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THE UNION EMBRACES SPACE

DEMOGRAPHY
Did you say the 'Old World'?

e-SCIENCE
From the Web to the Grid

Editorial

Growing awareness

The European Union has recently taken a number of initiatives in various fields that are vital for our future. First, space, where a genuinely common, EU-wide strategy is being implemented (p.3). Then electronic networks, where the Member States have decided to support the development of a new generation of Internet (p.14). Finally, there is fusion, where the Union is now ready – scientifically, technologically and operationally – to embark on a new and decisive stage in the history of this energy source in the making (p.16).

Far from being a coincidence, the fact that these three developments are taking place simultaneously in very different fields can be attributed to a single cause: the European Research Area. It now underpins the Union's entire scientific policy, and its vitality is set to influence every area of European research.

But these parallel developments – along with the imperative of seeing the ERA take a tangible form – are also inextricably linked to another phenomenon at work in many fields. This is the growing awareness that when Europeans get together they are capable of the very best. Ariane, Airbus, high-energy physics, fusion, environmental sciences, and the emergence of a European scientific community thanks to EU programmes are just some examples which show that Europe and research are an ideal match.

This insight is no longer limited to a few visionaries. It is increasingly one that is shared and more rarely one that is challenged – a development which is benefiting both Europe and its citizens.

Cover photo: The Canary Islands - from left to right Gomera, Tenerife, Gran Canaria and Fuerteventura.

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The EU embraces space

ALL OVER THE WORLD, Ariane, named after a heroine from Greek mythology, is the symbol of European technological know-how, recognised for its quality and dependability. Ariane rockets today rank among the world's leading satellite launchers. But Europe is not only at the forefront of space applications in the field of telecommunications and Earth observation; it is also a leading player in major international space exploration programmes. It is thanks to the combined efforts of the European Space Agency (ESA), national space agencies and industry that these skills have been developed.

A command of space is a key component of the modern technological world. Whole areas of human activities today depend on the use of space satellites and technologies. This is true of telecommunications and television, now so much a part of our everyday lives, as well as of activities such as meteorology, cartography, environmental observation and surveillance, agriculture, transport, security and defence.

Today, space as a tool has penetrated all fields of economic, social and cultural management to a degree which renders it of vital significance to the European Union. The ability to continue to develop and use space infrastructures autonomously and competitively, as well as to collect and use the information, is clearly a key priority for Europe. This is why last year European leaders reached agreement on the need to create a new common space policy.

2001 is a crucial year in which all those involved in the success of European space technology – both public and private – have agreed to cooperate on developing a new chapter in the history of space. Space will become an inherent part of a strategic vision common to the EU as a whole and, as such, an example of the dynamics of the European Research Area at work. A joint task force has been charged with implementing this strategy as defined jointly by the Commission and ESA, the latter forming the operational arm as it develops into a genuine *space agency for Europe*. The mission of this task force is to identify space priorities, in the interests of a coherent approach, and to mobilise public and private resources, scientific skills and industry, to take part in major projects.

Satellite picture of Friesland (NL) and the islands of Texel, Vlieland, Terschilling and Ameland (from left to right). Photo: ESA.

Achilleas Mitsos, Director-General for Research – 'Space strategy is a very concrete field of application for the concept of the European Research Area which now inspires the Union's entire science and technology policy.'

By the end of the year, European space strategy is due to produce a partnership between the Commission and the European Space Agency. Achilleas Mitsos, the Director-General for Research, is responsible for coordination and space policy at the Commission, and is currently the co-chair of the task force.

A new European

Europe did not wait for the EU to develop its presence in space, thanks to ambitious national policies and the European Space Agency (ESA). Why do we now need to change this approach?

ACHILLEAS MITSOS: Thanks to ESA and the 'pragmatic' approach adopted, Europe has become a major player in space, alongside the United States, Russia and Japan. Ariane, which is the symbol of its know-how, holds 50% of the commercial launching market. A new and encouraging fact is that last year the European space industry won more than half of all satellite calls for tender. ESA is also a key partner in major international scientific programmes.

With particularly efficient investments – less than one-sixth of the US space budget – Europe has acquired scientific, technological and industrial skills which rank among the best in the world.

Today, space applications are impacting on all our everyday lives, through satellite broadcasts, television, meteorology, cartography and Earth observation. Space is providing management tools which are proving increasingly essential for many EU policies, such as telecommunications, agriculture, the environment, transport, and soon for its new common security and defence responsibilities, too.

Space is now a strategic field, one which requires a coherent, global approach, particularly to safeguard European autonomy.

How does this new European policy area fit in with the idea of subsidiarity?

AM: The EU's role is first to support the initiatives of the sectoral players, both public and private. This support will help achieve the two objectives which have been central to the European space effort to date, namely to develop the technological and industrial base in order to permit independent economic exploitation of applications and, at the same time, to include a very high-level scientific component which contributes to the understanding of our planetary system and space exploration.

The Union will provide a common reference framework for these players to ensure that space infrastructure, and successful services derived from this, continue to be available. It is a question of integrating space science better in the European research effort, and of creating the appropriate political and regulatory conditions for developing the sector and commercial markets.

A third objective is now aimed at fully integrating the space tool in the implementation of European policies. Two key projects are under way in this field: Galileo for satellite navigation – particularly essential to the transport sector – and the GMES concept for monitoring the global environment and for security.

These two projects implement a space component and a terrestrial component in line with the specifications drawn up by the users. They contribute to European policies and to the development of industrial capabilities.

How should we understand the planned partnership between the Commission and ESA? Is the European Space Agency going to become the agency for implementing EU programmes and, ultimately, the European Union Space Agency?

AM: The Commission and the ESA executive have been given the go-ahead to define the terms of a partnership between the Commission and the European Space Agency by the end of 2001, so that, among other things, ESA can pursue its mission as an intergovernmental

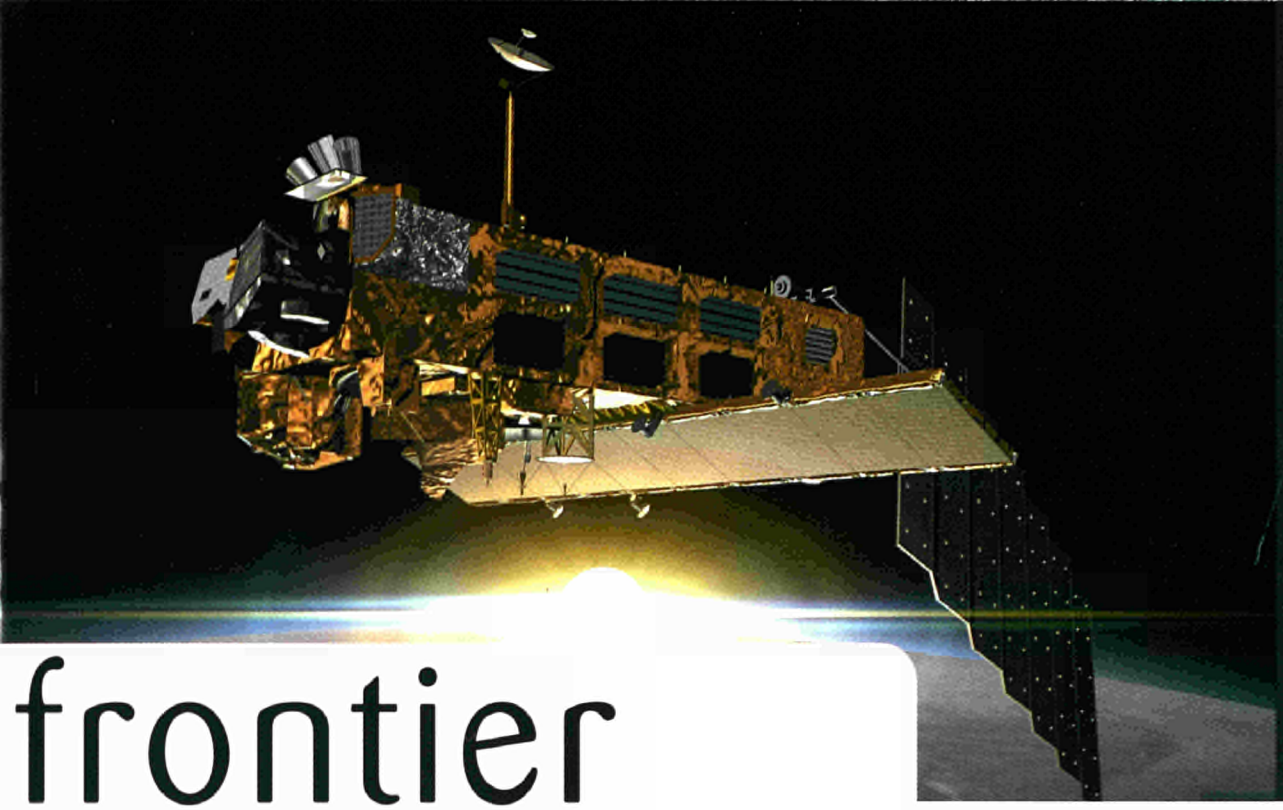
According to the Eurospace association which federates the European space industry, in 1999 this represented a turnover of 5.48 billion euros, 47.8% of which came from commercial contracts, 27% from contracts with ESA, 13.7% from national civil contracts, 9.5% from national military programmes, 1.7% from other clients and 0.3% from the European Commission. www.eurospace.org/

See

Commission Communication of 27 September 2000 entitled *Europe and Space: opening up a new chapter* (COM(2000) 597 final), ratified on 16 November 2000 by a joint resolution of the Union Councils and ESA

On the web

Site of the European Commission Space Coordination Group
europa.eu.int/comm/jrc/space/index_en.html



'Space is providing management tools which are proving increasingly essential for many EU policies, such as telecommunications, agriculture, the environment, transport, and soon for its new common security and defence responsibilities, too.'

ENVISAT satellite – artist's drawing ©ESA

agency while at the same time acting as the Union's space agency in accordance with the regulations. So, in a sense, ESA can be seen as complementing its two current 'pillars' – the scientific and optional programmes, which essentially amount to increased cooperation – with a third aspect, that of Community programmes.

Representatives of the Member States will sit on the Joint Strategic Space Advisory Group (JSSAG), a genuine forum where European space policy will be proposed and discussed.

Space is a mixed sector, with a public political strategy on the one hand and major industrial interests on the other. How can this duality be integrated?

AM: By setting up major aerospace companies, European industry is consolidating, in particular to meet the challenge of the US industrial giants. This effort continues to require a key support role on the part of the public authorities, and thus a very special kind of political accompaniment.

The EU is proposing a formula of mixed partnerships so that the public sector and the entire industrial chain of manufacturers and users can come together in operational projects. Private investment will mobilise as space projects offer profit opportunities. But these partnerships go beyond financial commitments. They concern the implementation of economic, political and regulatory frameworks making it easier for industrial and financial partners to make a profit on their investments.

In this respect, Galileo is a first for Europe. Similar structures are also possible in the case of the GMES, for information systems and services based on satellite observation.

Space applications have another dual aspect as they are very important to defence and security needs, in particular in the framework of the Common Foreign and Security Policy (CFSP). Is this dimension being taken into account?

AM: Most certainly. The joint task force has a precise mandate in this respect.

As civil projects under civil control, Galileo and particularly GMES are contributing to a strategy where not only do transport and environment policies meet each other but also the CFSP, in particular in the transfer of the so-called Petersberg[1] operations from the WEU to the European Union. The proposed integration of the WEU satellite centre into the Union, too, should facilitate implementation of the GMES project.

How are European research programmes going to include the EU's objectives in the space sector?

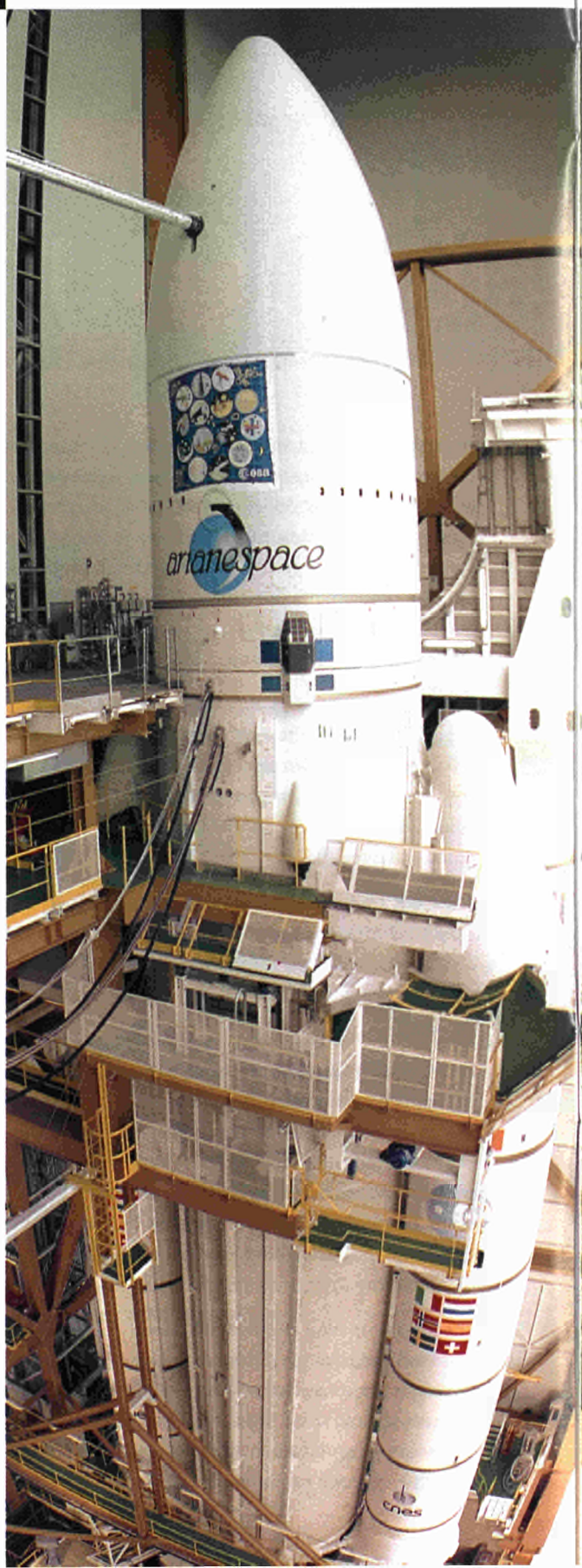
AM: The Commission wants to step up its action in this field and has adopted aeronautics and space as one of the seven priority themes of the new Framework Programme now being prepared.

Space strategy is a very concrete field of application for the concept of the European Research Area which now inspires the Union's entire science and technology policy. The aim is to cooperate with all the players – and primarily ESA – in determining the main thrust of a European space policy which is fully accepted and supported by all the Member States. The role of Union programmes is to encourage the structuring and coherence of this common strategy. ◗

(1) For many years, the Western European Union was the consultation body for European states on defence matters. Its military missions were established in the Petersberg Declaration in 1992. They cover humanitarian aid, evacuation, peacekeeping and combat in crisis situations. In 1999, the EU's Member States decided to transfer responsibility for these missions progressively to the European Union.

The Ariane connection

The European Space Agency (ESA) has been weaving the technological, scientific and commercial web of Europe's command of space for more than a quarter of a century. A brief profile of an institution renowned for its excellence reveals it is now ready to place its full potential at the service of European Union policies.



ESA IS MOST renowned for the long history of Ariane, nurtured by the agency since its birth. Controlling 50% of the market for satellites launched into geostationary orbit, Arianespace is today the world leader among commercial launchers. Set up by ESA 20 years ago, the company has since won 230 orders and completed 140 launches, with a further 50 already on its books. While Ariane 4 can boast of being 'the' reference in terms of reliability and adaptability, Ariane 5 is a global challenger on the heavy launchers' market.

Satellite launchers

An agency of 15 European countries[1] responsible for drawing up and carrying out the European space plan in association with the Member States, national agencies and industry, ESA is currently working on the development of two new upper sections for Ariane which will enable it to increase its payload from 6.5 tonnes to 11 tonnes by 2005. Ariane will then be ready to undertake every kind of mission: the double launch of satellites into geostationary orbit, the deployment of constellations in medium or low orbit, and the launch of interplanetary probes or Earth observation satellites. Work is also going well on the Vega programme to develop a small launcher able to put useful loads of 1.5 tonnes into polar orbit at an altitude of 700 km.

But ESA's success is not founded on launchers alone. The formidable autonomy created for Europe has also enabled it to develop technological know-how in the field of satellites. Since the development of OTS (1978) and Olympus (1989), the European aerospace industry has built more than 50 telecommunications satellites worth billions of euros. This year two new satellites will become operational: Artemis – which will operate direct links with mobile users on the ground and gather data from other satellites via laser beams – and Envisat, a European remote-sensing satellite with even more advanced instruments than those of its predecessor, the ERS-2. Next year will be the turn of the second-generation Meteosats which will provide much more precise meteorological information than those which have been operating over the equator since 1977.

©ESA

A series of missions

The technological and media effort deployed by the United States in the 'space race' should not conceal the second place acquired by Europe in the space sciences. Examples?

Scheduled for launch in 2003, the Mars Express project will permit the most detailed scrutiny of the Red Planet yet attempted as it looks for hidden water or ice and drops a landing module capable of detecting signs of life. In 2004, Huygens will be released into Titan's atmosphere (one of Saturn's moons) by the US Cassini probe for the most distant landing ever attempted on another world, bringing new insight into the origin of life on Earth. ESA, in association with BepiColombo, is also planning a mission to Mercury, the planet which lies closest to the Sun and has been somewhat overlooked by space exploration.

Other missions will be carried out under the Horizons 2000 research programme. The hunt for comets, which began with the Giotto probe (that passed close to the core of Halley's comet in 1986), will continue with the launch in 2003 of the Rosetta probe which will reach Wirtanen's comet in 2011 and stay with it for two years.

Following on from the SOHO mission, which has sent us many pictures of the Sun's atmosphere, the Cluster II mission, launched last year, will provide the first 3-D views of the gusts of solar wind which shake the Earth's magnetic field. The phenomena of extreme heat and violence often experienced in space are being tracked by XMM-Newton, the most powerful X-ray telescope ever placed in orbit, to be accompanied from next year by the 'Integral' satellite for gamma ray observation.

There is also no shortage of new projects at the study or development stage, whether to get closer to the Sun (Solar orbiter), to explore the formation of the stars and galaxies (Herschel) or black holes (Lisa), or to set off in search of planets which resemble the Earth (Darwin).

Objective: science

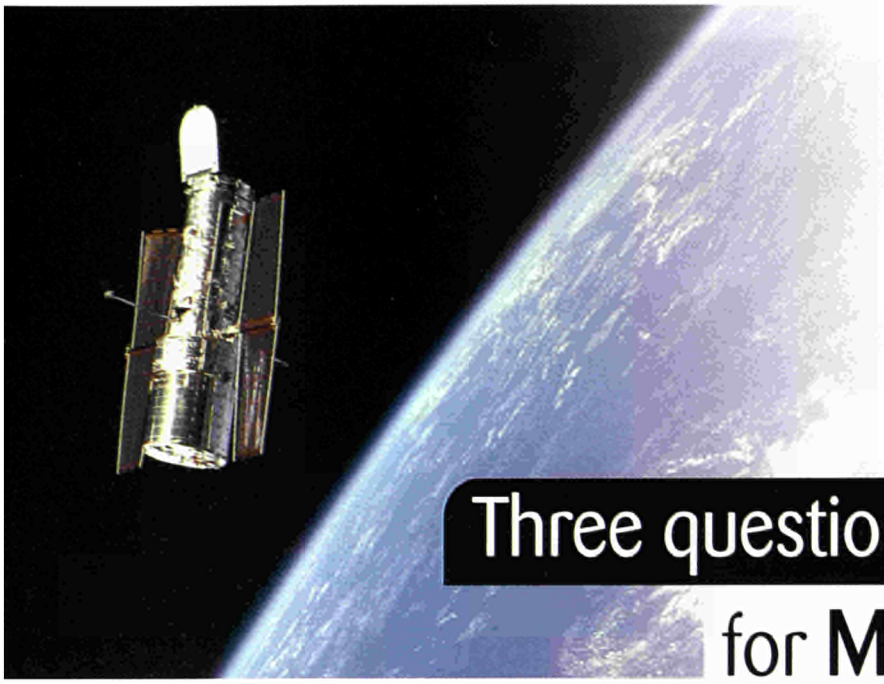
'Scientific programmes (see *A series of missions*) are clearly another priority for ESA, whether for the study of the planets, the Sun and its effects on the Earth, or the Universe, as the agency also has a clearly defined scientific mission,' stresses Michel Praet, ESA's representative in Brussels. 'Scientific spacecraft built by ESA, or with its cooperation, have played a major role in the study of the Sun, research on comets and planets, and exploration of the Universe. ESA is also at the forefront of monitoring the hole in the ozone layer (using the ERS-2), ice sheets, winds, ocean currents and other factors which affect the health of our planet.'

Scientific missions have also made a valuable contribution in other fields, such as the medical sciences and the development of new industrial processes. ESA's participation in the international space station will allow it to put up a laboratory for continuous research. Known as Columbus, this pressurised cylinder linked to the station's manned base will allow European astronauts to carry out more than 500 experiments every year in materials and fluid sciences, medicine, biology and technology, under conditions of microgravity.

Ariane, the symbol of European know-how, now ranks among the leading rocket launchers, with 50% of the commercial market. ©ESA

(1) All EU countries except Greece and Luxembourg, plus Norway and Switzerland. In 1999, ESA had a budget of 2.65 billion euros.

www.esa.int/export/esaCP/index.html



Three questions for Michel Praet

The Hubble telescope, on its third mission. Photo: NASA.

Michel Praet, ESA representative in Brussels.

Why has ESA now decided to define a new strategy with the European Union?

Things change and the world evolves. Space is often the stuff of dreams as it seems so distant, but the technology does not exist in isolation. It has become a formidable management tool and the need for such a device which can be applied to a range of Union policies – such as transport, agriculture, the environment – is increasingly evident. Not that space technology is the universal panacea... I see it as one element in a toolbox which includes among others, for example, the optical fibre tool. In this respect we are on the same wavelength as Commissioner Busquin's concept of the European Space Area. It is not just a question of undertaking research, but also of coordinating what already exists so as not to have to reinvent the wheel each time. The question therefore is whether to recreate a space agency within the Commission – which would not make any sense – or to use ESA as a space agency *for* Europe, which will also become an *implementing agency* serving EU policy needs. Finally, these needs must be defined in coordination with the Commission. Clearly, we will develop these in conjunction with European industry as ESA is not a commercial agency. We are there to aid industry and to help it to be competitive.

Why the emphasis on the Galileo and GMES programmes?

We are very committed to their success. Why? Europe created Ariane for a complex world and to have an autonomous space capability. Galileo is born of the same logic. We cannot depend on a single system which is itself highly dependent on the US Defence Department. This is a crucial political choice for the continent as a whole.

Similarly, if we want security and environmental questions to be better understood in Europe, we need an initiative such as GMES. This is not a dedicated programme, like Galileo, but rather a platform which aims to provide coherence. In the area of risk management, space technology can be a valuable tool for matters relating to floods, storms, earthquakes, sea pollution, etc., all of which Europe has experienced repeatedly over recent years.

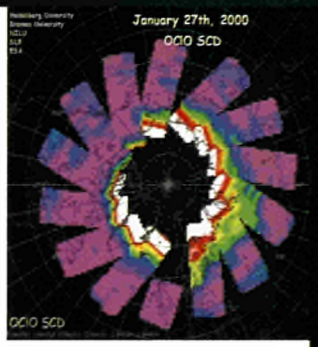
But how can we understand this dual, civil/military nature which is intrinsic to space, and particularly GMES?

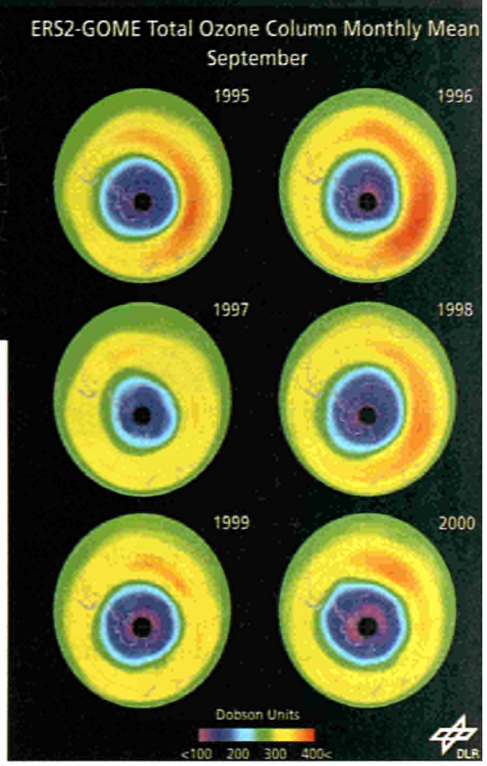
According to the terms of its founding convention, ESA must develop a space policy for peaceful purposes. Surveillance to verify that a treaty is being applied, for example, is a way of ensuring peace agreements are respected. Some concrete questions will be posed in the medium term. It is not possible to accept the mandate of Javier Solana and at the same time leave the Council lacking in information systems. In this area, too, we must acquire the means to have our own policy and have the necessary autonomous instruments to this end. But everybody is well aware, even after St Malo, that when it comes to European security and defence we have a long way to go.

The Earth in its sights

Launched in 1998 by the European Commission and a group of space agencies, the GMES (Global Monitoring for Environment and Security)° initiative aims to provide Europe with independent and permanent access to the information flows generated in space. Such information is crucial for monitoring the environment, preventing and managing natural and industrial disasters, complying with greenhouse gas reduction commitments, anticipating conflicts and handling crises.

Satellite data can give indications of crisis or disaster situations which can be of use to the populations concerned. Above, a fire simulation makes it possible to test the effectiveness of data provided by the REMSAT (Real Time Emergency Management via Satellite) programme.
© British Columbia Forest Service





A valuable tool in the study of the environment, satellite images enable the study of developing climatic phenomena in space and time. Top left, measurement of chlorine activity above the Arctic and, right, changes in the ozone layer above the Antarctic during the past six years.
© University Heidelberg
© DLR

'**WE NEED** to co-ordinate the structures of the systems which produce space information,' explains Christian Patermann, director of the environmental research and sustainable development programme. 'The surveillance systems – sometimes competing, sometimes complementary – such as ERS-2, SPOT and Meteosat, are now available. But the data they provide suffer from a lack of coherence, continuity and comparability. Hence the differences in the models and scenarios used to analyse these data. GMES[1] aims to implement an integrated European approach for the collection, dissemination and analysis of space information.'

The first task for GMES is to contribute to our understanding and command of global change, as satellite data makes it possible to draw up and validate models likely to improve our understanding of phenomena such as *El Niño* or the carbon cycle. It will also contribute to the study of the various processes which put pressure on the environment, in particular due to the growth of urban or industrial areas.

The security dimension

Civil protection and town planning agencies will also be major consumers of observation systems focusing on the prevention and evaluation of catastrophes and disasters of both human and natural origin, from forest fires and floods to pollution by hydrocarbons.

Finally, this initiative will make a fundamental contribution to the Common Foreign and Security Policy (CFSP) to which the European Union is now clearly committed. The space tool is essential today to peacekeeping missions, such as the EU's commitment in Kosovo. In 1999, for example, it was an observation satellite system developed by the Commission's Joint Research Centre which enabled the ECHO humanitarian aid agency to evaluate the impact of military operations on regional agricultural production.

(1) Apart from ESA, various national space agencies and the Commission, the GMES initiative also involves Eumetsat, the European Association of Remote Sensing Companies, the WEU Observation Centre and Eurospace.

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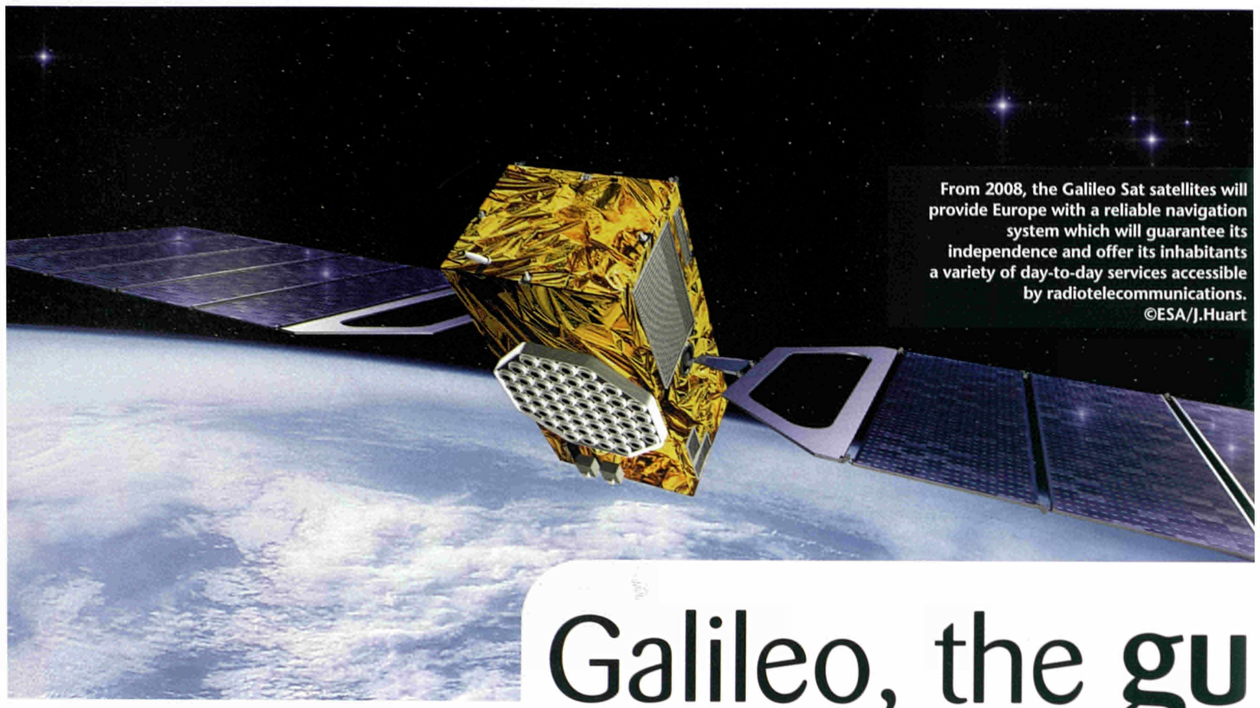
http://gmes.jrc.it/index.htm



From 2008, the Galileo Sat satellites will provide Europe with a reliable navigation system which will guarantee its independence and offer its inhabitants a variety of day-to-day services accessible by radiotelecommunications.
©ESA/J.Huart

In concrete terms…

Once operational, Galileo will have the potential to generate revenue from a variety of uses. A wide range of Galileo receivers will offer the different kinds of satellite navigation services available, possibly combined with other functions. A basic service, free for certain applications, could be made available to the general public. Mini-terminals in motor vehicles could provide drivers with an integrated navigational platform combining positioning and the monitoring of traffic information or services specifically dedicated to certain leisure activities (mountain climbing, sailing, etc.). More simply, a positioning function could be integrated into mobile telephones using the UMTS standard, permitting, for example, the supply of certain added-value services or precise locating in the case of an emergency call using the EU-wide 112 number.

More sophisticated services will be proposed for commercial and professional applications requiring a high level of performance and for which the user will have to pay. Finally, there will be restricted access to public interest applications requiring maximum dependability such as air and sea navigation, emergency services, etc.

Galileo, the **gu ardian angel** of mobility

Just like mobile telephony, Europe's Galileo satellite navigation programme will revolutionise many sectors of the economy – starting with transport. Initiated by the Commission and the European Space Agency (ESA), by 2008 this project is set to be the industrial and technological flagship of the joint space strategy.

SATELLITE NAVIGATION allows the owner of a transmitter/receiver to determine and communicate their position in longitude, latitude and altitude very precisely, at any moment, by picking up signals from a number of satellites. This continuously available 'guardian angel' from space is revolutionising air traffic control, the management of ship and lorry fleets, road and rail traffic monitoring, the mobilisation of emergency services, and the tracking of goods carried by multimodal transport.

Multiple applications of a vital tool

It is not just in transport where satellite navigation techniques are opening up new applications. Tracking dangerous materials, locating oil and gas deposits, identifying fishing areas, locating the site of wrecks, guiding the visually impaired, and facilitating the work of emergency aid teams and humanitarian operations are just some examples. Specific uses could also develop in the medical sector for the remote treatment of patients, in law enforcement for tracking prisoners on parole, and in customs for investigations in the field.

Today's two principal satellite navigation systems, GPS and Glonass, are both under military control, the former US and the latter Russian. Both are also open to civil applications, in Europe and elsewhere. They already enable tracking on the road, at sea, in the mountains and in the desert – but with no guarantee of precision or continuous service. The military authorities in the two countries can decide to stop or downgrade the signal at any time for reasons of national security.

For a Europe in the process of developing an integrated transport system it is therefore vital to develop independent positioning and navigational systems which are precise and reliable. The Union simply cannot afford to be absent or dependent on others when dealing with a technology whose potential market is estimated at 9 billion euros a year and which is likely to generate 140 000 jobs.

That is the *raison d'être* for the Galileo programme. Managed and controlled by civil players, Europe's future satellite navigation system is set to be open, global [1] and fully compatible with GPS, while offering its users accuracy in the region of 5-10 metres compared to 70 metres for GPS. It will be dependent on a constellation of 30 satellites in medium orbit at 23 000 km linked to a network of terrestrial command stations and centres required for the provision of services.

Public-private partnership

The start-up costs for this system are estimated at 3.25 billion euros through to 2008. Much of the financing will be raised through an open public-private partnership scheme. Almost 80 million euros have already been allocated from European funds for the study phase, now nearing completion. The development phase will continue until 2006 with joint EU/ESA public funding of 1.1 billion euros. Last March a group of industrialists, including service providers, operators, and space system and parts manufacturers, expressed a desire to be closely involved in the project – in particular in terms of defining the services offered by Galileo – by setting up a joint company and making an investment in the region of 200 million euros. The satellite deployment phase will follow in 2006-2007, with financing of 2.1 billion euros, largely raised by the private sector. The system will become operational in 2008, with maintenance costs estimated at 220 million euros a year.

In the meantime, Europe's Egnos initiative, launched by ESA, should make it possible to improve the performance of GPS satellites by 2003. The job of this transitional system, whose infrastructure will later be integrated into Galileo, is to inform the user within a very short time of any malfunction likely to affect the quality of the signal transmitted by geostationary satellites. This quality control by Egnos is essential for applications in the transport sector, and by becoming rapidly commercially available it will serve to open up the market and interest future private partners in Galileo. ◗

(1) This is the European contribution to the GNSS (Global Navigation Satellite Systems) for which negotiations are under way with the United States, Russia, Canada, Brazil and Asian and African countries.

On 5 April this year, transport ministers gave the go-ahead for the use of an initial community allocation for the development phase which will run through to 2006.
A first call for tenders will be very quickly launched to carry out studies on the various kinds of services which will be made available by the system and the revenue they are likely to generate.
At its December meeting, the Council of Ministers will decide on the maximum amount of EU funds to finance the operational and deployment phases.

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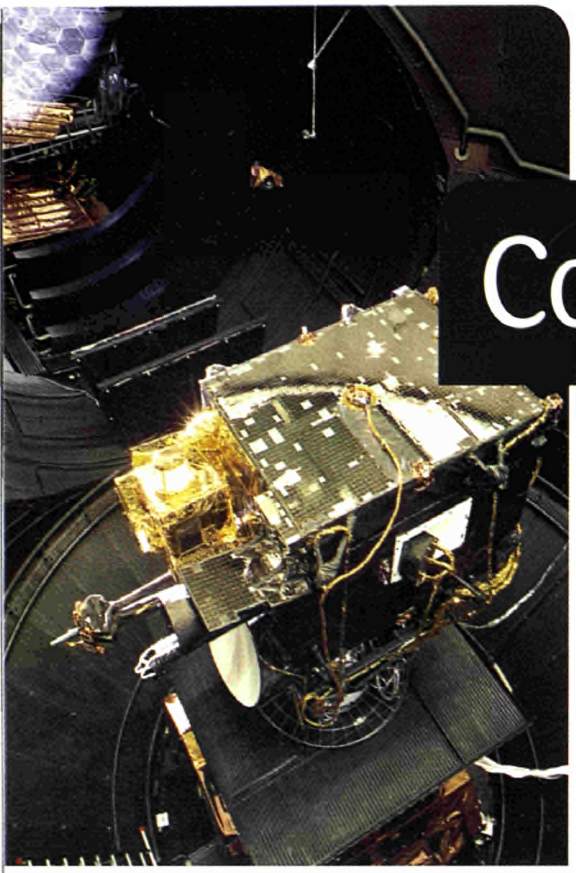

The Artemis satellite is being built. The role of this new geostationary satellite is primarily to serve as an intercommunication relay between terrestrial transmitting stations and mobile receivers on trucks, trains and cars. It covers the whole of Europe and North Africa. It can also be used to test inter-satellite communications using a revolutionary laser transmission technology.

Telecommunications, and mobile telecommunications in particular, achieved their remarkable growth by investing massively in terrestrial infrastructures. But space, too, has its attractions.

Communications: where

SEVENTY MILLION European TV viewers receive their programmes from space, using a satellite dish or cable. The 100 or more global telecommunication satellites currently in use also play a crucial role in applications as diverse as international finance, maritime communications, remote medicine and television teaching. This 'traditional' satellite telecom market, currently estimated to be worth 50 billion euros, is set to double over the next few years.

Constellation breakdown

Satellite technology is finding it more difficult to win a share of the mobile communications market – a market that has grown phenomenally, so far using terrestrial infrastructures. Over recent years, a number of major international projects, such as Iridium, Globalstar and Skybridge, have sought – at great cost and with mixed results – to instate the concept of satellite 'constellations' circling the globe in low or medium orbit. Their job is to continuously connect mobile users in even the most remote corners of the planet.

The implementation cost (over 5 billion euros for Iridium) makes profitability uncertain, the high cost of reception devices and communications tending to dissuade potential users. Originally backed by the US constructor Motorola, Iridium had to cease operations last year on the brink of bankruptcy. Its competitor Globalstar (initiated by Loral, Qualcomm, Alcatel and Vodaphone) is also facing difficulties, while Skybridge, an initiative launched by Alcatel, will not come into service until 2004.

A place to be won

'Following the difficulties encountered by the first generation of mobile systems based on satellite constellations, the potential of multimedia services transmitted via space remains to be proved,' explains Bernard Barani, who monitors the activities of the joint EU/ESA Task Force on Advanced Satellite Mobile services[1] at the Commission. In terms of research and development, European industry must meet the challenge of

European research

Following the first five IST calls for tender,[1] almost 50 million euros have been committed to support projects essentially concerning interactive multimedia services, based on IP networks, in which the satellite ensures the return transmission.

For example[2], the Brahms project, co-ordinated by Alcatel Space, aims to develop a universal interface for the user of broadband (up to 150 MB/s) multimedia services by satellite. Geocast plans to define the terminals, gateways, satellites and protocols necessary for the use of geostationary satellites for the supply of television services on request.

One of the major challenges is also to identify the architectures and technical solutions necessary for the proper functioning of mobile systems by satellite which can co-exist economically with future UMTS third-generation mobile telephony systems. The Virtuous and Future projects, for example, are endeavouring to develop gateways between terrestrial and satellite UMTS networks so that the user can treat them as if they were a single network. Meanwhile, the Satin project is working on validating an architecture to allow broadcast by satellite to mobile users, in a field where – due to its wide spatial coverage – the satellite presents economic advantages over terrestrial solutions.

(1) These projects are extending the research results of the previous ACTS programme.

(2) Other projects in audiovisual broadcasting and wideband access are funded by this programme. See www.cordis.lu/ist/ka4/mobile/

the **earth** meets the **sky**

ensuring total compatibility and perfect integration between satellite and terrestrial systems – in particular for Internet applications – and also increase the range of available services. As frequencies become saturated, it is also necessary to permit migration to higher frequencies in order to serve a wider range of users.

The experts believe in the future of the satellite in a global telecommunications context which will transmit not just conversations but also data such as SMS messages, Internet pages and multimedia applications. The difficulties encountered in starting up the market for the first applications of the future terrestrial system for third-generation mobile telephony – the famous UMTS that some operators have paid a fortune for – show that there is a place for the more diverse services satellites can offer to complement those of terrestrial systems. The satellite could also replace broadband terrestrial systems which, for reasons of profitability, will not serve thinly populated or remote areas. In the meantime, constellation operators, such as Iridium, are relaunching their activities by falling back on user niches such as air and sea transport, fishing, oil prospecting and mining, security and even defence.

'The IST programme's support for satellite communications is attempting to complement the activities implemented by the European Space Agency – under its Artes 3 programme, for example,' stresses Bernard Barani. 'Our aim is not to finance space technologies – the agencies do this very well – but to generate partnerships between the satellite community and other players, such as terrestrial operators and service and content providers. It is a question of promoting compatible standards, developing interoperability between diverse network architects, and establishing the feasibility of a full telecommunications chain.' (see box entitled *European research*).

(1) Some 30 industrial groups have already expressed their interest in this exchange platform which, as set out in a memorandum signed last March, seeks to identify complementary strategies, and to harmonise opinions on services, priorities, technical specifications, standardisation and regulation of the frequency spectrum.

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The space component

Olympus ©ESA

Over the past 30 years, ESA has initiated many telecommunications programmes, most notably with the launch of the OTS, ECS and Olympus satellite systems. The launching into orbit of Artemis is set to be a considerable technical feat as this first European electrically propelled satellite will serve as a geostationary relay. It will make it possible to establish optical communications (by laser) between satellites in a low orbit (such as the Spot-4 and Envisat Earth observation satellites) and terrestrial stations. Over a ten-year period it will also relay mobile communications and navigational services, being one of the keys to the European Egnos system, a precursor of Galileo (see p.11).

Under its Artes 3 programme, the European Space Agency is also supporting research and development based on future multimedia satellite systems, in particular on matters relating to space technologies, and demonstration and testing activities for television teaching and remote medicine.

From the Web to the Grid

In opening the door to network distributed computing, the next generation of the Internet must meet the growing data processing and computational needs of research and industry. The 'World Wide Grid': that is the cherished vision of the European promoters of Grid technologies – including CERN, birthplace of the WWW.

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To find out more

Ian Foster & C. Kesselman,
The Grid: Blueprint for a New Computing Infrastructure,
Morgan-Kaufmann, 1999

CONFIRMING 'Moore's law', formulated 35 years ago, the power of computers doubles virtually every 18 months. Computational performances have increased a million times over in the space of 15 years. The Cray 1, the leading supercomputer in the late 1970s, pales into insignificance today, when compared with even the most modest laptop.

Even so, computer technology is finding it difficult to keep pace with the ever-growing demand for calculation-intensive scientific and industrial applications in areas such as genomics, climatology, fluid mechanics, astrophysics, chemistry and biology.

Petabytes and teraflops

The challenge has been taken up today by scientific bodies such as CERN (the European Organisation for Nuclear Research), whose new particle accelerator, the Large Hadron Collider (LHC), is due to enter service in 2005. The particle bunches colliding in this device at the rate of 40 million times a second will generate a volume of data equivalent to that of 20 telephone conversations conducted simultaneously by every inhabitant on the planet.

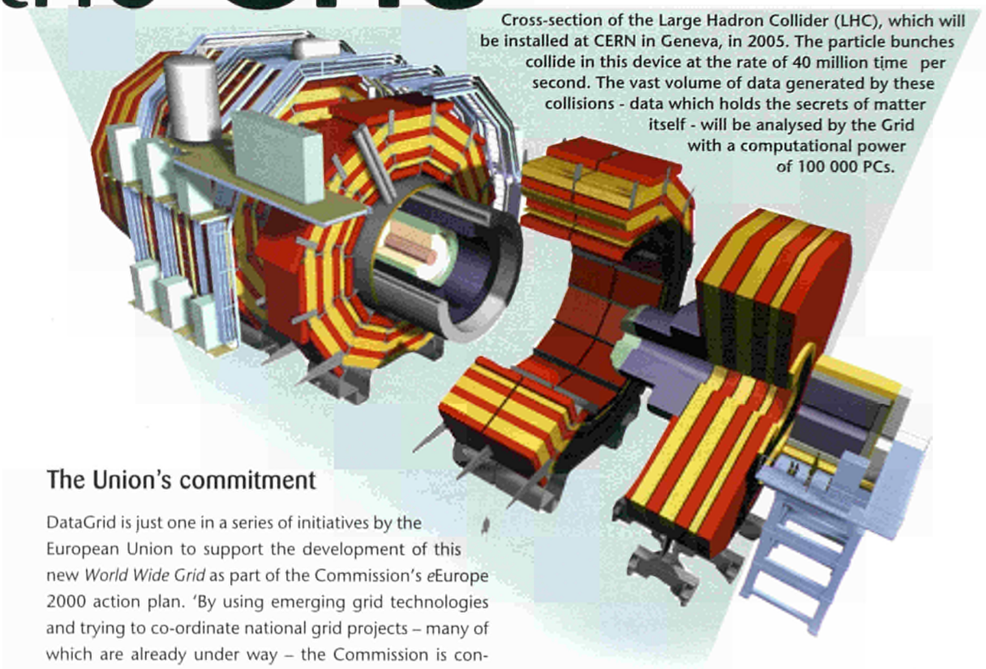
Processing such a vast quantity of data would today require the computational power of 100 000 individual computers. What is more, this power would have to be tripled to take account of the needs of all the institutes involved, worldwide, in the LHC experiments that will generate several petabytes (10^{15} bytes) of data every year. Processing this data will require a computing speed estimated at 20 teraflops, or 20 000 billion floating-point operations per second; today's most powerful supercomputers can only manage three teraflops. This is enough to make your head spin, especially as few research institutes have the budget necessary to purchase such machines.

All this makes it all the more timely to look at the *Grid* concept, developed a few years ago by Ian Foster, professor of computer science at the University of Chicago, and others. The principle is to decentralise computing resources by using a high speed network linking supercomputers, batteries of processors, disks, databases, computer systems, tools and, of course, users, in a kind of 'worldwide virtual laboratory'.

CERN at the forefront

Researchers at CERN – the birthplace of the World Wide Web – are all the more committed to this line of research as the increase in wideband capacities expected in Europe with the launch of the *Géant* project[1] opens the door to an operational pooling of resources. CERN is heading the DataGrid project, with financial backing of nearly €10 million from the European Commission's *Information Society Technologies* (IST) research programme. 'The 18 European research bodies involved are committed to developing testbeds to assess and demonstrate the feasibility and performance of interconnecting their capacities for scientific applications, not only in the field of high energy physics but also for genomics, medical imaging and assessing the hole in the ozone layer by Earth observation,' explains project leader Fabrizio Gagliardi.

DataGrid will essentially try to develop middleware, a layer of software which will adapt the applications to the different computer operating systems and provide transparent access to the system for a user community which is widely dispersed geographically. 'By co-operating with similar projects in the United States such as PPDG and GriPhyN[2], we will also be able to develop international standards which will be discussed within what is known as the Global Grid Forum.'



Cross-section of the Large Hadron Collider (LHC), which will be installed at CERN in Geneva, in 2005. The particle bunches collide in this device at the rate of 40 million time per second. The vast volume of data generated by these collisions - data which holds the secrets of matter itself - will be analysed by the Grid with a computational power of 100 000 PCs.

The Union's commitment

DataGrid is just one in a series of initiatives by the European Union to support the development of this new *World Wide Grid* as part of the Commission's *e*Europe 2000 action plan. 'By using emerging grid technologies and trying to co-ordinate national grid projects – many of which are already under way – the Commission is concentrating its efforts on developing and integrating the intermediate software, or middleware, and validating these technologies. Testbeds will enable a wide range of scientists and industrial users to share information and computer infrastructures in real time,' explains Kyriakos Baxevanidis, Grid project manager for the IST programme.

This is the aim of the EuroGrid project, for example, which concentrates on applications in fields such as chemistry and biology (Bio-Grid), weather forecasts (Meteo-Grid) and computer-assisted engineering for the automobile and aerospace industries (Cae-Grid). With a budget of €3.5 million (including €2 million from the Commission), Euro-Grid also intends to prepare the networking of high performance computational centres (HPC-Grid).

'Compared with the present-day Web, the World Wide Grid will mark the dawning of a new computing age with vast potential,' stresses Mr Baxevanidis. 'The Grid will provide effective sharing of resources with reliable, co-ordinated cheap access, while the user remains blissfully unaware of the system's complexity. This innovation is opening the door to new forms of co-operation at a global level. Take a small business, for example, which needs to run simulations that place high demands on computational and data capacity. Lacking the means to acquire its own supercomputers, it will be able to gain access to processing capacities as it requires from specialised brokers.' ◗

(1)The Géant wideband project, launched in November last year and also supported by the EU, aims to provide research centres and universities with transmission speeds of 2.5-10 Gigabits per second. An ISDN line currently offers a speed of 64 kilobits per second.

(2) PPDG (Particle Physics Data Grid) and GriPhyN (Grid Physics Network) are two projects developed by the Argonne National Laboratory, in association with a number of US universities and research institutes and with the support of the National Science Foundation.

DataGrid Principal partners

CERN (European Organisation for Nuclear Research – CH/FR) / CNRS (Centre national de la recherche scientifique – FR) / ESA-ESRIN (European Space Agency's Centre – IT) / INFN (Istituto Nazionale di Fisica Nucleare – IT) / NIKHEF (Dutch National Institute for Nuclear Physics and High Energy Particles – NL) / PPARC (Particle Physics and Astronomy Research Council – UK)

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EuroGrid Participants

Forschungszentrum Jülich GmbH (DE) / Centre national de la recherche scientifique (FR) / Deutscher Wetterdienst (DE) / GIE EADS CCR (FR) / Pallas Gesellschaft für parallele Anwendungen und Systeme (DE) / Swiss Federal Institute of Technology (CH) / University of Bergen (NO) / University of Manchester (UK) / Warsaw University of Technology (PL) / Debis Systemhaus GmbH (DE) / Fujitsu European Centre for Information Technology (UK)

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Fusion, now or never?

Climate warming is giving a real impetus to Europe's commitment to fusion research as a possible zero CO_2 energy source for the future. Technical studies on the construction of the ITER experimental reactor – the latest key stage in harnessing this 'energy source of the stars' – are now ready. This puts the ball firmly in the court of policy-makers.

European fusion research laboratories employ some 2 000 scientists. They ensure that the ranks of researchers are continuously being replenished by employing 250 doctoral students.

'TO BACK-PEDAL on ITER now would be to abandon for ever the control of this promising source of future energy, squandering the results of decades of research that would never come to fruition.' Such was the message of warning sounded jointly by Umberto Finzi of the European Commission and the Russian academic Yevgenii Velikhov at the Fusion Conference held by the International Atomic Energy Agency last October in Sorrento (IT).

But let us recount the story so far... It was in 1985, at the Reagan-Gorbachev summit, that the idea of a project for co-operating on an extensive international project to build a new large-scale experimental reactor – vital to the progress of fusion research – was first put forward. One year later, under the ITER (International Thermonuclear Experimental Reactor) project label – *iter* also means 'the way' in Latin – Europe, Russia, the United States and Japan teamed up to start the definition and design studies for this machine of the future.

The energy source of the stars

Teams of scientists in all four partner countries had been working on this fascinating conquest of *the energy source of the stars* for a long time. In Europe in particular, since the late 1950s, a network of 20 high-tech experimental laboratories had been actively experimenting on the conditions for fusion. In 1977, the Union gave the green light to build the first joint facility, known as JET (Joint European Torus) which started up in 1983. It is currently the largest nuclear fusion machine in the world. The forerunner of ITER, JET established an all-time record in 1997 when it produced 16 MW of fusion power.

At the same time, work continued throughout the 1990s on defining the ITER concept. Initial plans for building the reactor, completed in 1998, involved a high cost of around 7 billion euros. Such an investment, to be made over a limited number of years, proved too much. Especially as in the meantime the United States had decided to pull out of the project and the Russians, while providing a remarkable resource in terms of brain power, were now facing financial constraints.

Consequently, over the period 1999-2000, the three remaining partners – Europe, Japan and Russia – decided to review the detailed technical objectives while retaining the overall scientific ambitions for this experimental reactor. 'Less costly – with an investment of between 3.5 and 4 billion euros – the new version of the machine will nevertheless develop 400 MW power and produce ten times as much energy as it consumes,' explains Robert Aymar, general project director. 'ITER will be a necessary stage, and a sufficient basis on which, finally, to plan a demonstration reactor – the *DEMO* project. This will be the first operational, fusion-based, electrical power plant.'

The new climate factor

Mastering an energy source which man discovered by studying the stars is a considerable challenge. Triggering a fusion reaction involves raising the plasma's temperature to 100 million degrees and generating very high density magnetic fields to confine it. This requires extremely complex technologies, and a very long and costly development. At this stage, all fusion research must therefore be funded out of the public purse[1].

But today a new factor – the growing concern at the prospect of climate warming – is sparking an increased interest in fusion as a source of sustainable energy. Forecasts of a doubling or tripling of world-wide energy consumption by 2050, coupled with the need to reduce the high level of dependence on fossil fuels, which are responsible for greenhouse gas emissions, is making fusion a particularly attractive 'zero CO_2' solution for the future – especially as a source of large-scale electricity production for densely populated areas. However, according to a group of independent experts, who recently published a report favourable to Europe's continued commitment to

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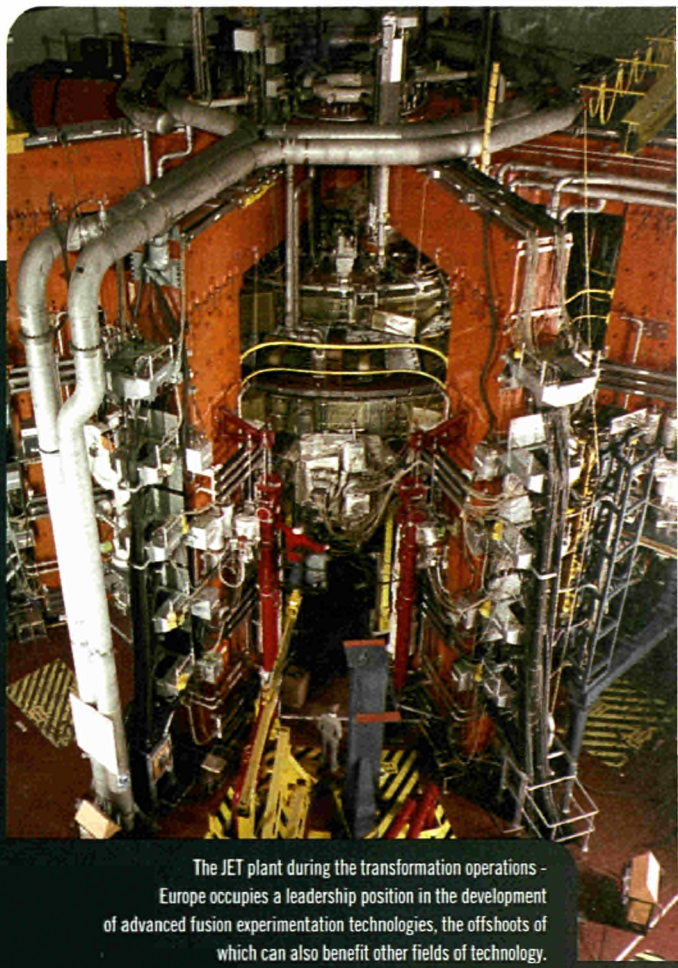
europa.eu.int/comm/research/fusion1.html

Internet sites

ITER
www.iter.org
Fusion-EURATOM Associations
europa.eu.int/comm/research/fusion/assoc.html
EFDA
efda.ipp.mpg.de/
JET-EFDA
www.jet.efda.org



The JET plant during the transformation operations - Europe occupies a leadership position in the development of advanced fusion experimentation technologies, the offshoots of which can also benefit other fields of technology.

The European fusion area

Of all areas of scientific research, it is without a doubt fusion which, in the 1970s, best anticipated the concept of the *European Research Area*. Since then, all the laboratories and researchers working on national programmes have coordinated their efforts, in particular under the continuous series of Fusion programmes funded by the European Commission, which has financed an average of 40% of the research. The flagship of this co-ordination was the construction of the Joint European Torus (JET), which is currently the most efficient test plant in the world and which will continue to play a key role in preparing for ITER.

In 1999 a new European Fusion Development Agreement (EFDA) was signed under the Commission's Fusion key action, bringing together all of Europe's physics and technology laboratories working in this area. EFDA's mission is to carry on the JET research, manage European participation in ITER and continue to explore the technological challenges of interest to the future of fusion energy. JET, like ITER, is a machine whose magnetic confinement has a *Tokamak-type* toroidal configuration, currently considered to be the most advanced. But other research, also supported by the Fusion key action, is continuing to study possible variants in magnetic confinement which could bring benefits in the future. For example, it will be possible to undertake major research thanks to the new *Stellarator W 7-X*, an installation currently being built at the Max Planck Institute of Plasma Physics at Greifswald (DE).

fusion, a proper approach to energy supply must clearly be based on a shared rather than all-or-nothing philosophy(2).

But to help satisfy our future energy needs, this promising option, the ITER decision cannot be too long in coming. The project is now on the starting blocks – waiting for the politicians to fire the starting gun.

Fusion: How and Why?

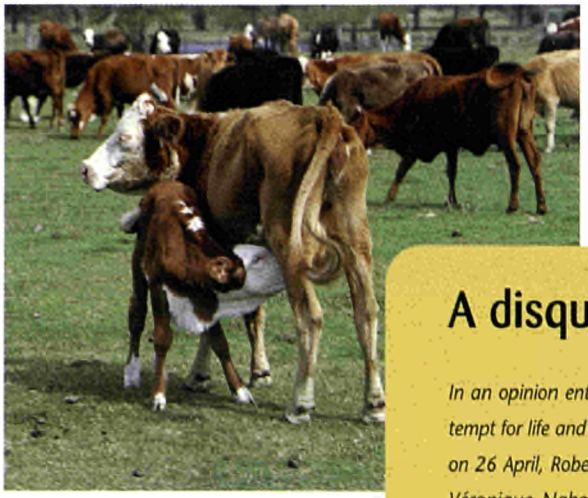
Nuclear energy produces no greenhouse gas emissions. But the traditional fission-based technology generates energy as a result of a process which splits heavy nuclei, resulting in the production of long-life radioactive residues which reprocessing cycles are unable to completely eliminate. It is because of this waste problem - and the shock of the Chernobyl disaster - that this energy source is widely debated in society as a 'zero CO_2' option for the future.

Fusion changes all that: 'It is based on hydrogen, one of the most common chemical elements,' explains Jérôme Pamela, responsible for JET research at EFDA. 'By fusing isotopes of this light element at a very high temperature, it is possible to produce a formidable quantity of energy. The hydrogen isotopes are deuterium, found in abundance in the world's oceans, and tritium, generated in the fusion reactor from lithium which is also abundant in nature. Compared with fission, fusion offers a twin safety advantage: the absence of long-life waste and the impossibility of either a meltdown (melting of the reactor core) or runaway (the triggering of a chain reaction). And the day-to-day operation of a fusion electrical power plant would not give rise to any transport of radioactive materials.'

(1) The Union's present contribution to the Fusion Key Action for 1999-2002 is 788 million euros, or 40% of Europe's total public funding.
(2) Opinion of the External Advisory Committee of the Fusion Key Action.

News in brief... News in

TSE: research in a European area



Mad cow disease – and the risks of transmission to man and other animals – is today the subject of a major European research effort on transmissible spongiform encephalopathies (TSEs), both at the EU level and in a number of national scientific programmes. Last November, European research ministers instructed the Commission to draw up an inventory and evaluation of studies carried out in the Union. In April, the group of experts charged with this mission submitted a report on the research efforts undertaken in the Member States. The report highlights a number of deficiencies, in particular the lack of well-characterised samples, the limited availability of animal models and cell lines, and the lack of suitably trained researchers.

This report is therefore grist to the mill for Philippe Busquin, European Commissioner responsible for research, who has proposed that the European Union should adopt a genuine common strategy to coordinate and reinforce national research efforts. In particular, this inventory will help direct the evaluation of the projects submitted in response to the new call for proposals published at the end of May this year as part of the TSE Community action plan.

For its part, the Commission's Scientific Steering Committee has also just published an inventory of the *Geographical Risk of BSE* which assesses the spread of mad cow disease across the world.

Download

the TSE report

europa.eu.int/comm/research/quality-of-life/pdf/tse-finalreport.pdf

the Geographical Risk of BSE reports

europa.eu.int/comm/food/fs/sc/ssc/outcome_en.html

Don't forget Archimedes

Archimedes, the European prize awarded to science students seeking to pursue their research – with up to 50 000 euros going to the best projects – is alive and well. There are four specific themes this year: new concepts to aid disabled people; desertification and drought; mathematical modelling for social and economic sciences; new medicines from natural sources. The next nine awards (with three separate prizes) will be made in the autumn. The closing date for entries is 31 July 2001.

www.cordis.lu/improving

Opinion

A disquieting silence

In an opinion entitled 'Mépris du vivant et négation de la souffrance' ('Contempt for life and denial of suffering'), published by the French daily Le Monde on 26 April, Robert Dantzer (veterinarian – director of research at the INRA), Véronique Nahoum-Grappe (anthropologist) and Emmanuelle Wollman (researcher at the CNRS) stress the unacceptable excesses which have resulted from the policy of systematic slaughter to combat foot-and-mouth disease. We asked Robert Dantzer, who is also an expert on the Commission's Health and Animal Protection scientific committee, to comment on this stance.

Right from the start of the foot-and-mouth epidemic, the press and intellectuals were quick to condemn 'the animal pyres sought for our good by leading economists and veterinarians...' (Bertrand Poirot-Delpech, *Le Monde*, 18 April 2001). The scientific and ethical community remained strangely silent in the face of such challenges. The few researchers who did say anything were very careful to stick to the official line, stressing the need to contain the epidemic, the problems of organising emergency vaccination and economic constraints.

Nobody wanted to say that since the European directive had been adopted banning vaccination and imposing the systematic slaughter of animals and destruction of carcasses, further studies had been carried out on the possibility of diagnostic tests and the production of vaccines making it possible to distinguish infected animals from vaccinated animals. Yet the studies in question, partly financed by a European Union concerted action, had made it possible to identify the technological obstacles to be overcome to permit a general implementation of emergency vaccination.

But the debate did not take place - either at Commission level or within the Member States - to determine whether, in the light of these data, it would be possible to endeavour to replace the strategy of systematic slaughter by the slaughter of sick animals only and perifocal vaccination [i.e. within, say, 10 km of the focus of the outbreak]. There was even less likelihood of such a debate taking place as nobody dared criticise the economists for failing to include in their model what they themselves correctly call the non-market variables, represented in this case by respect for the animal's welfare and the avoidance of the misery caused to farmers by the 'the mania for slaughter'.

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Robert Dantzer

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brief... News in brief...

Letter

The small world of scientific collaboration

How many papers have you written? How many other scientists have you collaborated with? And how many handshakes are you from, say, a Nobel laureate? In a recent paper in the Proceedings of the National Academy of Sciences (1) I analysed four different databases of papers in biomedical research, physics and computer science, and constructed networks in which pairs of scientists are connected if they have co-authored a paper together.

Some of the results are quite surprising. For example, the average network distance between scientists in biomedicine is only 4.6, and in physics it is 5.9. In other words, if you choose two physicists at random, you can connect them together by a path of collaborators which typically contains only about six steps. In this sense, science is a very small world.

Over a five-year period from 1995 to 1999 the average scientist wrote about five or six papers. In biology and medicine there were about four authors on each paper, but in computer science only two. And computer scientists only collaborated with about four different people during the five-year period, whereas high-energy physicists collaborated with a staggering 173. And that's just the average figure. One physicist had 4 101 different documented collaborators in five years!

As well as providing some entertaining statistics about our world of scientific collaboration, studies of this kind have a serious side. It has been suggested for example that collaboration networks could be used to find 'referral chains' of acquaintance that could help people establish new contacts in the business. Collaboration data can also be used as a window on the structure of organisations or communities. At present there is a surge of interest amongst mathematicians and physicists in the structure of social networks, and we are only beginning to address the many interesting questions that arise out of studies such as this.

(1) M. E. J. Newman, The structure of scientific collaboration networks, Proceedings of the National Academy of Sciences of the USA, 98, 404-409 (2001).

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AlphaGalileo, the research-media interface

AlphaGalileo (AG), a pilot project managed since 1998 by two enthusiastic promoters of scientific information in the European media – Peter Green of the U.K. and Sabine Louët of France – has established its credentials. After receiving full backing from the British authorities – Research Minister Lord Sainsbury in particular – throughout the start-up phase, as well as support from the French and German ministries, AG now has some 1 100 contributors in Europe. They include universities, research networks, companies and specialist publishers. 56% of the information comes from British sources, 17% from France, 8% from Germany and the rest from the Netherlands, Spain and Switzerland in equal proportions.

AG is mainly intended for journalists – numbering 2 300 at present – the most assiduous of whom are based in the United Kingdom (38%), France (15%), Germany (9%) and the United States (9%). Media professionals can request automatic e-mail alerts according to their interests. The AlphaGalileo site also has a searchable database of all press releases received. A meeting point for science and the media, AG also provides the names and particulars of all information suppliers, and a recently launched service allows journalists to directly contact European experts best qualified to answer their questions in particular fields.

AG has just obtained major backing from the EU's *Human Potential* programme: 700 000 euros for the next two years. This aid will enable AG to consolidate the experience acquired (bringing together British, French, German, Greek, Finnish and Portuguese partners) and to become a more European tool, in particular by strengthening its multilingualism.

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Eureka: winning partnerships

In a survey carried out among 2 379 companies that have participated in Eureka research projects – with a response rate of around 50% – one third say they are satisfied with their participation and believe it has enabled them to increase their turnover.

This survey shows that the revenue generated by successful projects – on the national, European and international market – is sustainable. The total amount of new revenue reported by the companies surveyed comes to 4 100 million euros. The most successful projects set down their aims from the start in the business plan agreements. The success or failure of research and development cooperation also depends on the ability to raise venture capital, which is often sought outside Europe. This question is a priority for the Eureka initiative which made it its central theme at the annual interparliamentary meeting in Madrid last May.

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Calls for proposals

Deadlines | **2001** | **2002**

QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES (www.cordis.lu/life/)

KEY ACTIONS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
Food, nutrition and health									X(6)			
Control of infectious diseases			18(2)									
The 'cell factory'			18(2)									
Environment and health									X(6)			
Sustainable agriculture, fisheries and forestry			18(2)						X(6)			
The ageing population and disabilities									X(6)			
Generic research			18(2)						X(6)			
Genomics & human health / Transmissible spongiform encephalopathies			18(3)									
European information network on biodiversity		28(3)(7)										
Endocrine disrupters		14(3)(7)										
Inclusion of partners from the new Associated Countries							15(4)					
OPEN CALLS	**JUL**	**SEPT**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JUL**
Training: Marie Curie individual fellowships			10(1)						10(1)			
SME Measures (exploratory awards / cooperative research)		19(5)				16(5)			17(5)			
Accompanying measures			11(1)				8(1)				12(1)	
Support for research infrastructure			18(1)				8(1)					

*(1) Call published on 06/03/99. (2) Call published on 15/11/00. (3) Targeted calls published on 31/05/01. (4) Call published on 31/05/01. (5) Call published on 01/04/99. (6) Exact date to be determined. (7) Calls published jointly with the Environment and sustainable development programme. * Work programme Version 2001.*

USER-FRIENDLY INFORMATION SOCIETY (www.cordis.lu/ist/)

KEY ACTIONS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
Systems and services for the citizen			15(5)									
New methods of work and electronic commerce			15(5)									
Multimedia content and tools			15(5)									
Essential technologies and infrastructures			15(5)									
Cross-programme themes			15(5)									
Future and emerging technologies			15(5)									
OPEN CALLS	**JUL**	**SEPT**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JUL**
Future and emerging technologies		Call open until 28/2/02(1)(3)					28					
Cooperation with newly associated States		Call open until 28/2/02(1)					28					
Various support activities		Call open until 28/2/02(1)					28					
SME Measures (exploratory awards / cooperative research)		19(4)				16(4)			17(4)			

(1) Call published on 27/01/01. (2) Proactive initiatives. (3) Submissions in 2 stages. (4) Call published on 16/3/99. (5) Call to be published on 15 June 2001.

COMPETITIVE AND SUSTAINABLE GROWTH (www.cordis.lu/growth/)

KEY ACTIONS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	IUNE	IUL

overview

For the latest information on calls for proposals and calls for tender, see: **www.cordis.lu/fp5/src/calls.htm**

Deadlines | **2001** | **2002**

ENERGY, ENVIRONMENT, AND SUSTAINABLE DEVELOPMENT (www.cordis.lu/eesd/)

OPEN CALLS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
Generic research			15(2)		14(1)							
Training: Marie Curie individual and industry host fellowships					14(1)							
SME Measures (exploratory awards / cooperative research)		19(4)				16(4)			17			
Accompanying measures		19(2)			14(1)		15(2)	15(1)				12(2)

(1) Energy (E) only - call published on 24/10/2000. (2) Environment and sustainable development (ESD) only - Call published on 15/11/2000. (3) ESD - Closing date for industry host fellowships only - call published on 15/11/00. (4) Call published on 01/04/99.

NUCLEAR ENERGY (FISSION) (www.cordis.lu/fp5-euratom/)

KEY ACTIONS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
Nuclear Fission						21(1)						
OPEN CALLS	**JUL**	**SEPT**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JUL**
Generic research						21(1)						
Support for research infrastructures						21(1)						
Training: Marie Curie individual fellowships						9(1)						
Other training actions		24(1)(2)						25(1)(2)				
Accompanying measures		24(1)						25(3)				

(1) Call published on 17/10/2000. (2) Including fusion programme. (3) Special courses, training-research networks, cooperation with third countries.

INTERNATIONAL COOPERATION (www.cordis.lu/inco2/)

CALLS BY COUNTRY GROUPS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
States in pre-accession phase	16(1)			16(1)				15(1)				16(1)
NIS & other CEEC	16(1)			16(1)				15(1)				16(1)
Mediterranean partners (INCO-MED)	16(2)	17(3)		16(2)				15(2)				16(2)
Developing countries (INCO-DEV)	16(2)	17(3)		16(2)				15(2)				16(2)
Emerging economies and industrialised countries		17(2)(4)	16(2)				18(2)				17(2)	
Fellowships for Japan								1(5)				

(1) 'Support for participation in conferences' calls opened. (2) 'Accompanying measures' calls opened. (3) Calls for research projects, concerted actions and thematic networks: 15/03/01. (4) Accompanying measures for the coordination of multilateral research - Diseases linked to poverty. (5) Call published on 27/03/99.

INNOVATION / PARTICIPATION OF SMES (www.cordis.lu/innovation-smes/)

OPEN CALLS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
SME Measures (exploratory awards / cooperative research)		19(1)				16(1)			17(1)(4)			
Mechanisms facilitating the establishment and development of innovative companies		14(2)										
Innovation projects					15(3)							

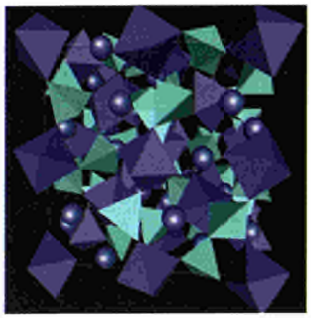
(1) Call published on 01/04/99. (2) Call published on 15/05/2001. (3) Call for proposals planned for 15/09/2001 (subject to confirmation) – dates subject to modifications. (4) Note – Close of call for CRAFT, final submissions possible !

HUMAN POTENTIAL (www.cordis.lu/improving/)

OPEN CALLS	JUL	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JUL
Marie Curie individual fellowships		12(1)(2)						13(1)(2)				
Marie Curie industry host fellowships			3(3)									
Marie Curie development host fellowships and training sites												
High-level scientific conferences							1(1)					
Awards for first-class research	31(5)							15(5)	5(4)			
Raising public awareness of science and technology	2(6)								15(7)			
S&T policy strategy: Groups of experts (Strata)	Open until 30/9/02											
S&T policy strategy: Accompanying measures (Strata)	1(8)	Open until 15/6/02									15(8)	
Joint basis of indicators for science and innovation: thematic networks and RTD projects			15(9)									
Accompanying measures for the programme	Open until 28/6/02									28(10)		
KEY ACTIONS	**JUL**	**SEPT**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JUL**
Amélioration de la base de connaissances socio-économiques					15(11)							

(1) Calls published on 16/03/99. (2) Individual fellowships, return fellowships, fellowships for experienced researchers. (3) Call published on 15/02/01. (4) Descartes Prize: call scheduled for 13/12/01 (subject to confirmation). (5) Archimedes Prize: call scheduled for 03/09/01 (subject to confirmation). (6) Call published on 07/04/01. (7) Call scheduled for 15/01/02 (subject to confirmation). (8) Call published on 01/02/01. (9) Call published on 16/01/01. (10) Call published on 16/06/99. (11) Call scheduled for 01/09/01 (subject to confirmation). Reference: 4th edition of work programme.

News in brief...News in



Neutrons for science

Set up in Grenoble in 1967, on the initiative of France, Germany and the United Kingdom(1), the Laue-Langevin Institute (named after two pioneers in materials science, the German Max von Laue and the Frenchman Paul Langevin) operates the most powerful neutron source in the world. Totally dedicated to civil research, it welcomes some 1 500 scientists every year who use the institute's 34 neutron instruments to carry out analyses in the field of fundamental or applied materials science. Their research falls into a wide range of disciplines, not only in physics but also in chemistry and the biosciences.

The demand for neutron sources in science and technology is increasing and, to meet it, at the beginning of April the ILL officially presented a new investment programme of over 88 million euros. Known as *Millennium*, this ambitious plan aims to achieve a tenfold increase in the institute's instrument and infrastructure performance by 2010.

www.ill.fr/

(1) The United Kingdom joined the ILL as a full member in 1973. Six more countries are now partners (Austria, Switzerland, Italy, Spain, Russia and the Czech Republic).

Drawing on the potential of the NIS

On 27 April this year, INTAS (the International Association for the promotion of cooperation with scientists from the New Independent States of the former Soviet Union) issued three calls for proposals, with a budget of 18.5 million euros, to set up projects and networks for cooperation between scientists in Western Europe and the NIS. The aim is to draw on the strong research tradition in these countries by supporting projects in fields such as materials science, plasma physics, optics, quantum electronics, nanotechnologies, the life and earth sciences and the environment. The closing date is 28/08/01.

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www.intas.be

A FEW FIGURES

A nervous Europe, except in the North

According to Statistics on science and technology in Europe, published by Eurostat, Europe remains nervous when it comes to investing in research. In 1998, with gross domestic expenditure on R&D of 141 billion euros, the European Union's total R&D effort was just 1.86% of GDP, compared to 3.03% for Japan (€102 billion) and 2.58% for the United States (€202 billion). Between 1993 and 1998 the figure even fell in relative terms, in contrast to the trend among our competitors. The three economies also present a contrasting picture in terms of the contribution to investment by companies. In Japan they accounted for 75% of R&D expenditure, in the United States 77% and in the EU 64%. Public sector investment in Europe, on the other hand, easily outstrips that of its rivals.

The figures for individual European countries show that the Scandinavians are easily top of the class. Sweden and Finland invest 3.77% and 2.89% of their GDP respectively, and Iceland, a partner in the European Economic Area, 2.02%. In addition, the share of employment in 'knowledge-intensive' services, as a proportion of the services sector as a whole, is clearly above the European average in Sweden (63%), Denmark (60%) and Finland (57%).

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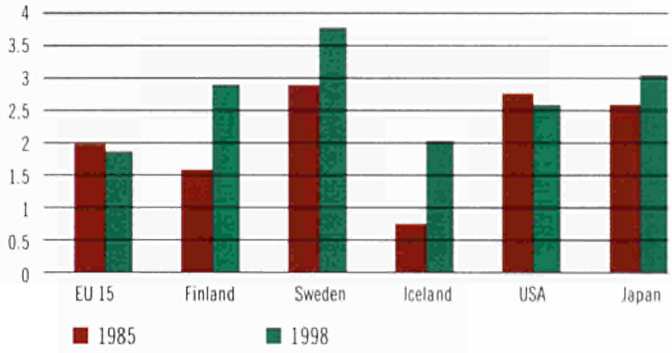
Percentage of GDP allocated to R&D in 1985 and 1998



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brief... News in brief...

New on the Web

On the European Research website europa.eu.int/comm/research/

European research - News centre

The Research DG's home page now includes a new service, *European Research - News centre*. It provides access by major scientific topics – such as agriculture, medicine, energy and the environment – to hundreds of articles and project profiles, as well as other information published by the European Commission on scientific, technological and political developments in the European Research Area (in particular in *RTD info*). Likely to be of interest to a wide-ranging public including journalists, teachers, students, politicians, etc., this service is designed to be a practical instrument in bringing science and society together.

http://europa.eu.int/comm/research/news-centre/index_en.html

Key documents

- *Commission proposal for the new framework programme* http://europa.eu.int/comm/research/nfp.html

And also...

- *The contribution of socio-economic research to the benchmarking of RTD policies in Europe (PDF)* www.cordis.lu/improving/socio-economic/conf_bench.htm
- *A European Research Area for Infrastructures (working document)* ftp.cordis.lu/pub/improving/docs/infrastructures_sec_2001_356.pdf

A selection of information

Among the new pages launched over recent months, the following information can be consulted by visiting the 'What's New?' site on the dates indicated.
europa.eu.int/comm/research/whatsnew.html

16/05/01 *Improving performance of European cancer research*
15/05/01 *Genomes: knowing more, discovering faster - Boosting Europe's capability in bioinformatics*
14/05/01 *Signing of two cooperation agreements between the European Union and the United States on research in the field of energy*
11/04/01 *Agricultural Research in the European Research Area - Palais des Congrès, Versailles, 5-6 Dec. 2000: conclusions and report (PDF file available in English)*

Publications

Just published...

- **Stop the roads from becoming a dead end** – New leaflet in the European research in action series – Available in 11 languages – research@cec.eu.int
- **Five-year evaluation of the European Community's framework programmes in RTD** – Report – Available in 3 languages (FR, EN, DE) – gilbert.fayl@cec.eu.int
- **Food for health: an insight into the natural bioactive compounds of plants** – brochure – eur-op.eu.int/general/en/s-ad.htm
- **Impact of major transport infrastructures on the quality of urban shape** – project report – eur-op.eu.int/general/en/s-ad.htm
- **IPTS special issue - March 2001: Science and governance in the knowledge-based society** – summaries of presentations at the Science and governance conference on 16 and 17 October 2000 – www.jrc.es/pages/f-report.en.html
- **The participation of women researchers in the TMR Marie Curie fellowships** – Report – improving@cec.eu.int
- **Biomass: an energy resource for the European Union** – brochure – 17 p – eesd@cec.eu.int
- **Energy from fusion** – 4 p – patricia.libert@cec.eu.int
- **European research in action series** – 10-page leaflets on the responses of European research to the principal challenges of our times. Subjects available: natural disasters, water resources, global change, employment, health, road safety, protection of cultural heritage – Available in 11 languages – research@cec.eu.int
- **Towards a European Research Area** – Full text of the Commission communication – Available in 11 languages – 52 p. – On the Web, with all the latest documents on the ERA: europa.eu.int/comm/research/area.html
- **Science, technology and innovation: key figures 2000** – An update of performance indicators for European science and technology compared to the rest of the world – 86 p.
- **Participating in European research programmes** – A practical guide to submitting research projects – Available in FR, EN, DE – 100 p – research@cec.eu.int
- **Results and research for SMEs** – Available in FR, EN, DE – 2 volumes of 25 fact sheets – innovation-sme@cec.eu.int.

... and as a reminder

(research@cec.eu.int)

- **Research and technological development in Europe - Examples of projects** – volume 3 – 78 p./ Presentation of 36 research projects in a range of disciplines and fields – Available in FR (EN and DE versions available shortly) – research@cec.eu.int
- **Talking science...: European Science and Technology Week 2000** – Special issue of RTD info - January 2001 – research@cec.eu.int – On the Web: europa.eu.int/comm/research/rtdinfo/fr/january01/

A complete list of new scientific publications from the RTD programmes is placed on the research website every two months: europa.eu.int/comm/research/pub_rtd.html

Diary

The end of the Swedish presidency

- **Bioethics in research** – Conference on the ethical aspects of biotechnologies and biomedicine – 11–12/6/01 – Umeå
- **Research Council Meeting** – MES – 26/6/01 – Luxembourg

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Research meetings under the Belgian presidency

(provisional programme)

- **Conference on socio–economic research** – 12-13/9/01
- **Integration of Renewable Sources and Distributed Power Generation** September
- **Research, innovation and SMEs** October – Walloon Region
- **Best practices in evaluation** 12-13/11/01
- **European Platform Biodiversity** 3-4/12/01
- **Popularising science** 17-18/12/01 – Flemish Community

From 1 July, the site of the Belgian presidency of the Research Council will be open at CORDIS at the following address www.cordis.lu/belgium/home.html

Other events

- **Food & Nutrition for Better Health (HEALFO)** – Food, nutrition and health programmes & projects of the EC – 14-15/6/01 – www.cmns.mnegri.it/healfo
- **A challenge for measurements** – Institut de l'environnement industriel et des risques (INERIS) – 14-15/6/01 – Unesco Paris – www.env-conference.net/withfla.htm
- **The Glass Ceiling for Women in the Life Sciences** – organised by the European Molecular Biology Organisation (EMBO) – 22-23/6/01 at EMBL, Heidelberg. – www.embo.org/womeninscience.html
- **10th European Congress on Biotechnology (ECB10)** – organised by SEBIOT – 8-11/07/01 in Madrid – www.sebiot.es/congreso. htm
- **FISA 2001** – EU Research in Reactor Safety – 12-14/11/2001 – Luxembourg – www.cordis.lu/fp5-euratom/src/ev-fisa.htm
- **IST 2001 Technologies Serving People** – 3-5 December 2001 – Düsseldorf – www.cordis.lu/ist/

Hard facts,

British biologist Anne McLaren is someone people listen to when it comes to questions of ethics and life sciences. She was in on the invention of *in vitro* fertilisation and embryo transplantation. Nowadays her intellectual rigour and analytical capacity are tools to create a lucid and open-minded approach to the ethical and social issues which arise from the application of scientific knowledge.

Further reading

The International Journal of Developmental Biology **(vol. 45, no. 3, special issue 2001) contains a feature on Dr McLaren's scientific achievements, by Brigid Hogan of the Vanderbilt University School of Medicine, Nashville, Tennessee, USA.**
www.ijdb.ehu.es/0104contents.htm

See

www.welc.cam.ac.uk/prospectus/mclaren_prosp.shtml

Recent publications on ethics by Dr Anne McLaren

- ***'Role of the state in genetics and reproduction in the 21st century'*** **in Towards Reproductive Certainty: Fertility and Genetics Beyond 1999, Parthenon Publishing Group, 1999.**
- ***'Scientific implications of cloning'*** **in Proceedings of a Workshop on Societal, Medical and Ethical Implications of Cloning, European Commission, 1999.**
- ***'The ethical dilemma: the living world'*** **in European Science and Scientists between Freedom and Responsibility, EC Euroscientia Conference, 1999.**
- ***'Problèmes de planification dans les pays développés: une perspective féminine'*** **in Contraception: contrainte ou liberté?, Odile Jacob, Paris, 1999.**

IT IS NOT EASY to arrange an interview with Anne McLaren. 'Yesterday it was the House of Lords and tomorrow it is the European Parliament,' she explains as she leads the way into the minuscule office she shares with a colleague in the Wellcome/CRC laboratories in Cambridge. 'I hardly have any time left to get on with my research.' At the age of 74, Anne McLaren's prominence stems from half a century's work during which she has repeatedly pushed back the boundaries of our knowledge of biology and reproduction.

A lifetime's work with mice

She started her career as a zoologist working with mice, and she has studied this animal all her life. 'It is through mice that I became interested in reproductive biology and embryology. Working with them has allowed us to understand the immensely complex question of how life develops and is transmitted.'

In 1958, Dr McLaren and fellow biologist John Biggers published a landmark article in *Nature*. It explained how they had succeeded in growing a mouse embryo in a test tube, and then in transplanting it to be born 'naturally'. This scientific 'first' paved the way for an unprecedented leap in our understanding of reproductive mechanisms and eventually led to the human fertility treatments which are used today.

'I have always worked on the borderline between genetics, reproductive biology and developmental biology, because I am interested in the whole cycle of heredity. Reproductive biology is about the hormones, the sperm and eggs, fertilisation. Developmental biology looks at how the fertilised egg, the single cell, manages to develop into a complex adult organism. And of course genetics underlies the whole generation cycle.'

Beyond the laboratory

This incurably curious scientist argues ardently that humans both need research, and have a duty to carry it out. But she is also clear about the limits this implies. Her horizons do not end at the laboratory door. For the last 20 years, conscious of the many dilemmas that advances in life sciences are throwing up, Dr McLaren has spent more and more time and effort on issues of biological ethics.

In Britain, she was a key member of the Warnock Committee, which laid the groundwork for the 1990 Human Fertilisation and Embryology Act, an early initiative which has become a model for defining ethical rules for human *in vitro* fertilisation and embryology. Her insistence on transparency, the clarity of her explanations, her personal modesty – all qualities which have benefited the many young researchers she has trained – have made her an expert with a wide international reputation. At the European level, she is an active member of the Group on Ethics in Science and Technology, and the High Level Group on Life Sciences, set up last year by the Directorate-General for Research.

Dolly: potential and limits

Where does her commitment come from? Dr McLaren believes that scientists have an ever greater need for a sense of ethical responsibility, not so that they can make the rules – which is the prerogative of society and its democratically elected political leaders – but so that they can clarify the issues on the basis of a sound understanding of the facts.

For example, the heated debate on cloning which followed the birth of Dolly the sheep. An advocate of resisting the temptation to resort to any form of human

firm principles

Anne McLaren, photographed by biologist John Biggers in 1958, the year they succeeded in fertilising a mouse embryo *in vitro*. It was subsequently transplanted and born normally – a scientific first which paved the way for the fertility treatment we enjoy today.

reproductive cloning, she has clearly set out the reasons against using the technique, which is in any case rejected by society at large.

On the other hand, she is careful to point out that this technical feat, which consists in transferring the nucleus of one cell into enucleated oocytes, could have a promising consequence which has nothing to do with cloning: the production of human stem cells which could be used to repair damaged organs.

'I fully support the recent decision of the British Parliament, which has just passed, by a very respectable majority, regulations allowing human embryos to be used for three clearly defined new purposes, including tissue therapy,' states Dr McLaren. She thinks Europe should follow this route, and should authorise research on stem cells, probably under licence, so long as the results are published and made freely accessible to all, in the same way that the results of genome research have been. 'This open European model could counter the American model, where the private sector dominates the research and wants to keep its results secret. From my point of view, such an attitude is understandable in technology, but not in science.'

Science and the public

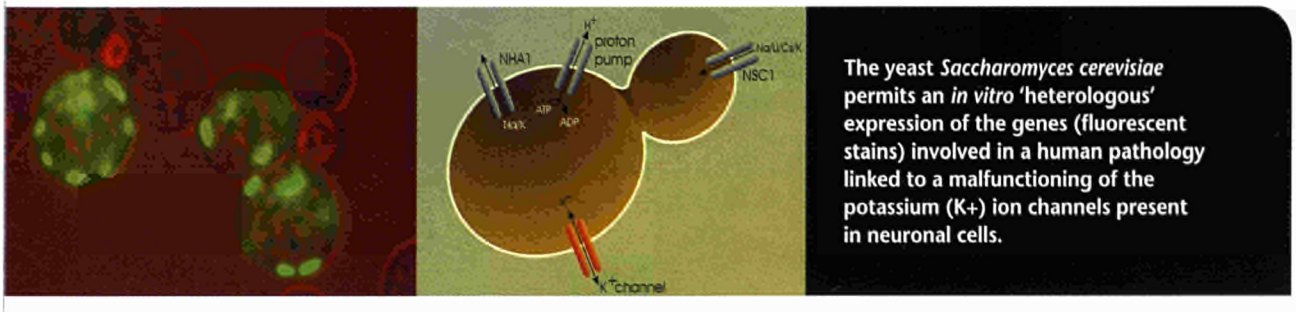
Does the growth of ethical concern express a growing public unease about the impacts of scientific advance? She feels that in Britain, the country she knows best, this diagnosis of distrust for science – at least as regards bio-medical science – is greatly exaggerated. 'People in this country certainly do not want cloned babies. But they do want as much medical advance as possible.' What is more, life sciences are far from being the only branch of science or technology currently provoking ethical questioning. The material development of the developed societies is threatening the Earth's ecosystem – climate, ozone layer, loss of biodiversity – without which life cannot continue.

On this issue, Dr McLaren had a great deal of sympathy for the public outcry that the growing of genetically modified crops in the UK provoked. 'This development is not taking place to serve a consumer need, but in the interest of the seed companies. And since there are unquantifiable risks for the environment – I do not think there are any risks at all for food safety – the risk-benefit calculation is not on the side of the genetically modified crops.'

Women and science

A final question: what does the president of the UK's Association of Women in Science and Engineering think about the question of gender in science? Even if she has not suffered any real discrimination in her own career, she notes with concern the predominance of male applicants for Medical Research Council and Wellcome Trust research grants. This is just an example. 'Women scientists face a terrible problem, the shortage of affordable and accessible childcare facilities – which is also important for men of course. Perhaps women have to be a little bit more confident and assertive.'

In vitro versus



The yeast *Saccharomyces cerevisiae* permits an *in vitro* 'heterologous' expression of the genes (fluorescent stains) involved in a human pathology linked to a malfunctioning of the potassium (K+) ion channels present in neuronal cells.

The search for alternative methods to experiments on animals is stimulating reliable, more effective and less costly techniques for the development of new therapeutic molecules. Under the combined effect of a strict legislative framework and adequate financial support, Europe is providing the impetus in the field which is producing encouraging results.

To find out more

Ethical criteria for the evaluation of European research projects
ftp://ftp.cordis.lu/pub/life/docs/ethical_review.pdf

Scientific Information Service on advanced alternative methods to animal experiments in biomedical sciences
http://ecvam-sis.jrc.it/index.html

WHY, when it is now possible, do we not stop using animals? Researchers are not against the idea. Leaving aside the ethical issues, animal experimentation is far from a panacea in scientific terms. An animal's reactions to a particular drug or toxic substance do not always perfectly mimic reactions in man. Furthermore, in some fields - in particular the study of the effects of new drugs which require the use of a very large number of animals as models - the search for alternatives is yielding new solutions which are more useful and efficient than traditional tests.

Progress in neurology

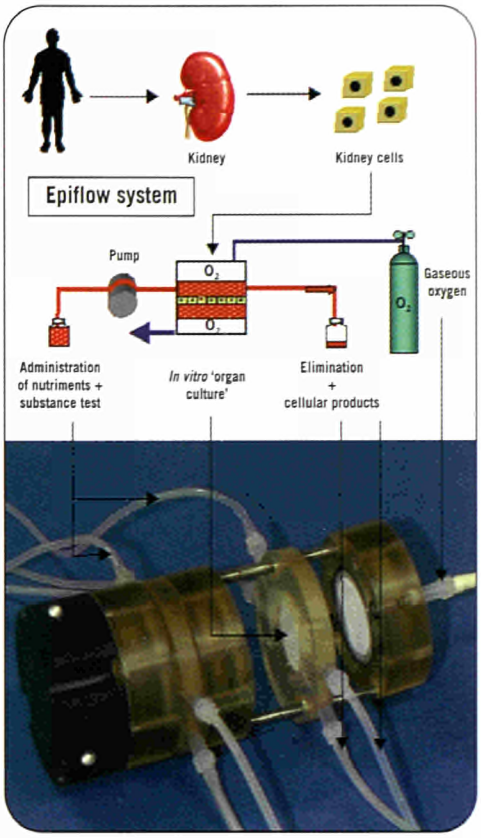
Neurological research is a field where the demand for alternative methods is particularly high. Scientists in this field are seeking to evaluate the action and thus the potential risks of toxicity of a growing number of new molecules of possible therapeutic value.

An avenue being explored under one European project concerns potassium (K+) ion channels. These tiny generators of electrical signals, present everywhere in nerve cells, are a prime pharmacological target. According to Hella Lichtenberg (Bonn University), the coordinator of this research, a number of disorders – which are found in many body organs and tissues with no apparent correlation – may be linked to changes in the genes that code for proteins in these channels. But due to their extreme diversity, the genes are much more difficult to study than other possible targets, such as receptors.

Using yeast as a model, the project conducted research on a heterologous expression of proteins in these well-known channels. Long used by man, and the first eukaryote to have been sequenced, this small fungus has many genes which resemble those found in the human genome. 'As soon as a gene involved in a human pathology has been identified, its function can be deduced from, or at least perceived by, the known function of a similar genome sequence in yeast,' explains Hella Lichtenberg. Six European teams have contributed to this project: five universities and one Swedish company, Astra Arcus AB. The experimental system developed has made it possible to demonstrate the validity of an approach which is able to replace animal experimentation for an initial identification of interesting active molecules and screening tests for their toxicity.

It was also in the field of research on the neurotoxicity of drug molecules that seven European partners worked on a new multi-electrode device for *in vitro* electro-physiological measurements. Previously, this type of test involved studying the propagation of electrical signals in sections of animal brain, thereby establishing a 'map' of the brain's responses to each molecule. This required the death of many 'guinea pigs'. 'With our technique, we are able to study a dozen drugs using just one animal,' points out project coordinator Massimo Grattarola. 'The brain sample in fact acts as a biological sensor whose response to the various molecules to be tested is analysed,' explains Yves Du Pont of the French instrumentation company Bio-Logic Instruments, which contributed its skills in the field of electro-physiological data recording.

in vivo



Stimulating the liver and kidneys

In a completely different area, a project involving five university teams and three industrial partners has developed a system enabling the *in vitro* study of the action on the liver and kidneys of cytokines. These are recombinant proteins produced by the body which influence cell growth and immune reactions. Advances in molecular biology and genomics are today making it possible to use biotechnology to produce cytokines with a view to possible applications in the treatment of cancer or immune disorders. But there remains the fundamental problem that, for genetic reasons, cytokines are 'dependent species'. Not only must they be of human origin to be applied to man, but they cannot be tested on animals as the results would be of no relevance. Direct tests on man are also clearly impossible for ethical reasons.

'Our project allowed us to develop the Epiflow bio-reactor, now commercially available, which enables stable cultures of various human liver and kidney cells to be produced, these two organs being extremely sensitive to the effects of cytokines,' explains project coordinator Walter Pfaller of Innsbruck University. 'This *in vitro* system makes it possible to simulate and model the basic functions of the liver and kidney, and to test the cellular reactions to the different kinds of cytokines, by examining their treatment and/or toxic effects.'

Even if this project represents a particular case of an alternative to animal experimentation – and one where the latter was not an option in any event – it does show that the possibilities for *in vitro* analysis open up particularly interesting possibilities for the pre-clinical study of the increasingly sophisticated new medicines now being developed by molecular biology. ◗

Research and legislation

'Replacing, reducing, refining.' Europe has set itself the clear objective of applying the ethical code of the 'three Rs' which guides the practices of a very large part of the scientific community in the field of animal experimentation. This desire is reflected both in the legislation – the directive adopted in 1986 (86/609/EEC) aimed at harmonising the provisions of Member States for the protection of animals [1] – and in consultation between the various Commission services concerned by the problem. The ball is in fact just as much in the court of the research programmes as of the Environment Directorate-General (initiator of the 1986 directive), the Health and Consumer Protection Directorate-General – where a scientific committee is specifically responsible for the applicability of alternative methods for evaluating the safety of ingredients used in cosmetics – and the industrial policy units.

In terms of research, the ethical framework drawn up by the 'Quality of Life' programme to assess projects supported by the EU requires researchers to explicitly mention the use of animal experimentation and to justify it. Also, 25 million euros were allocated to support alternative research methods (as described above) under the Fourth Framework Programme, an amount already exceeded by projects under the current Fifth Framework Programme. Finally, in 1991 the Commission set up the European Centre for the Validation of Alternative Methods, managed at the Joint Research Centre (Ispra, IT).

(1) Another directive, proposed as early as 1976, concerns the particular case of animal experimentation in the cosmetics industry; it is still pending with its seventh amendment currently being discussed at the Council and European Parliament.

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The genetic fingerprint: a reliable practice, increasingly used when investigating crime and establishing paternity.

The Law and **DNA**

Access to biological identity makes it easier to solve complex judicial inquiries. But before a reliable international exchange of genetic data is possible, the methods of analysis must be standardised. Which is precisely the aim of a network of European institutes.

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Internet sites

Stadnap project
www.stadnap.uni-mainz.de
Short Tandem Repeat Internet Database
Compilation of population studies published by the National Institute of Standards and Technology (NIST), USA
www.cstl.nist.gov/div831/strbase/
The Distribution of the Human DNA-PCR Polymorphisms
www.uni-duesseldorf.de/WWW/Med/Fak/Serology/dna.html
The International Society for Forensic Genetics (ISFG)
www.isfg.org
Y-STR Haplotype Reference Database
Ystr.charite.de

'ABOUT 150 laboratories carry out genetic tests in Europe. But due to the absence of a single analysis protocol, they do not all examine the same parts of the genome to obtain a genetic fingerprint,' explains Angel Carracedo of the Institute of Forensic Medicine at Santiago de Compostela (ES). It is generally the microsatellites - repetitions of mini-sequences of base pairs of different sizes - that are studied to draw up a biological identity card, or other kinds of identifying markers, such as genetic polymorphisms. The large number of potential markers does not make standardisation any easier.

In 1997, nearly 20 partners from 17 countries(1) joined the Stadnap (Standardisation of DNA profiling) project with the aim of standardising the identification methods. The first step was the somewhat daunting task of recording and evaluating the many markers and analysis protocols used. A limited list of reliable markers and methods was then drawn up to permit reproducible and explicit results. Exchanges of personnel between the various laboratories were also organised as a means of stimulating the transfer of technology and of studying the databases of the markers used.

Different sources of DNA

'A particular effort was made to analyse the genetic markers situated on the Y chromosome which is specific to the male genome. This is very useful for studying the cell mixes and helping to solve certain cases of sexual aggression,' continues Angel Carracedo.

Apart from the markers present on the DNA of chromosomes, the researchers also studied the DNA of mitichondria (the energy sources of cells) which have the advantage of being easily identifiable in a sample of poor quality. The genetic fingerprints taken from the mitichondrial DNA are, however, rather difficult to work with and interpret. When used for identification purposes they therefore need to be processed in accordance with strict standards.

New genetic markers – such as DNA chips – and new methods of analysis are constantly being developed, making continuous standardisation essential. European cooperation is all the more necessary as individual countries are compiling their own national records of genetic fingerprints which could form the core of a joint databank. ◗

(1) AT, BE, CH, DE, DK, ES, FL, FR, GR, IR, IT, NL, NO, PT, SE, UK, USA.

Did you say the 'Old World'?

Are Europe's demographic trends a time bomb waiting to go off? Although economic and social scientists are agreed on the figures, the scenarios sketched by the researchers differ. But one thing's certain: the age of the baby boom is well and truly over.

EUROPEANS currently make up 13% of the world's population. Fifty years from now they will represent no more than 7%. Their total numbers will remain stable, but their average age will increase from 36 in 1995 to 45 in 2025. This considerable change will result from two trends: a major increase in the over-65s – and particularly in the over-80s – and a reduction of at least 10% in the 15-29 age group.

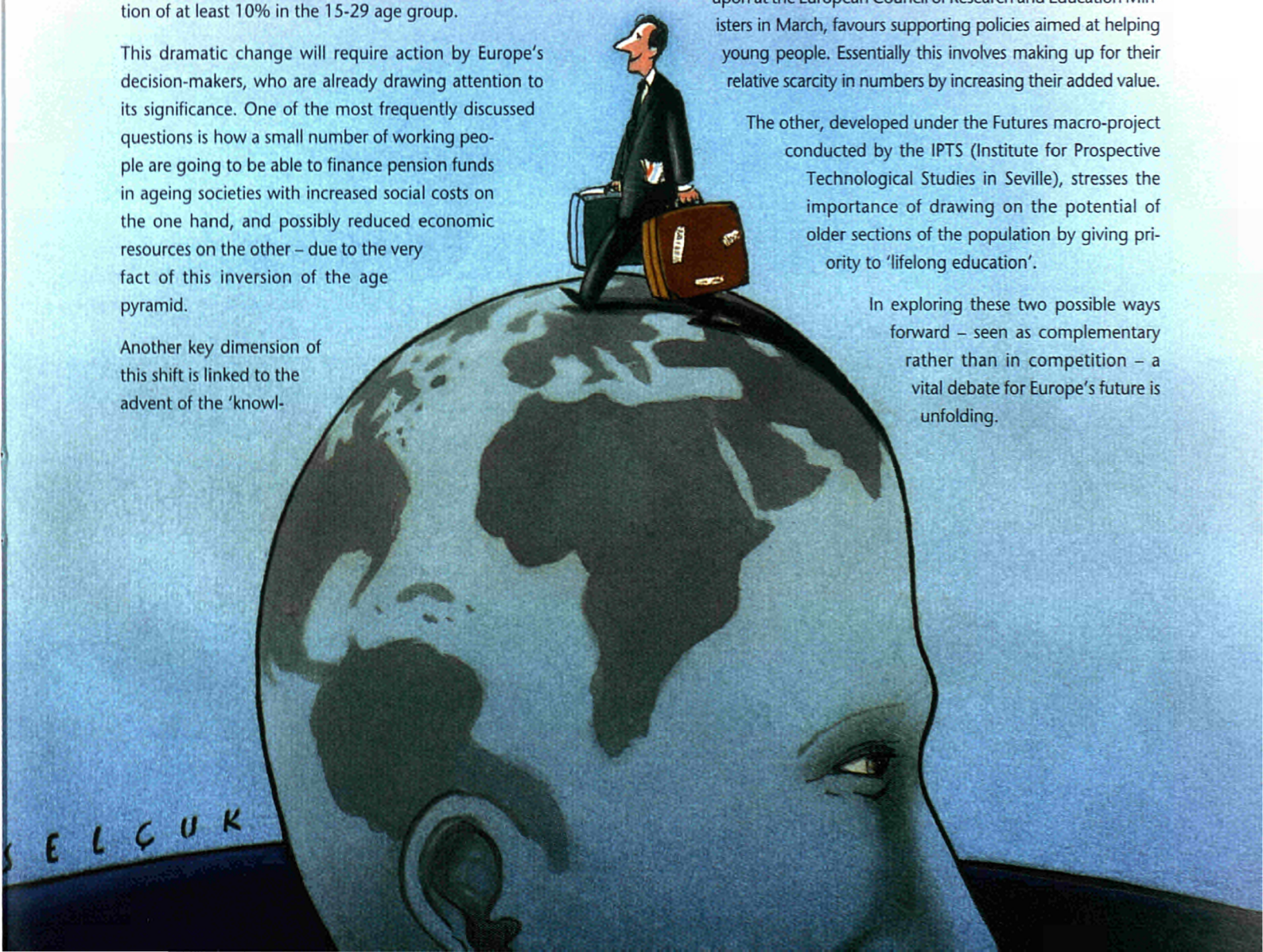
This dramatic change will require action by Europe's decision-makers, who are already drawing attention to its significance. One of the most frequently discussed questions is how a small number of working people are going to be able to finance pension funds in ageing societies with increased social costs on the one hand, and possibly reduced economic resources on the other – due to the very fact of this inversion of the age pyramid.

Another key dimension of this shift is linked to the advent of the 'knowledge-based society', the inevitable consequence of scientific and technological progress. How are education and training policies – with the mission of making maximum use of available skills and abilities – going to adapt to this new demographic structure?

There are two theses. One in particular, which was elaborated upon at the European Council of Research and Education Ministers in March, favours supporting policies aimed at helping young people. Essentially this involves making up for their relative scarcity in numbers by increasing their added value.

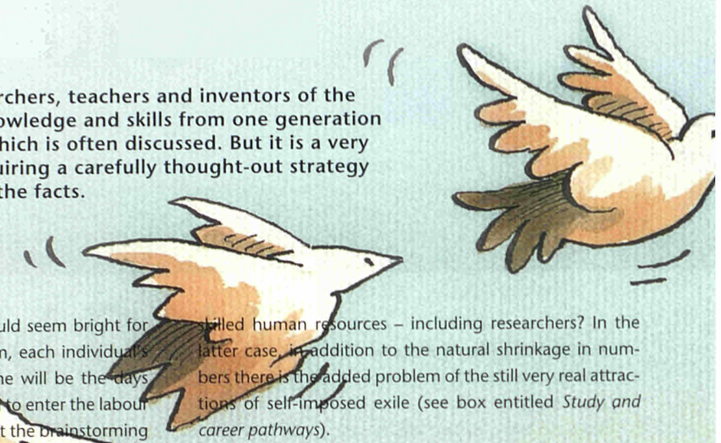
The other, developed under the Futures macro-project conducted by the IPTS (Institute for Prospective Technological Studies in Seville), stresses the importance of drawing on the potential of older sections of the population by giving priority to 'lifelong education'.

In exploring these two possible ways forward – seen as complementary rather than in competition – a vital debate for Europe's future is unfolding.



Transferring the grey matter

Who will the scientists, researchers, teachers and inventors of the future be? The transfer of knowledge and skills from one generation to the next is not a subject which is often discussed. But it is a very real problem for Europe, requiring a carefully thought-out strategy based on a full awareness of the facts.



AT FIRST SIGHT, the demographic future could seem bright for the younger generation. With fewer of them, each individual's contribution will be worth even more. Gone will be the days when structural unemployment made it hard to enter the labour market. But could this be a simplistic view? At the brainstorming of European ministers in Uppsala (SE) last March, Lena Sommestad, head of the Institute for Futures Studies (IFS) in Stockholm, warned against naive optimism. 'Demographic change is in danger of creating a shortage of human and financial resources. Faced with growing demands from older people, society will have to make difficult choices on how it allocates education budgets. Also, as demand for labour in Europe will increase primarily in the field of personal services for the elderly, the thrust of innovation within the European economy could slow. As young people are faced with this less-stimulating and less-competitive labour market, they could be less inclined to continue their education. Such a situation would create problems recruiting young people into careers in science and technology.'

An ageing population overturns a whole lot of socio-economic and cultural data. How will it be possible, for example, to replace skilled human resources – including researchers? In the latter case, in addition to the natural shrinkage in numbers there is the added problem of the still very real attractions of self-imposed exile (see box entitled *Study and career pathways*).

Opening up Europe's universities

What long-term strategies could Europe develop to compensate for this shortage of young brains? Researchers at the IFS recommend a three-pronged approach.

The first could be to improve the quality of education from the earliest age. Being better prepared, students might be more inclined to opt for courses with a demanding reputation. 'Concentrating on education for children and young people is the *sine qua non* for a competitive economy and reduces the need for basic training programmes for adults. Furthermore, an early introduction to science and technology helps develop not only a knowledge-based society, but also a knowledge-based culture.'(1)

However, making education a priority could prove a difficult political choice in a society where the elderly are in the majority, and which may prefer to direct public money more towards health care or social policy.

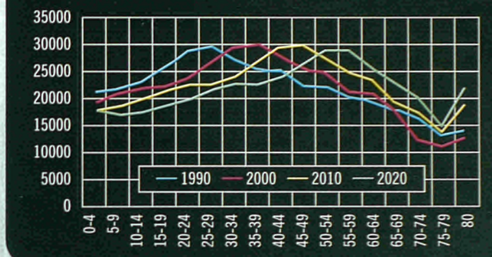
The second response lies in a family policy which takes better account of the situation of young couples, including their need for housing, family benefit, etc. This recommendation is not inspired by a desire to encourage people to have more children, but to allow often well-trained young women to realise their career potential. As a corollary, this would allow research centres and industries to benefit from an often inaccessible labour pool.

The third strategy for an ageing society is to make Europe more open to students from countries with a younger age structure. Although it is the United States which has the reputation of being most 'welcoming' in this respect, Europe does not in fact compare so unfavourably: 3.7% of students in the EU are foreign,(2) compared to 3.2% in the USA. The leaders in this respect are Austria (11.5% foreign students), the United Kingdom (10.8%) and Belgium (9.8%). These numbers could be further increased by action at source. An example? 'If the population of North Africa is added to that of Europe, the combined age structure becomes much younger with a remarkably balanced population. An effective way of rendering our universities accessible to these young people could be for Europe to invest in basic, primary and secondary education in these countries.'

(1) All quotations from Lena Sommestad.
(2) Meaning from non-EU countries.

Changes in age structures in the European Union, 1990-2020

(in thousands of persons and per 5-year age groups)



In 1990, the 25-29 age group included the largest number of people in the Union. In 2010, it will be the 50-60 age group.

According to IFS, Stockholm. Source: UN

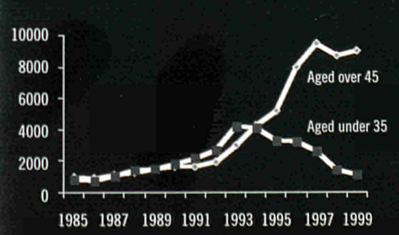
Study and career pathways

Contrary to popular belief, a proportionally greater number of students study science subjects in Europe than in the United States and Japan. This is reflected in the degrees awarded, with 38% in science subjects in the Union compared to 30% in Japan and 29% in the US (figures for 1996-97). These percentages vary according to the particular degree and country. Between 1990 and 1997, a growing number of students in the Netherlands and Portugal obtained qualifications in S&T, compared to a slight fall in Belgium, Spain and Italy, and a marked fall in Denmark and Sweden.

Nevertheless, there are not enough skilled personnel available in Europe to fill the jobs available. This is due to the continuing 'brain drain'. Between 1993 and 1997, the number of Europeans holding teaching posts in science and technology in the US increased from 76 000 to 84 000, of which 55% were recruited by the private sector. Of these, 23% were aged under 34, and 35% between 35 and 55; 24% held a doctorate.

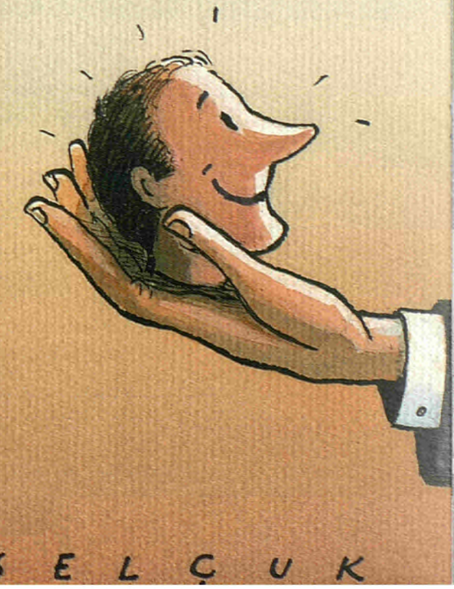
Pessimistic observers point to the scale of loss this represents. But the optimists point out that many of these expats return to their continent of origin at some point, bringing with them the knowledge and experience acquired elsewhere. But there must be more incentive for them to do so. The Taiwanese Government has clearly understood this. After implementing a very concrete policy, encouraging start-ups for example, Taiwan now has a 60% return rate.

Unemployment among electrical engineers in Germany



In Germany, low economic growth between 1985 and 1995 caused a rise in unemployment among electrical engineers. After that date, however, a clear generational divide becomes evident, with increasingly high unemployment among engineers aged over 45 and a fall in unemployment among young engineers. But the latter trend could reflect other factors. Are young people turning away from this career or finding employment abroad?

Source: www.iai-bochum.de/



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Senior citizens on the job

There is no denying the economic and demographic realities. 'Active ageing' is replacing early retirement as 'lifelong learning' becomes the motto for the future. By 2007, there will be more workers aged 55-64 than 15-24.

Comparison of employment and unemployment rates among 55 - 59-year-olds between the EU15 and Sweden

	Employment rates 55-59 years		Unemployment rates 55-59 years	
	EU15	Sweden	EU15	Sweden
Men +Women	55.2	80.4	10.8	7.5
Men	68.6	84.4	10.5	9.3
Women	42.0	76.4	11.4	5.5

Source: Labour Force Survey Results 1997, Eurostat 1998

To find out more

James P.Gavigan, *The Learning Imperative for Europe's Ageing Workforce, The IPTS Report n°38.*

Géry Coomans, *Demographic and Social Trends (Futures Report). Europe's Changing Demography Constraints and Bottlenecks , IPTS.*

David Mercer, *The Future of Education in Europe until 2010, IPTS www.jrc.es/*

On the web

Documents published by the IPTS http://futures.jrc.es/publications-b.htm

LAST YEAR, the Institute for Prospective Technological Studies (IPTS), part of the Joint Research Centre (JRC), presented the results of its *Futures* project, an attempt to take stock of the likely scientific, technological, economic and social changes of the coming decades. Among other things, this wide-ranging prospective study looked at the likely impact of demographic change in Europe.

Apart from the social issues raised by an ageing population (see *Living life to the end*), the impact on the age structure of the working population will be of crucial significance. In 2010, the 50-64 age group will make up almost 30% of working Europeans (an 18% increase compared to 1995), outnumbering the 15-29 age group.

Shock therapy

'This rapid ageing of the working population will be the first demographic shock and one which requires policy measures now,' stresses Géry Coomans in the report on the *Futures* project entitled *Demographic and Social Trends*. What is more, this problem is coming at a time of increasingly rapid scientific and technological progress.

The need for a radical rethinking of education and training systems and mechanisms with a view to what is known as *Lifelong Learning* is therefore becoming increasingly vital. James Gavigan, the coordinator of the Demographic and Social Trends Panel of the IPTS *Futures* project, is consequently calling for a 'shock therapy joining public and private efforts, to involve the middle- to upper-age cohorts in appropriate continuous learning up-skilling while there is still some time'.

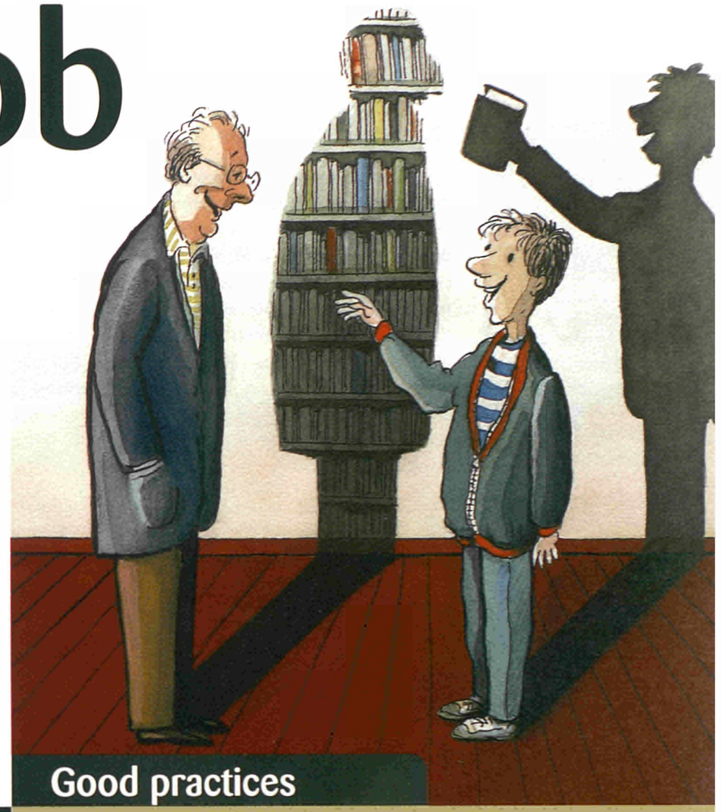
Finland and Sweden

However, this plea for lifelong learning – one of the priorities highlighted by the Union's education and training policy – implies radical changes to the mindset which is blocking the labour market. 'There seems to be a general aversion to ageing workers,' believes Rita Asplund, a researcher at ETLA (the Research Institute of the Finnish Economy). 'The older you are, the less chance of being re-employed if you lose your job. And then if you are re-employed, it is usually in a job in a non-technology firm with much less job security. The employment is also commonly on a temporary basis, often with the help of public subsidies for the employer.'

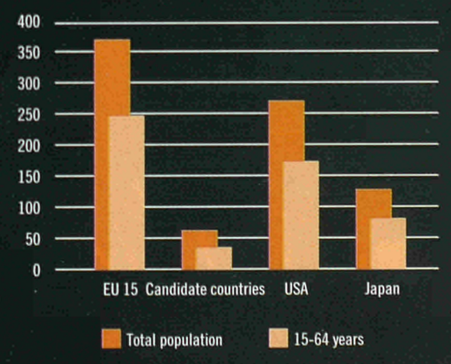
ETLA and other research institutes are working on a multi-disciplinary project (*Towards a successful old age: from a full working career to an active retirement*) as part of Finland's ambitious *Research Programme on Ageing*. This is an issue which seems to be of particular pertinence in a country which has opted firmly for new technologies (following the economic difficulties of the 1990s) and where the difference in the level of training between the over-45s and young people is particularly wide.

Its neighbour, Sweden, is an example of a country where population ageing, already more pronounced than in the other Member States, is accompanied by an employment rate among the 55-59 age group which is one and a half times the EU average (see graph).

Sweden 'is anomalous with regard to the age-dependence of the training-participation rate, with a relatively even spread over different age brackets, compared to a steady decline of participation rates with age for the EU as a whole,' notes James Gavigan. 'In fact, the highest job-related training participation rate (20%) in Sweden is for 40-49 year-olds, while over 59 year-olds at 10% is over five times the EU15 average.'



International comparison – Total population and working population (15-64 years): projection 2025



By 2025, the working population as a proportion of the total population will have tended to fall everywhere, but with very different intermediary scenarios depending on the world's regions. In the USA the phenomenon will come much later due to more sustained growth of the population overall.

Good practices

The Uitzendbureau 55+ (NL) employment agency specialises in finding jobs for this age group. The German metallurgical company Keller GmbH has decided to build on the experience of its older skilled workers by introducing special courses to train them in the new industrial technologies. The financial company Fidisco (BE) has decided to reduce the working week for the over-60s by two hours with no loss of earnings. Ruoka-Saarioinen Oy (FI) has acquired new equipment and modified its facilities to cater for its senior citizens. These are all examples of human resources management which takes full account of older workers. Alan Walker's guide gives a number of examples 'in the field', looks at the actions and good practices from the angle of the employers, unions and individuals, and identifies the principle ways of removing age barriers, including a non-discriminatory recruiting policy, training and promotion actions, opportunities for flexible working hours, taking into account ergonomic data and, of course, an enterprise culture adapted to this new reality.

***Alan Walker**, Managing ageing workers – Guide to good practices, published by the European Foundation for the improvement of Living and Working Conditions, 1999.*

Life expectancy

In 1996, life expectancy in the most developed countries was 74 years for men and 82 years for women – with the Japanese and the French obtaining the highest scores. The figure shows a regular increase of 2.5 years every decade (three months a year). Particularly good news is that people are not only living longer, but better, with a longer healthy life span. At the age of 80, life expectancy for women (ten years) is close to that of men (seven years) in the countries with the highest scores. One girl in two born today in an OECD country will live for a century. In France, the number of 100-year-olds is expected to increase by more than 3 000% by 2050.

(1) The baby boom *refers to the major increase in the annual birth-rate following World War II, which lasted until the early 1960s.*

Overturning set ideas

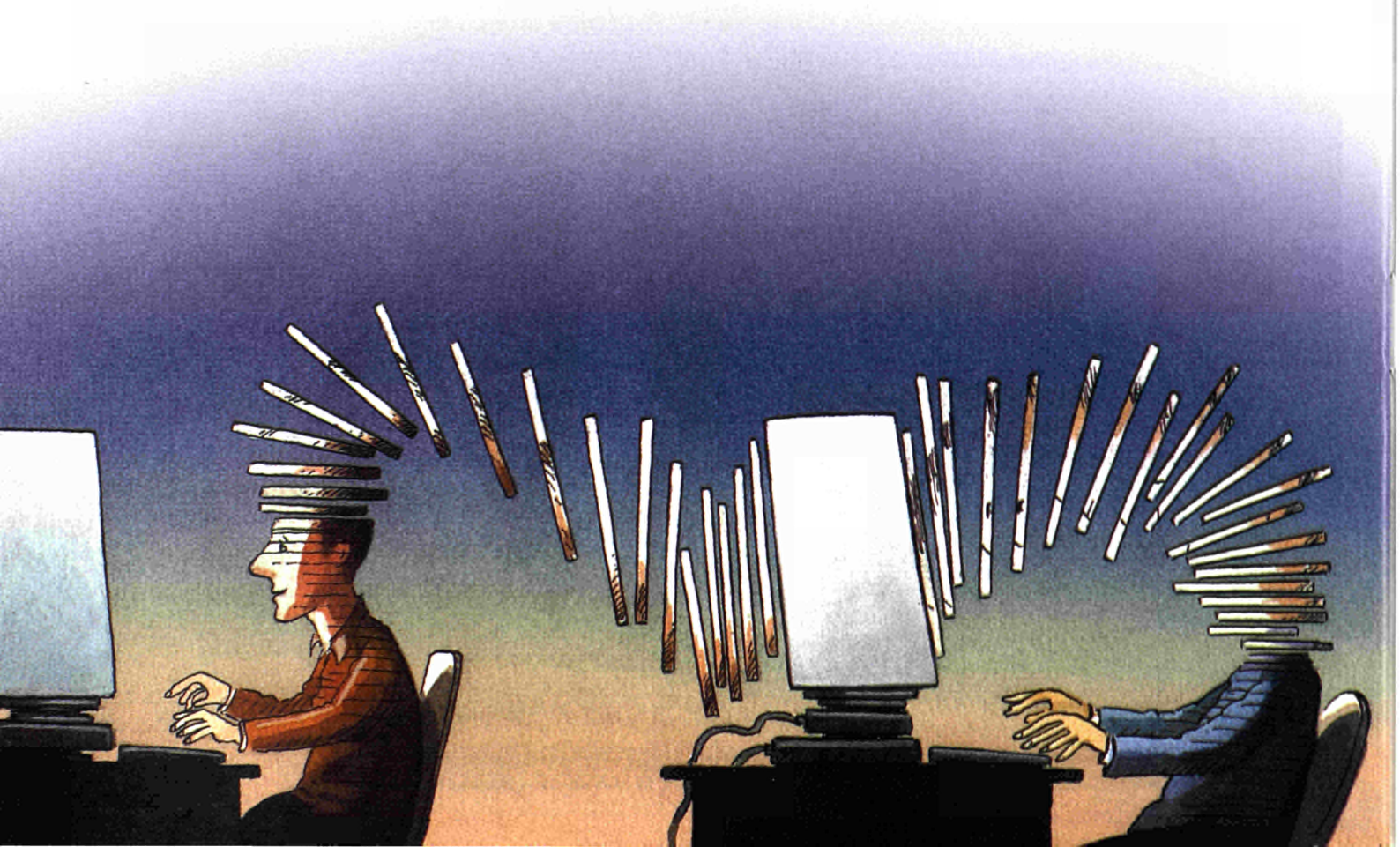
Géry Cooman believes too many companies are stuck in the thinking of the age of Taylorism and the outmoded idea of a link between increasing age and shrinking productivity. This attitude is particularly evident when large companies restructure, systematically opting for early retirement for the over-50s, at huge expense. An expert in the field, he cites the results of research concluding that older employees possess valuable experience and skills which must be passed on. 'In some cases, the wave of early retirements we have seen in recent years in Europe culminated a little later in those same over-50s being asked to return to work.'

Of course one can argue that older workers often have higher salaries. Maybe. But then again salaries are not determined by seniority alone, but also by experience. Alan Walker (see box entitled *Good practices*) also makes the point that a number of studies have found that 'older workers are no less efficient', have 'fewer accidents and remain committed to the company'. The conclusion is that 'their net average cost to the employer is comparable to that of younger staff'.

Finally, many companies believe that a broad range of ages, allowing for a balanced team structure, is a positive factor at the human level and in terms of efficiency.

Their heart in their work

This does not mean to say, however, that the older people are the more they put their heart into their work. 'Those who are close to retirement age see retirement as an inviolable social contract they have entered into with society,' points out Lena Sommestad (IFS, Stockholm), seeing this issue as a major obstacle to remaining in work. James Gavigan is more optimistic, believing that today's sudden end to work at a compulsory age is often, in fact, unwelcome for healthy 60-year-olds. He places his trust in the ability of the present generation of baby boomers[1] – who will soon form the 'cohort' of the 'elderly' and are therefore at the heart of what he calls a 'demographic time bomb' – to rewrite the rules as they go through life. 'With the need to find a new balance of social responsibility and cost-coverage this generation may in turn reinvent old age and retirement, building on ideas such as semi-retirement and flexible work arrangements, which accommodate individual choice and preferences. Much innovation in public policy, business, civil society and people's mindsets is needed.'



Living life to the end

Living longer is one thing, but how are we also going to live better? What challenges does an ageing population pose for medicine and society? What will be the economic impact? Why has death become taboo? These questions are at the heart of a number of research projects supported by the European Union.

TODAY, 20% of Europeans are senior citizens. By 2020 that will be 25%. This ageing population – coupled with falling fertility – presents new challenges for society and individuals. The need to increase research on this subject was raised by Members of the European Parliament and gave rise to the creation of the *Ageing* key action under the EU's research programmes (see box). Very diverse fields – the life sciences, human sciences, new technologies – are involved in this complex issue which requires an increasingly multidisciplinary approach. But what is the aim?

Ageing well

'Longevity is not the point, but quality of life,' stresses Dr Anne Degrand-Guillaud, a scientific officer at the Directorate-General for Research. As a doctor with solid experience in the field, 'longevity at any cost' is of no interest to her. The important thing is to 'age well' and that is the concern of the *Ageing* key action for which she is responsible. (1)

It is a question of gaining a better understanding of the many factors which determine how an individual is going to age. What is the relative importance of heredity, environmental factors and mental attitude? What are the factors in healthy ageing, and what are the 'little everyday things' which permit a better life? Could younger people be more tolerant of the old? How, and at what cost, can the elderly remain as long as possible in their own homes? How can you combat loneliness? These are all questions to which researchers can provide some of the answers – and which cannot be ignored by public health strategies.

Dispelling the taboos

Finally, at the end of the road, there is the taboo of our Western societies. 'When one speaks of ageing, it refers to the end, to the time of death. Death is part of life and yet we are unable to approach it with serenity. We avert our eyes. Doctors are not trained to talk about it and nobody dares discuss it. In the meantime, in Europe we are not dying as we should,' continues Dr Degrand-Guillaud. So there could also be 'better dying'.

A growing number of people (50% to 70% of Europeans, depending on the country) die in hospital. 'But the purpose of hospitals is to treat. We should be thinking in terms of support in the home, a discreet presence which is acceptable to close family and friends. Fifty years ago we knew nothing about the start of life. We have since learned an enormous amount about the fœtus. Today we are still totally ignorant about death.' (2)

(1) Determinants of healthy ageing and of well-being in old age.
(2) The European Commission held the 'End-of-Life Care' workshop on 13-14.12.2000 in Brussels. This multidisciplinary meeting, attended by doctors, sociologists, philosophers, public health officials, representatives of associations for the elderly, etc., raised the issues of euthanasia, pain and support for the dying.

One action, five parts

Part of the European Union's *Quality of Life* programme, the *Ageing Population and Disabilities* key action aims to support research which is beneficial to the health and well-being of the elderly, and to fuel the debate on public health policies and social security. It comprises five strands:

- health-related research (Alzheimer's and Parkinson's disease, osteoporosis, sight and hearing difficulties, memory problems, depression specific to very old age, etc.);
- analysis of ageing factors (the cultural, psychological, biological and genetic factors which determine the quality of life of old people);
- demographic and socio-economic problems (health care policies, pension management, etc.);
- development and evaluation of technologies for senior citizens (mobility, stimulation of the memory, tele-surveillance); and
- organisation of specific health care and social services.

Contact

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Website

www.cordis.lu/life

To find out more

Survey of the Current Status of Research into 'Ageing' in Europe, EUR 18594, European Commission, Brussels, 1999.
Report on ageing research in Europe, produced by the ad hoc committee on coordinating European research policy.

Ageing in Europe, IOS Press, Amsterdam, 1999.
The latest developments in the biomedical and medical field concerning elderly people in 11 EU countries. Publication supported by the Commission.

ISBN 90 5199 382 X

Coping with deviant behaviour

Fear and insecurity, violence and despair, exclusion and injustice, anger and vulnerability are all part of everyday urban life in the early 21st century. In an attempt to bring about change, police, social workers, psychologists, teachers and doctors are joining forces and switching roles. They are also adapting to new policies aimed at managing deviant behaviour.

To find out more

Nouvelles formes d'encadrement, Social science research actions nos 136-137, March 2001, Paris, éditions du Seuil

IN PARIS, guards on the underground organise the 'transfer' of the homeless at the end of the day. They take them to reception centres where they can take a shower and find a bed for the night, before returning to a métro station the next morning. In Krefeld (Germany), with the help of a 27-point list, the *Ordnungshüter* (law and order officer) investigates such minor infractions as failure to ensure that a dog does its business in the gutter, or overly aggressive begging methods. In Greece, police officers in the large cities have become a key element in prevention policy, helping to train others involved in the field, while in the Netherlands their role is often akin to that of social workers (with whom there is generally harmonious cooperation). In Belgium, many GPs claim they are becoming the administrators of poverty.(1)

Common problems, local strategies

When vulnerability and exclusion change, so does the pattern of crime. New problems bring new forms of behaviour, leading in turn to policies being adapted to combat them. Unsafe urban areas, rootless young people, drugs, new forms of violence such as vandalism and extortion, new trouble spots such as schools or public transport...

To what extent should society prevent or punish? And how? Who is responsible for what?

'The same social problems are encountered right across Europe. But they are acted out in a different context and it is interesting to study the specific ways in which different countries tackle them,' explains Rémi Lenoir, director of the Centre de sociologie de l'éducation et de la culture (Paris) and coordinator of the project entitled *New forms of public management of deviant behaviour in Europe*. Supported by the TSER programme, the project includes researchers from five countries (BE, DE, FR, GR, NL).

'The State is under-investing in the social and over-investing in the penal,' remarks Luc Van Campenhoudt, head of the Centre d'études sociologiques des Facultés universitaires Saint-Louis (Brussels), with reference to the situation in Belgium. 'They are trying to contain the effects but without combating the causes. The courts are becoming the regulator. In the past, if a pupil was a regular truant the headmaster would speak to the parents. Today, the case is submitted to the public prosecutor.' In this small country a whole armoury of new mechanisms (security contracts, victim aid, penal mediation, consultation assistants, etc.) support the police in their role as the central player in 'global, integrated prevention' which is based just as much on the courts as on the social players. Meanwhile the *traditional* actors complain of having lost their autonomy, of a shift from assistance to prevention, of acting as supervisors, or even – when they have to report to the public authorities – as informers, effectively helping erode the principle of professional confidentiality in the process.

What exactly are we talking about?

Whether dealing with problems, institutions, actions or actors, how is it possible to make comparisons when you do not speak the same language? During their field work, the researchers sought to define the terms used to describe situations which are not always identical from one place to another – or for which the 'translation' could create confusion.

A much favoured term in Belgium, such as *médiation*, has no equivalent in the Netherlands, for example. In France, *proximité* is used with significantly different connotations depending on whether the context is economic (with reference to jobs or recruitment), or legal (with reference to the police or justice). Traditional equivalents between the French 'baccalauréat' and German 'Abitur' refer to quite different educational systems. The terms *criminalité* (FR), *criminaliteit* (NL) or *Kriminalität* (DE) are truly false friends. As to terms 'imported' from other cultures or fields, such as zero tolerance, employability or benchmarking, they do not necessarily refer to the same things in each country.

The glossary prepared by the project (which should be very valuable for many other projects too), describes each term in its national context, with a brief presentation of its social philosophy and a bibliography. A comparative context is provided by referring to related words in other languages while, at the same time, making sure that false or absent friends are identified.

New players and the drive for efficiency

This all seems to be part of a general trend towards a wider 'entrepreneurial' approach to social problems. 'Projects used to be long term, but now the talk is of short term, profitability, results by the end of the year, target audience and the like,' observes Gérard Mauger, a sociologist working with Rémi Lenoir.

In a country such as Germany – with a mosaic of Länder committed to their autonomy – this drive for efficiency is in the hands of a highly decentralised management in which non-government institutions including charitable organisations, trade unions and churches play a major role. The *Caritas-Verband*, for example, manages thousands of local bodies – hospitals, detox clinics, nurseries, retraining centres for juvenile delinquents, etc.

In Greece, recent sociological changes, such as immigration from Eastern countries and the creation of ghettos in some poorer towns, have led to a new approach to the problem of anti-social behaviour. 'The approach is twofold and often contradictory. When it comes to controlling crime, the state oscillates between a protectionist policy tending towards repression, and a voluntarist policy distinctive for its "economic" rationality,' explains Nikos Panayotopoulos, a professor at the University of Crete. 'Social management is also increasingly decentralised and contracted out to private experts, who often import foreign models without adapting them at all.'

In the Netherlands, of particular concern is the prevention of new forms of apparently senseless violence, carried out by young people from a range of backgrounds. Some believe the social problems are due to the socially outcast groups themselves. Others believe it is the circumstances – the creation of ghettos – which fuels the socially deviant behaviour, and that social mixing in a particular geographical area could have an impact on the causes of this delinquency.

'We are studying both the principles which underlie social policy and the form it takes in practice,' continues Rémi Lenoir. 'Our aim, on the basis of these comparisons, is certainly not to provide decision-makers with ready-made answers, but rather to identify the pertinent questions which could help in preparing a European social policy.'

Nikos Panayotopoulos believes that, 'there is every reason to create this genuine Social Europe, which would be the best possible defence against aggressive sentiments by reducing the likelihood of tensions and violence between individuals or groups.'

'The same social problems are encountered right across Europe. But they are acted out in a different context and it is interesting to study the particular ways different countries tackle them.'

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(1) Judging by the nature of the letters received by the highly regarded and professional Quotidien du Médecin.

Research to quench the flames

Every year forest fires destroy hundreds of thousands of hectares in Europe, mainly in the Mediterranean Basin. Using satellite pictures, digital cameras, computer modelling and other high-tech devices, scientists are now exploring new ways of combating this scourge.

'HERE IN THE VAR, the threat of fire is a constant fear which is never far from anybody's mind.' A taxi driver for the past 15 years in Hyères (France) and volunteer fireman, Michel knows what he is talking about. 'You feel pretty small up against a wall of fire racing across the countryside.' Every year southern France, like the other regions in the Mediterranean Basin, pays a very heavy price for forest fires.(1) An estimated 2.5 million hectares of Europe (or two-thirds the surface area of a country the size of Belgium) went up in smoke between 1993 and 1998, while Greece had a particularly disastrous summer in 1999, with 331 743 hectares reduced to ashes. To combat this scourge, since 1985 the Commission has supported research projects aimed at containment and eradication. Between 1994 and 1998, 16 projects with participants from ten European countries were allocated total funds of over 14 million euros. The effort is continuing and new projects are currently being negotiated.

Satellite vigilance

One of the key challenges for research is to develop ways either to prevent fires from starting in the first place or at least to ensure early detection. Many research projects are based on progress in Earth observations by satellite. The EU's FIERS project, for example, has looked at how low-resolution satellite pictures with information on the dryness of vegetation can help civil protection services.

Projects carried out during the summers of 1998 and 1999 yielded a number of interesting conclusions. First of all, due most notably to cloud cover and the position of the orbiting satellites, satellite information is at present only applicable on a weekly basis. In other words, while it is very valuable for risk management during a critical period, it has not yet proved possible to provide the emergency services directly with tools which are really operational on a daily – or even hourly – basis.

(1) Last October the Var hosted the 2000 Euromediterranean Wildfire Meeting, attended by experts from all over the world – Europeans, Americans, Australians, Canadians, Chinese – as well as Philippe Busquin, the EU's Research Commissioner.

Fire figures

- Every year, on average, 45 000 forest fires destroy 500 000 hectares in Europe.
- 2.1 million hectares in five Mediterranean countries (France, Greece, Italy, Portugal, Spain) were destroyed in the five years 1993-1997.
- Between 1 000 and 5 000 euros a hectare: that is the cost of fighting fires and restoring devastated areas.
- In some regions 10% of areas destroyed by fire become virtual deserts.

A wildfire research centre

Lying a few kilometres from Marseilles and Aix-en-Provence, the *Centre d'essais et de recherche de l'Entente interdépartementale en vue de la protection de la forêt contre les feux* (CEREN) is a unique research centre in Europe. It possesses its own *fire tunnel* where it can recreate fires and, using a blowing apparatus, vary the intensity of the winds which fan the flames. This enables it to test fire-proof equipment, for example, such as flame retardants and fire-fighting suits. Its thermal test bed is also able to recreate forest fires while controlling combustion parameters, and to test chemical products which can be added to water and sprayed from land or air.

Fire behaviour modelling, fire-fighting equipment design, and the qualitative analysis of the toxicity of certain combustion products are all subjects on which CEREN's researchers are working. This test centre has been a partner in projects supported by the Union for many years now, most notably Minerve I and II, Prometheus, Inflame and Rapsodi.

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With an electrical resistance permitting temperatures as high as 420°C, the epiradiator is used at the CEREN to measure the flammability of vegetation. Both the time required for vegetation to catch fire and the total combustion period can be measured.

Protecting the fire fighters

Every year, tens of thousands of professional and voluntary fire fighters attempt to combat forest fires in Europe, sustaining their share of casualties in the process. The violence and size of some fires – not only forest fires, of course – makes it essential to develop new kinds of protection. Last October, a consortium of three SMEs – one French, one British and one Dutch – presented a revolutionary new design for a protective helmet developed with the help of the TNO National Research Centre in the Netherlands under an EU cooperative research project (CRAFT).

Made of extra-light, ergonomic materials, this helmet – which can be adapted according to the fire risk in question – is also equipped with a sophisticated communication system allowing the operator to remain in contact with the command services at all times. This innovation is of potential benefit to some 4 million fire fighters in the European Union.

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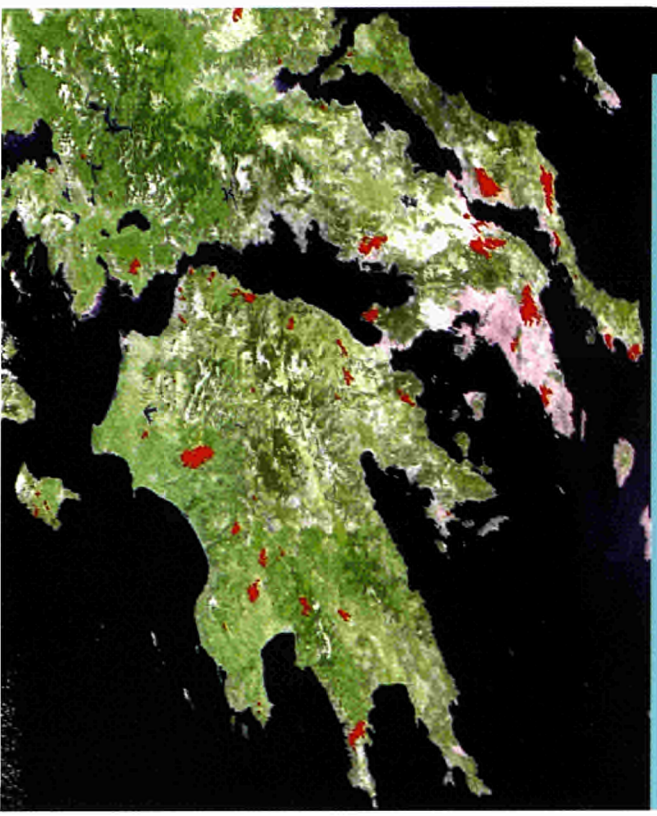

Pre- and post-disaster management

The satellite picture is a valuable tool in assessing fire damage. Supplied by the Space Applications Institute (SAI) at the Joint Research Centre in Ispra (IT) as part of the Natural Hazards project, this picture maps the fires which destroyed 97 959 hectares of forest in Greece between 7 July 1997 and 15 August 1998. The institute is concerned with two common types of natural disaster – forest fires and floods – and specialises in the use of satellite data combined with other sources for preventive management (risk indicators, protection maps) and the rehabilitation of devastated areas (observation of damage, replanting maps).

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But this certainly does not rule out the possibility that, in the near future, satellite pictures may permit early detection of forest fires and the close monitoring of their spread. That is the hope of researchers on the FUEGO project, coordinated by the Spanish company INSA (*Ingeneria y Servicios Aerospaciales*). The team has been looking at the feasibility of launching a fleet of 12 mini-satellites into low orbit (700 kms altitude) by 2005. They would monitor those areas of Europe most at risk, that is the Mediterranean Basin. 'Such a fleet of orbiting satellites would effectively ensure a revisit interval of 24 minutes,' explains Ignacio Tourné, director of INSA. The FUEGO satellites would each be equipped with four cameras. Medium infrared would identify heat spots, thermal infrared would obtain additional data linked to the presence of fire and filter any false alarms, while the near and visible infrared would provide information on winds and the presence of smoke.

Satellite observation is also very valuable for the management and rehabilitation of zones destroyed by fire (see box *Pre- and post-disaster management*).

Camera detection

On the ground, early automatic detection of fires is also the subject of intensive research on surveillance techniques, using cameras fitted with software programmed to recognise the start of a fire. At last October's *Euromediterranean Wildfire Meeting* in Hyères, the company T2M presented the results of the Rapsodi project: an intelligent system consisting of video cameras and an image-processing unit. These cameras supplement human surveillance and can play a very important role in peri-urban areas – where very fast detection is crucial – and in areas that are difficult to monitor due to their topography, in particular mountainous regions. Several systems were recently installed in the Var region.

Model support

The researchers also have high hopes for computer modelling techniques. 'The aim of these models is to be able to predict how a fire is going to behave, if it will spread quickly for example, and in what direction,' explains Professor Xavier Viegas of the University of Coimbra (PT), the coordinator of the Inflame project. 'But these are complex models to develop as they involve taking into account a whole range of data such as topography, vegetation, wind dynamics, etc.'

These models can also provide food for thought when it comes to town and country planning. 'We cannot of course change a region's topography or climate, but we can do something about what feeds the flames, namely the vegetation,' explains George Eftichidis (Algosystems – GR), the coordinator of the Prometheus project which has developed tools for preventive forest management. 'To manage forests effectively you must get the politicians, associations, foresters and fire fighters to sit down at the same table. Fire modelling is then a very valuable decision-making tool,' adds Colonel Picard, director of CEREN in southern France (see box p.39). But he stresses that for people in the field, such as fire fighters, modelling also has its limits: 'The calculations take a long time and models cannot take real-time account of changes in the action taken.'