glasses. They could see how stars travel through the Galaxy over intervals of millions of years, observe the space distribution of some of the recently discovered extra-solar planets, and follow

the passages of stars whose space motions brought them close to the Sun in the geologically recent past. Other sequences illustrated the new insight that the Hipparcos data are giving into the details of our Milky Way Galaxy, for example its age, three-dimensional structure, and its possible formation process.

The GAIA Cornerstone science mission, recently accepted by ESA for launch a decade from now, will

build on the results of Hipparcos to map the three-dimensional structure of more than one billion stars extending throughout our Galaxy.



Dr. Michael Perryman



The ESTEC audience in their 3D polarising glasses

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