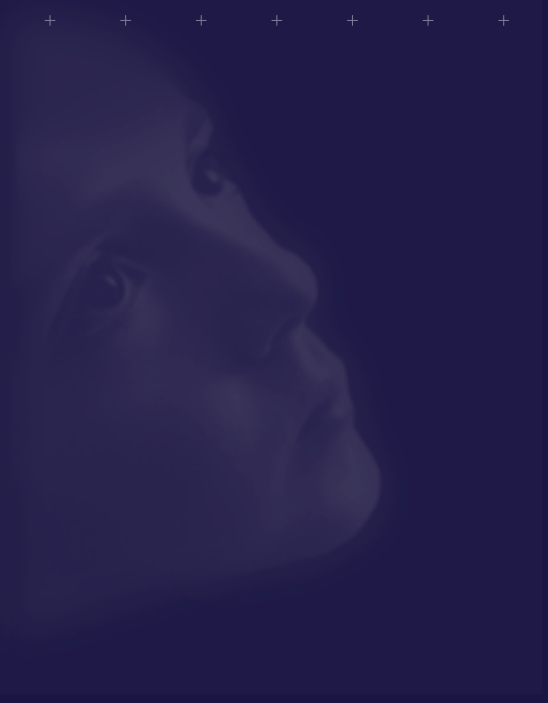
European Commission

GREEN PAPER

European Space Policy



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G R E E N P A P E R

European Space Policy

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This Green Paper was adopted by the European Commission on 21 January 2003 [(COM (2003) 17 final]. The Commission invites all those which, upon reading the text, would like to react, send comments, and/or put forward proposals, to please do so before 30 May 2003, preferably by means of the On-line Forum open for this purpose on Internet at the following address:

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Foreword

The efforts made in Europe over the past few decades have been motivated by a desire for autonomy in space matters. So far the framework for these efforts has been intergovernmental, led by the European Space Agency (ESA), whose base of knowledge, experience and co-ordinating role make it an essential player, and national (national agencies and industries).

These efforts have made it possible to create a solid industrial base and to give Europe recognised capability in the field of launchers, science and technology and applications, in particular telecommunications satellites. As a result, it has become a leading player in the commercial field.

However, the world and Europe are being affected by profound changes, which equally impact the space scene. The successes notably obtained by the action of the Agency, should be reinforced and will be justified by their availability to, and corresponding support of the Union.

Over the last few years, the Union became aware of the importance of space. It has been enhancing its role as an actor, in particular on the basis of applications useful to the conduct of its policies (e.g. the Galileo satellite positioning and navigation project) and the GMES initiative (Global Monitoring for Environment and Security) for observation of the environment and for security purposes.

The development of space applications, particularly for earth observation, has made it possible to expand their field of interest. Consequently, space represents a tool with unique characteristics at the service of numerous objectives and policies, such as transport and mobility, information society, industrial competitiveness, environmental protection, land use planning, agriculture and fisheries, sustainable development and, more generally, the Lisbon Strategy aimed at "making the Union the most advanced knowledge-based society in the world".

Moreover, the growing challenges in terms of security, coupled with the many uses that can be made of space, have now also led to a complete reappraisal of the role of Europe in space. In this connection, the rapid development of the Common Foreign and Security Policy (CFSP) and European Security and Defence Policy (ESDP) merit special attention.

Integrating space in current European policies would have two main advantages for this sector: it would open up a vast range of applications and users and provide possibilities of better integration of resources and a greater political resonance.

On this level, the fundamental question is that of European ambition. No European nation is capable of independently maintaining a space policy at the necessary level. That the United States devote six times as much in terms of public resources to space as all European countries put together means that Europe cannot remain indifferent if it wishes to play a role in this field.

Some of the issues to be considered are sensitive, for example the degree of independence that Europe is seeking in this strategic field, its ability to adopt a global approach to the security dimension and the level and type of funding that it is prepared to grant.

At the organisational level, there could be a call for a redefinition of the roles and responsibilities of the parties involved, in a spirit of subsidiarity, in order to reflect the political changes in the current situation and respond in a more effective manner to a revived European will.

Introduction

The aim of this Green Paper is to initiate a debate on the medium- and long-term future use of space for the benefit of Europe and on policy options available.

This debate is naturally incorporated in the discussions on the future of Europe at the next Intergovernmental Conference.

The contents of the Green Paper reflect the concerns of the European Commission, often shared by the European Space Agency (ESA). Notably, it presents a first reply to the request of the European Parliament in its Resolution on space[1].

(1) Parliament Resolution, 17 January 2002, PR TAPROV(2002)0015 "Europe and Space".

A NECESSARY DEBATE

"Last Frontier..", "discovery of the Universe and its origins…", "..life on other planets..", "..first footsteps on the Moon..", "…space heroes…". Space represents to humanity an infinite, timeless source of dreams and striking reality.

In practice, space has for a long time been a source of progress and technological and commercial success of Europe. Space systems already play a notable role in numerous facets of the daily life of Europeans: satellite communications permit the exchange of messages with the furthermost regions of the Earth; each person can watch television programmes reflecting their own culture, thousands of kilometres from their country of origin; data from earth observation satellites are at the basis of weather forecasts.

Photos: ESA

Space technology can already make a marked contribution in saving human life thanks to search and rescue networks with global coverage, as well as providing monitoring infrastructure allowing efficient action during natural catastrophes.

In general, data and information from space systems are essential to the organisation and good functioning of a modern society.

The current situation and the prospects for the future of the European space sector are, however, worrying.

Space is, and will remain for a long time, a high-risk sector, of fragile economic viability, even if the potential of its application is ever increasing.

In these circumstances, the equilibrium of the economic model adopted for space development in Europe until now, associating a strong commercial element to support from public authorities, is markedly reduced, notably as a consequence of the difficulties of the communication market and the mounting capability of several regions of the world. It is today compromised.

At the same time, choices and continued major investments must continually be made in order to remain in the "hunt" technologically, whilst the difference in investment, in particular by comparison with the United States, worsens.

Finally, the situation for space in Europe reflects a situation not without certain ambiguities. This results in the first place from the more strategic, rather than commercial, nature of space, and the fundamental role played by the States. The positions taken, be it at national, intergovernmental or community level, can vary markedly, and national intervention in the industrial matrix, at a time when industry is moving towards a trans-national dimension, is heavy with consequence.

Any decision to become a space power is the result of a political will. For its part, Europe has much to gain – or to lose – according to its presence or absence from the field. To avoid that opportunities are lost, to provide counsel on decisions to be taken and actions to be made, a broad debate is necessary.

To support and organise this, the current document first of all reviews the fundamental issues which underpin the European space activity (Chapter 1); afterwards, it illustrates the considerable potential afforded to the benefit of the citizens and the policies of the Union (Chapter 2); it is completed by an examination of certain institutional and regulatory aspects, and of the organisational consequences to be drawn (Chapter 3).

THE GREEN PAPER PROCESS

The Green Paper is a new stage in the dynamic of the evolution of the European space sector. By this action, the Commission seeks to help increase awareness among the authorities, business and citizens on the strategic and political significance of these matters, which are too often limited to specialists.

This paper takes account of the shared thoughts of the European Commission and the European Space Agency[2] worked out within the Task Force on space set up in 2001 and continues their joint work on European space strategy and European space policy[3].

Without claiming to be exhaustive, the Green Paper is intended to raise those questions that appear to be the most important in determining the options to be chosen in the medium and long term. The response of interested parties to the questions raised will subsequently make it possible to draw up an action plan ("White Paper").

(2) The document was also drawn up on the basis of work carried out recently in both institutions, particularly the following:
- initial discussions held at the high-level workshop (October 2002) chaired by Commissioner Busquin which was attended by C. Bildt (Rapporteur), J-L. Dehaene (Vice-President of the Convention), Commissioner Liikanen, A. Rodotà (Director-General of the ESA), and representatives of the Danish and Greek Presidencies, the High Representative/Secretary-General of the Council, the European Parliament and business leaders;
- the report on "Strategic Aerospace Review for the 21st century" (STAR21, July 2002);
- the report "Towards a space agency for the EU" (December 2000 – C. Bildt, J. Peyrelevade, L. Späth).

(3) COM(2001)718 final.

1. EUROPEAN SPACE IN A CHANGING GLOBAL CONTEXT

The Green Paper is based on an assumption and a premise:
– space must, by nature, be considered at the global level;
– the effectiveness of Europe in space can drive the success of certain of its policies.

1.1. Fundamental elements

The existence of European capabilities in a number of fields is essential so that Europe and the various players involved can continue to provide the basis for such success, either in competition and or in co-operation with the other world space powers.

The leading power, the *United States*, uses space systems as an instrument for guaranteeing strategic, political, scientific and economic leadership combining the concepts of "space dominance" and "information dominance".

This political will is reflected in a level of investment without equal: American expenditure for and in space accounts for some 80% of world spending in this area (civil + defence).

Russia, which is likewise a pioneer of space development, has succeeded in maintaining a very important scientific, technological and operational base. As things stand, it has developed more institutional links and industrial co-operation with the United States than with European partners. *Ukraine*, moreover, has developed considerable technological know-how, in particular in the launcher sector.

Finally, the activities of the *new space powers* which have emerged more recently (Japan, China, India, Brazil) are very much dictated by strategic considerations.

Europe for its part has followed an original path, which has so far shown a number of specific characteristics (cf. Figure 1):

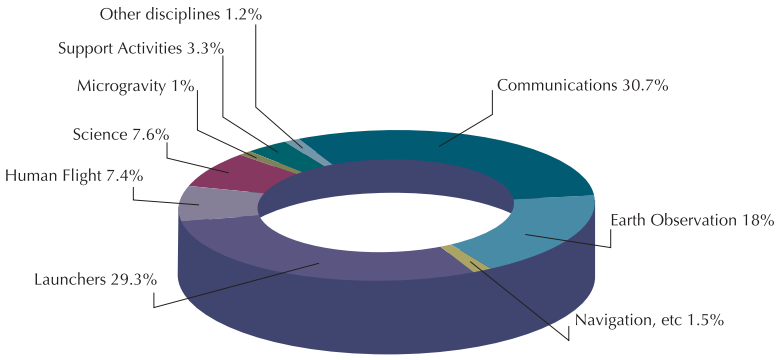


Fig. 1: Split of public and private European investment on space activities (year 2000)
[source: Euroconsult, ESA]

– political ambition: gaining and maintaining independent access to space by developing its own launch vehicles and satellites;

– a sustained effort to develop, scientific knowledge, applications and associated infrastructures;

– an industrial policy aimed at the development of a competitive and innovative industrial base and a geographic spread of activities;

– priority given to civil and commercial aspects, particularly in the field of launch services and satellites;

– opting for international co-operation with the leading space powers for major instruments and encompassing missions, including manned flight.

1.1.1. Independent access to space

Launch vehicles and launch infrastructures are the key elements in any space project. Since 1980 Europe has, through Ariane and the space centre in Guyana (an infrastructure of European interest), independent and reliable access to space, giving it considerable freedom of initiative in achieving its space ambitions.

This autonomy has been combined with commercial success which began in the 1980s in a favourable international context, notably including:

– the fact that the US more or less stopped using conventional launchers, replacing them by the space shuttle until its accident in 1986;

– the ban on Russian launch vehicles from the commercial market until the end of the Soviet regime (1990).

This stage has now been overtaken by events. The European operator Arianespace currently faces fierce competition combined with a downturn on the launch services market.

Ariane-5, the new generation launcher, is operational but under the current circumstances its medium-term competitiveness must be based on new technical developments and the renewal under preparation, of the method for public support of its use.

At the same time, the range is widening with the advent of the Vega launch vehicle planned for 2006 and the introduction, likewise envisaged for 2006, of the Russian Soyuz launcher at the Guyanese space centre.

A fundamental question which emerges over and above the process of restoring the economic stability of the European launcher in the medium term is the need to guarantee European access to space in the long term.

European autonomy and competitiveness: a delicate balance

- The permanent availability of a reliable **launch vehicle** to meet European institutional demand – 0 to 3 missions a year – has to date been based on a launcher capable of schedule maintaining workload through service contracts on the world market, i.e. a launcher in practice optimised for telecommunication satellites.
- In accordance with this principle, the commercial success of **Ariane** has ensured the economic equilibrium of its use and has enabled the states to focus their efforts by priority on new developments intended to maintain competitiveness
- This balance is currently threatened by three factors: the economic constraints of the **transition between the two generations** Ariane-4 and Ariane-5, the **contraction of the commercial market** and the fall in prices due to **worldwide overcapacity** of means of launch.

Q1: Should Europe maintain, until 2020 and beyond, its independent access to space, based on the development of a family of European launchers and their preferential use by institutional users?

What should be the formula for a wished-for evolution in the sharing of responsibilities between the public authorities and the private sector in the economic balance of the use of these launchers and in the finance of new developments?

1.1.2. Maintaining scientific excellence

The European scientific community enjoys a leading position in the two main disciplines of space science, i.e. astrophysics and exploration of the solar system, as well as in earth observation. In addition to the competence of European laboratories, a number of factors have been decisive in this respect:

– The highly integrated programming framework represented by ESA to define most missions and develop space systems (see box);

– The availability of independent means of launch which has made it possible to carry out several wholly European large-scale space missions, giving Europe a pioneering position in particular fields (e.g. astrometry, infrared or X-ray astronomy);

– The technical competence of industry including the existing synergy in the field between civil and defence applications programmes.

European space science makes a significant contribution to knowledge of the physical world and research into living in space. It is supplemented by knowledge from earth science and disciplines using microgravity. It is also a powerful driving force of technology as it involves taking higher risks than in operational systems. The long-term level of finance, the split of responsibilities between national and European actors, and the balance between European autonomy and and international co-operation are the decisive elements for the vitality of the European Space Science programme, itself an essential component of the European space programme.

Characteristics of the integrated scientific programme of the ESA

(1) Stability of the budget adopted for five-year periods (annual level: €360 million) to which the ESA Member States are obliged to contribute.

(2) Long-term planning organising the alternation between missions of differing scope, ensuring a balance between the disciplines and determining the choice between European autonomy or a co-operative framework.

(3) Complementarity of responsibility between the ESA, developing the platforms, and national laboratories, developing on-board instruments.

A comparable programme has been instigated by ESA for scientific users in the earth observation field.

Photo: ESA

1.1.3. The industrial and technological base

Europe's space sector should, in order to be competitive and credible, must have available an industrial structure of high quality, and access to key technologies.

Industry

The strong industrial base existing in Europe that is competitive at world level, and capable of mastering the entire chain, must be maintained and/or reinforced if Europe is to exercise its freedom of initiative in the space sector.

Today, the European space sector directly employs 30 000 highly qualified people, spread over about 2 000 companies which cover the full range of skills relating to systems, subsystems and components.

As for its characteristic features, space industry is at the same time:

– Strategic: it ensures Europe's independence in essential sectors of the space field;

– Dual: it covers both civil and defence markets;

– A "catalyst": its effects go beyond the space sector as such, in particular with regard to the electronic consumer equipment and television broadcasting industries.

A competitive industry

- The overall **turnover** of the European space industry is **€5.5 billion a year**.
- In recent years, half of the total turnover of the European space industry has come from institutional orders and the other half from the **commercial market** (cf. Figure 2). This contrasts with the situation in the United States where three quarters of turnover come from NASA and Defence Department orders.
- In public expenditure, the ratio between **civil and defence** expenditure is 1:5 in Europe whereas in the US they are of equal magnitude. Accordingly, European industry does not benefit from the same synergies as its American counterpart.
- Investment in the space applications sector in general generates a **services** market (e.g. TV broadcasting) larger by a factor 10 (cf. Figure 3).

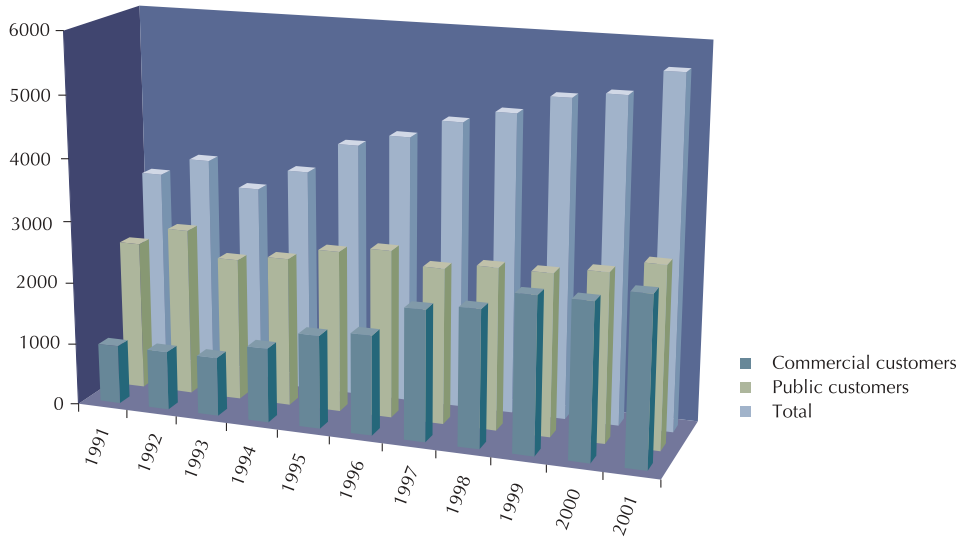


Fig. 2: Consolidated turnover of European space industry (in million €)
[Source: Commission]

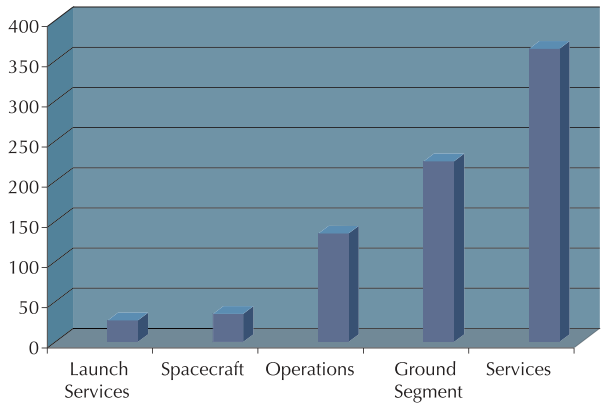


Fig. 3: Estimation of the cumulative value chain for the global commercial market (satellite navigation and communication by satellite – 1998-2007) (in billion €)
[Source: Arianespace, ESA]

Increasing competition has over the years led European space industry to carry out major restructuring. It is now organised at European level and is in competition with or a credible partner of its American counterpart.

However, it is affected crisis in growth in telecommunications and the sharp fall in demand for this type of satellite.

Europe must determine if it wants to maintain an industrial base covering the whole chain of space activities and applications. In the industrial sector, it should also identify the sectors of maximum added value, where the best comparative advantage may be developed.

Technology

In order to remain competitive, European industry needs a broad and efficient technological base maintained through research and demonstration programmes.

This requires, in particular, that close co-operation be maintained between the space industry, service providers and public research bodies and also calls for early identification of technological requirements in the coming decades.

In the space sector, the technological chains are costly and market volumes limited; this makes it imperative for the public authorities to intervene.

In this context, the European Union, the ESA, the national players and industry have established various instruments to intervene in the whole value chain.

This does not exclude a possible need for programmes, or additional co-ordination mechanisms.

Support to Technology: a range of actions

- The **space technology plan** drawn up by the ESA provides the framework in which all public and private players in the European space sector are invited to identify European requirements and participate in joint actions. The ESA itself conducts a number of research and technological demonstration programmes.
- The **6th Framework Programme for Research** of the Union focuses its efforts in the space sector on applications connected with teledetection, navigation and communication.
- **National R&D programmes** and self-financed initiatives of industry complete the European space technology landscape.

Q2: In which fields – including those concerned with space systems used for security and defence – does Europe have critical technology and industrial short-comings, and how to redress the balance?

1.1.4. The commercial market and the institutional demand

The open commercial market represents around 30% of the total world space activities. The remainder is made up of an institutional demand, the main part of which (American) is until now not accessible to European players. The latter have concentrated their investment mainly on the commercial segment.

N.B.: in 2000, the increased requirements of communication satellite operators, coupled with more severe export controls by the American administration, were particularly beneficial to European industry.

The breakdown of the commercial space market (particularly certain price practices, overcapacity and government restrictions) make this market difficult.

European industries are more vulnerable since the relevant part of their activities taken up with this type of market is greater than for their American counterparts. Analyses agree however that certain niche markets, mainly applications, have a favourable commercial potential.

To create a better long-term equilibrium, industry is calling for the creation of a true institutional market in Europe, based in particular on the environmental, security and defence elements, and at the same time posing the question of European preference.

The United States in particular protect their industry from external commercial pressures thanks to support from a large national security and defence market which is closed to foreign suppliers. Application to commercial civil satellites of export control laws – notably the application of clauses related to dual use technologies – reinforces this support.

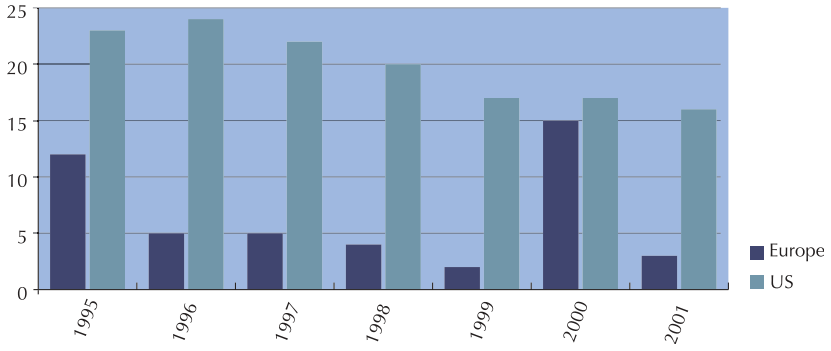


Fig.4: Commercial satellites: European versus American orders since 1995 (numbers of satellites)
[Source: Euroconsult, AIA]

The world space market: comparison between public and commercial expenditure

[Source: ESA]

- The **world space market**, including commercial revenue generated by space applications (telecommunication, navigation, earth observation), is estimated to total **€167 billion** in 2001.
- Budgets for **institutional** space programmes worldwide in 2001 totalled **€42 billion** (civil activities: 26 billion; defence activities: 16 billion). The world **commercial** market – satellites, launch services and operations – in 2001 is estimated at **€49 billion**.
- For 2002, **US public expenditure** in the space sector is **€31.8 billion** (5% up from 2001) and is essentially equally shared between civil and military expenditure.
- In 2002, **European public expenditure** in the space sector is **€6 billion** (slightly down from 2001), 90% of which is attributed to civil programmes.

Q3: What is the outlook for growth in the European institutional market? In parallel, is it necessary to seek agreement with key international partners (United States, Russia) to establish more balanced market conditions?

Photo: ESA

1.1.5. International co-operation

International co-operation can be considered for space activities in relation to the wish or need:

– to attain particular objectives through co-operation rather than independently;

– to clarify particular issues in a global context, e.g. matters of international trade, regulation, standardisation, etc.

ESA and certain Member States have established a long tradition of co-operation with other space powers. More recently, new international co-operations have seen the light of day, notably with the launch of the Galileo and GMES initiatives by the Union, making it even more necessary that Europe ought to "speak with one voice".

From the outset, Europe's relations with the United States in respect of space co-operation have been privileged, given the scope of the American programme and the family links of scientific, technological and industrial cultures.

These relations have nevertheless been marked by a constant desire on the part of the Americans to be preeminent in space. Europe participates in American initiatives in space science and in manned flight. However, as a general rule, and thanks to the size of its investment, NASA expects to remain in control design, development and, means of launch, such that Europe contributes to the less strategic aspects of space missions.

This relationship is often reflected in the relative share of on-board instrumentation, and the way observation and experimentation time is allocated between the two scientific communities within a co-operation project.

In space co-operation with Russia, which is more limited in scope, Europe's contribution has been even less decisive, has been for the supply of scientific instruments onboard interplanetary probes or space stations. Seventeen European astronauts have participated in Russian programmes. Politically, a deeper co-operation of Europe with Russia, in the framework of a closer partnership and either current or future instruments, may be of mutual interest. The Ukraine may equally be the object of special political attention.

Europe has today gradually acquired a strong capacity in launchers, science and applications. It is henceforth capable of taking the initiative, intervening on a par with its partners and playing a strategic role in major space projects in a co-operative framework. A review appears necessary over the range of future major space programmes as to the balance to be found between European autonomy and international co-operation.

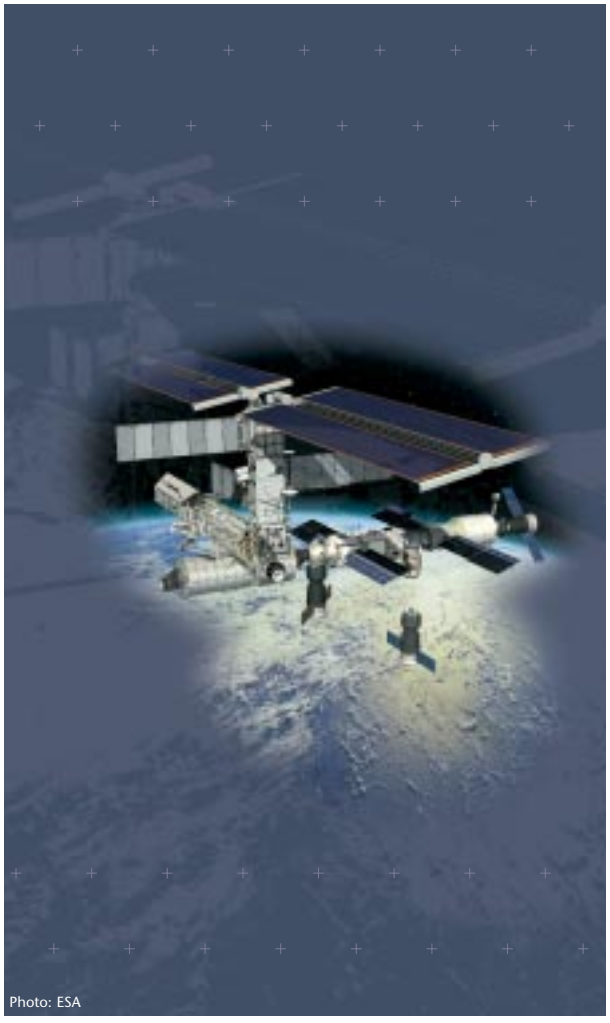


Photo: ESA

1.1.6. Manned space flight

Manned flights are among the most emblematic aspects of the space sector and consume an important part of the budget of ESA, which has created a European Astronaut Corps. Forty years after the first mission in orbit, manned space flights now always take place in the co-operative framework of the International Space Station (ISS).

The ISS combines, under US responsibility, contributions from the five main participants: the United States, Russia, Japan, Canada and Europe. It is the most ambitious and the most costly civil research infrastructure ever built (about €30 billion in development costs).

Europe's contribution via ESA to the ISS remains modest (cf. box). Compared with earlier forms of co-operation with Americans and Russians in the area of manned flight (Spacelab, access to the Mir space station), it has nevertheless increased considerably in terms of both the technological and industrial dimension of the developments and enhanced possibilities for experiments offered to the European scientific community.

The level of European effort in the field of manned space flight – principally Spacelab and ISS – has sometimes been questioned, notably concerning the scientific interest, the actual possibilities for onboard experimentation and access for European astronauts.

Moreover, American decisions concerning the financing of the ISS, the onboard experimental programme, astronaut visits and access to the station must be considered in the light of Europe's objectives.

Q4: From a European point of view, do the results eventually expected from the experimental programme on board the ISS correspond to the level of investment and the running costs? How should Europe develop its participation and its objectives?

European participation in the ISS

The **European contribution** amounts to about **8%** of the total effort (€3 billion in investment and €300 million a year in operating costs). It comprises:

- a component of the station, the pressurised Columbus laboratory;
- the associated scientific instrumentation;
- an automatic freight transport facility, the Automated Transfer Vehicle (ATV), which will be regularly launched by Ariane-5 towards the space station in order to meet its logistical requirements.

The European astronauts have access to the station to carry out experiments via the American space shuttle or the Russian Soyuz vehicle.

Photo: ESA

1.2. Budgetary and financial resources

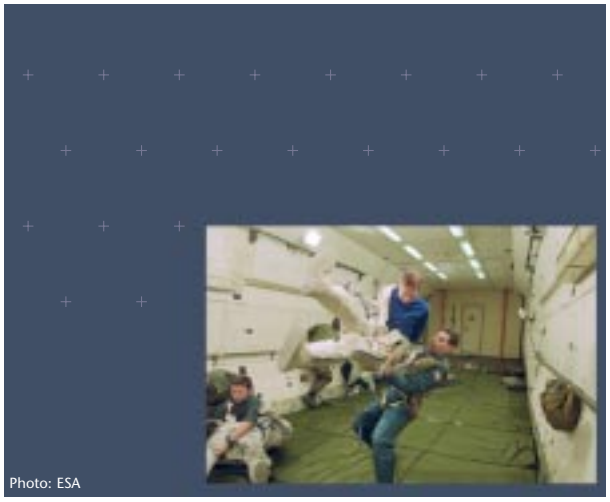
The average level of public funding of space activities in Europe is less than €15 per head per year. The corresponding amount in the United States is around €110. As an illustration, the split of resources allocated to the space sector in 2000 is given in the diagram below.

Optimisation of certain instruments and the institutional architecture should make it possible to achieve greater efficiency in the use of existing resources (cf. Chapter 3). Compared to the main competitor, the United States, the return on investment remains very unfavourable, and Europe must determine to what extent it wishes to increase its investment in the space field.

In Europe, space has been financed largely from funds under research budgets. However, the development and operation of launch vehicles, applications and infrastructure go well beyond this budgetary framework.

At Community level, moreover, use can be made of a range of instruments (trans-European networks, R&D, structural funds, development aid, etc.) governed by different rules.

Q5: How may the financing of space activities at European level be organised in a more coherent manner, avoiding that an increase of resources at European level is accompanied by an equivalent reduction of investment at national level?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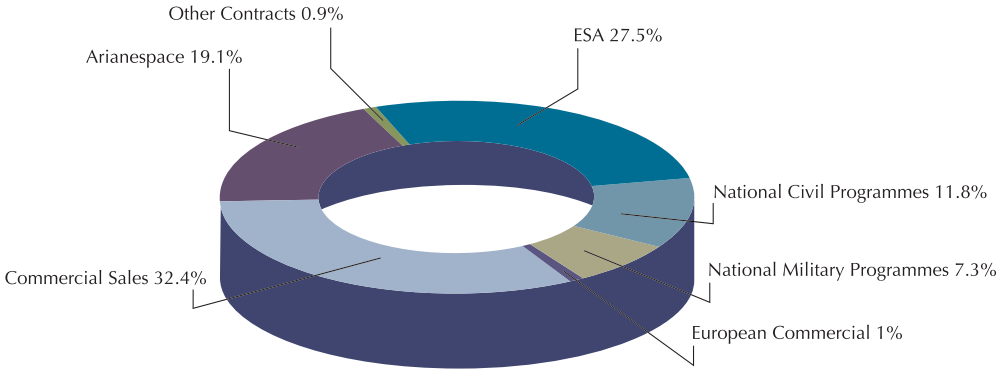


Fig.5: Distribution of sources of revenue for the European space sector (year 2000) (in %)
[Source: Euroconsult, ESA]

1.3. Vocation and competencies

Reviews carried out in connection with the establishment of the European Research Area and the publication of STAR21 have shown that there are a number of generic problems in Europe affecting scientific disciplines, including the fact that fewer students are coming through.

Given the very long lifecycle of space projects and their specific features, the sector is particularly sensitive to the continued transfer of know-how and information between generations of scientists and engineers. However, the population of space specialists is ageing.

Notwithstanding productivity gains in space industry (cf. Figure 6), Europe must invest in human resources and know-how. For the space sector, the need to attract young scientists and the mobility of scientists and engineers are particularly acute problems.

Human resources: a cause for concern

In Europe it is estimated that nearly **30%** of people employed in the space sector are due to retire in the next **10** years. In the United States **26%** of persons employed in the aerospace sector will retire in the next **five** years; 54% are over the age of 45.

Europe must increase the number of researchers in this field, e.g. by making better use of the female scientific potential, by recruiting researchers and engineers from third countries, by making it easier for expatriate European scientists to return (in particular by preventing a "brain drain") and by setting up attractive programmes offering incentives to young scientists.

Q6: What action should be taken in space professions and associated field to make them more attractive, in particular to young people?

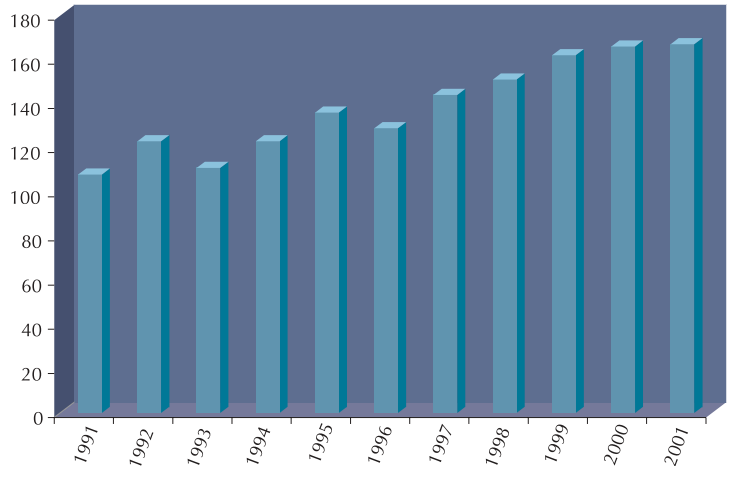


Fig. 6: Productivity in the European industrial space sector (x €1 000 per employee)

2. PLACING SPACE MORE AT THE SERVICE OF EUROPE AND ITS CITIZENS

Space technologies increasingly can offer opportunities of multiple use, making it possible to develop solutions responding to the various needs of European citizens. Nevertheless, it should be more in line with user expectations in terms of cost, adaptation to actual requirements and continuity of services on offer.

In addition to the very widespread use of telecommunication satellites for the exchange of information (telephony, television and digital data transmission), Europe has in recent years developed a number of applications showing the contribution of space infrastructures which have in most cases provided the basis for services of general interest, to citizens.

Added Value for the Union

More generally, a strong European presence in particular key areas of space applications is indispensable both as a political asset and in order to enable the Union to maintain its strategic independence and contribute to its economic competitiveness.

The decision to launch the Galileo programme shows the European will to acquire a proper share in the emerging market in navigation and positioning services. In this respect, new space technologies offer equally a considerable potential to increase international co-operation and access to new markets (in particular Asia and South America).

Current examples of space applications for citizens and policies

- **Weather forecasts** on the short (five days) or medium term (three months) have become possible thanks to the systematic use of earth observation satellites. They are also of considerable importance in detecting major meteorological phenomena such as cyclones and El Niño.
- The setting-up of a world-wide **satellite navigation and positioning system** has made it possible to reduce travelling time for people who can now obtain accurate and reliable location data at any time enabling them to optimise their itinerary.
- **Citizens' security** also benefits from the use of space technology (monitoring of hazardous transport operations, border surveillance, exchange of sensitive information between administrations).
- The stringent implementation of the **common agricultural policy** requires control facilities, in particular to verify production and land lying fallow. Earth observation satellites provide national administrations and the parties concerned with standard facilities throughout the Union that can be pressed into service with few bureaucratic and administrative constraints, providing highly accurate and reliable results.
- Given the possibilities of surveillance at sea, **the policy for maritime safety** and the new **fisheries policy** make generalised use of satellite positioning technology. These applications combine satellite positioning and telecommunication.


Photo: ESA

This broader orientation towards the Union's citizens and general interests makes it possible to open up the field to players other than those of the traditional space industry: service providers, content providers, private and public users. De facto, it considerably enhances the potential of the space sector.

In view of the above, greater priority ought to be given to the process of transferring technologies from the research sector to the commercial sector e.g. by encouraging private investment through long-term commitments by the public authorities with regard to their requirements.

It is equally essential to give preference to research actions aimed at industrial applications and value added services which go beyond the strict context of space. In this way, the impact of user demand on the provision and the structure of the proposed space segment will be increased. The Union could play a determinant role in the structure and progressive consolidation of this demand, notably the public demand.

In the decades ahead, Europe will have to face major new challenges and large-scale requirements. Three main themes, which have received the attention of European Summits, may serve to illustrate the potential contribution of the space sector:

– the objective of turning Europe into the world's most advanced knowledge society by 2010 (including its larger dimension and permitting cultural diversity);

– the strong stance of the Union on sustainable development issues;

– the Common Foreign and Security Policy and the Common Security and Defence Policy which are in active development.

2.1. Contributing to the emerging knowledge society and the competitiveness of European industry

Space systems are closely linked to the setting-up of a competitive knowledge society, intended both to ensure that all European citizens, notably those with special requirements, may have access to advanced technologies and services, and to make European industry more competitive. Digital television, third generation mobile communications and internet, individually or together, are examples of useful platforms for the deployment of such services, to which space systems can contribute(4).

The key problem in this area is the need to develop new economically viable applications, which make optimum use of the benefits of earth and space technologies, with generally different industrial cycles and capital yield profiles. However, in an extremely competitive environment, the level of public support for the developments merits debate.

Example of services linked to information society

- In the middle of 2002, **40% of homes in the Union** had access to the **Internet**, i.e. about 150 million web users in Europe, the same number as in the United States.
- Despite the current economic difficulties, **telecommunication satellites** constitute the most important market for the space sector world-wide. European companies have been genuinely successful; for example, there are now two European service operators among the four world leaders.
- In Europe, more than **1 250 television programmes** are broadcast by satellite to **100 million homes.**

(4) The Commission launched in 2002 the "eEurope 2005" action plan, using these technologies to modernise public services, to create a favourable environment for e-business, and to secure the broadband networks necessary for a modern economy.

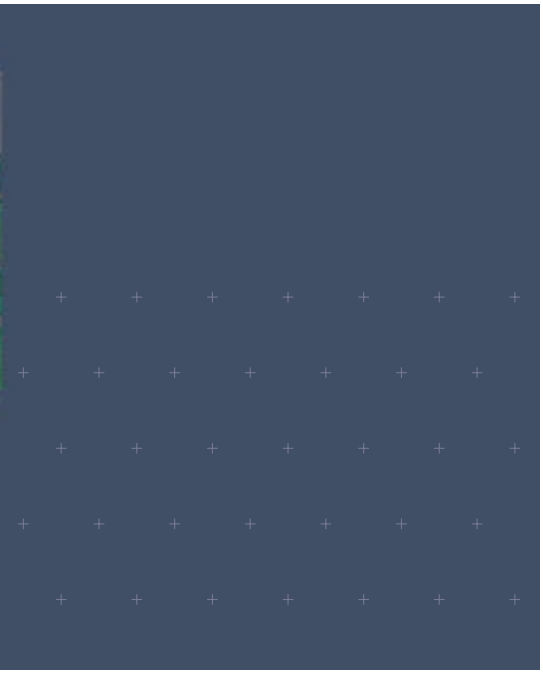

Photo: ESA

Equally, it would be useful to define the new space systems necessary to optimise the global information exchange network; for what applications, and on what economic basis.

Ten new Member States will join the Union in 2004, adding 75 million citizens to the existing Community of 375 million people, increasing markedly the benefits accorded by investment on space systems.

"Social inclusion" in terms of communication, circulation of cultural content and access to high quality services is crucial in ensuring the success of rapid integration. "Digital inclusion", which makes use of space-based resources, is an element of major importance in this respect.

A Union enlarged to continental size, with an even more diversified geography and considerable inequalities in the level of equipment and infrastructure, means an increased demand for which use can be made of particular capacities provided by space-based infrastructure.



Using space to support the integration process

- Examples of dedicated space applications have been identified in areas such as border control and data dissemination to enable full participation in the **Schengen** information system.
- Data collected through space-based facilities are useful in maintaining **land registries** and enhancing **urban and regional planning** as well as the monitoring and control of reductions in industrial pollution.
- Satellites can contribute to **broadband access to internet**, particularly to the benefit of rural regions.
- Various future Member States have already decided to take part in regional European satellite systems for **television broadcasting.**

Q7: What are the conditions for the emergence of economically viable and competitive applications and space services for citizens and industries? Will political actions be justified, and if this is the case, to what extent could public support be considered necessary?

These capacities should speed up the integration of the new Member States and make it possible to more rapidly improve the quality of services to which citizens, companies and public authorities have access:

– development of their links with the other countries of the Union (for example, in reinforcing the communications infrastructures);

– maintain the interests of an enlarged Union (notably for the monitoring and security of the frontiers).

The diversity and cultural exchanges of Europe's populations can also be better served thanks to the flexibility rendered possible, in particular, by television broadcasting via satellites.

2.2. Supporting sustainable development

The Union has given a commitment to support a sustainable development policy, in particular for the benefit of developing countries. This has been translated, in particular, into commitments made at the World Summit on Sustainable Development convened in Johannesburg in August 2002.

Earth observation, particularly for meteorological and environmental purposes, is a field of excellence in Europe, thanks in particular to achievements under ESA programmes in this area (e.g. Meteosat, managed by the EUMETSAT Agency, Envisat). Space applications of this type contribute to global monitoring of changes on the planet, for example as regards meteorology, climate, oceans and vegetation.

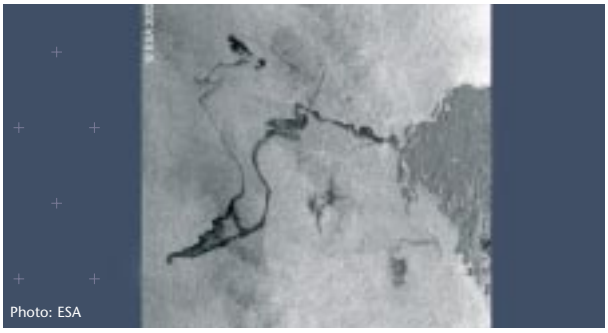


Photo: ESA

It also enables more effective management of natural resources and stricter control of environmental parameters and regulations. Capacities for managing environmental crises are also beginning to be developed.

However, space solutions of this type are still generally under-utilised, due in particular to the experimental and fragmentary nature of the system components available. The Global Monitoring for Environment and Security (GMES) initiative specifically strives to find a range of coherent solutions operational by 2008.

At global level, it has been shown that space systems can play a decisive role in implementing and monitoring the application of international treaties through surveillance and control.

Contributing to sustainable development via space

Environmental aspects: protection and surveillance of the global environment

- Observation satellites can provide rapid and coherent information on forest changes and land cover and use, which are factors affecting global climate change. During the past decade, the planet lost **94 million hectares of forest**.
- Radar satellite monitoring of atmospheric temperature and water surface provide valuable indications to assess the rise in **ocean levels** and **global warming**. They also enable monitoring of glacier contraction and ice floe movements.
- Satellite systems can also be effective in detecting and monitoring **oil slicks** at sea.

Economic and social aspects: impact of space on transport

- The use of satellite navigation systems such as Galileo makes it possible for **air navigation** services to rationalise earth-based infrastructure, which tends to be redundant and costly, by replacing conventional navigation aids by satellites. Numerous possibilities are offered to **maritime and terrestrial navigation**, particularly to simplify and make more reliable management tasks and the control of operators and administrations.
- Studies carried out when the **Galileo** programme was being devised indicate that macroeconomic benefits, which can be achieved over a 20-year period amount to about **€18 billion**, combined with the creation of 145 000 jobs. [source: Price Waterhouse].

In the case of the Kyoto Protocol, the commitments given by the Union represent a substantial effort in economic terms. The Union should have the capacity to ensure that the partners to the agreement meet their commitments, it should also determine the effect of emission reductions.

Europe may better exploit its participation in this type of agreement by the development and offer of space techniques for monitoring and control, as it has recently shown with the Envisat satellite.

2.3. Improving the security of citizens

The ESDP, which will gradually complete the process of European integration, aims to give the Union the ability to decide and act autonomously with a view to a global approach to crisis management, including conflict prevention, by means of various instruments, civil and/or military (cf. "Petersberg tasks").

It takes account of the far-reaching changes in the concept of security in recent years and the great potential for progress that could stem from its scientific, technological and industrial dimension. In addition, it is important that the services offered by space systems in normal times and crises are adequately protected.

Space systems are the main tool for collecting, transmitting and disseminating information at a global level and the only one which is physically non-intrusive, thanks to the capabilities provided by broadband communication systems and optical imaging, infrared or radar systems, the performance of which has made spectacular progress. A space component supporting a rapid capability for decision making will contribute to a credible and effective CSFP.

To a certain extent, the critical shortcomings of current crisis management are directly linked to a space technology capability, and this applies to all players – civilian and military – involved in crisis management, whether they act together or separately[5].

An example of duplication of space systems in Europe.

- In the field of military space, there are five programmes in Europe for communications satellites and three for observation satellites, each based on its own technology, making delicate a possible interoperability.
- In practice, these systems have been developed without co-ordination: in none of the military fields does an operational European system exist.

(5) ECAP report, November 2002, ref. 13809/1/02

Q8: How better to define and clarify, as part of a coherent whole (including framework and time-scale): the nature and scale of the space capacities required to achieve the political objectives of the PESC? Within what context the possible new space capability may be placed at the service of the security of citizens?

In Europe, space can play a unique role to the benefit of the convergence of various processes towards common goals. Strictly military capability effectively remains to a large extent within the remit of Member States, such that several different satellite programmes exist.

Moreover, there are many common features of civil and military space technologies, so that it is appropriate to combine resources in the most effective manner, having regard to improvements in the performance of commercial systems, budgetary constraints in Europe and the technological gap which has developed between the two sides of the Atlantic.

The STAR21 report recommends that the Union should develop a satellite-based defence and security capability on an entirely European basis. So far, a number of national general staffs have co-operated to produce a joint definition of "common operational needs for a global European satellite observation system for security and defence purposes (CON)", which could be extended to other partners.

This first step could be complemented by the GMES initiative in order to produce a European observation system in space, subsequently extended to information and reconnaissance. According to some estimates, acquiring a minimum common space capability would require annual investments of €800 million for 10 years or so.

The goal is to ensure Member States discover added value.

3. TOWARDS A MORE EFFICIENT AND AMBITIOUS ORGANISATION AND FRAMEWORK

In Europe, a number of public agencies are pursuing space activities, to varying degrees and on the basis of various policies and instruments.

This diversity is characteristic of Europe. However, it calls in question the optimum use of resources and the various types of instruments available in order to achieve greater efficiency.

3.1. Union, ESA and Member States: roles and relationships

The fact that no space policy can be formulated in Europe in a purely national context was first addressed some 30 years ago.

The ESA, set up in 1975, met the initial objective to bring together the necessary resources and skills required for developing an integrated space science programme and producing a European launcher. The national agencies of certain Member States, operational bodies and Community space initiatives complete the European space (see box).

This diversity in the space sector has evolved pragmatically over the years. Today it poses the question of an optimised organisation complying with the subsidiarity principle permitting Europe to fix new objectives and new ambitions.

Q9: What is the most efficient manner to exploit the space "acquis" in Europe for the benefit of Union policies?

Public space activities in Europe: institutional and programming diversity

- The **ESA**, an agency for developing technologies and space systems, is an instrument for co-operation between certain European states. It has provided Europe with know-how and autonomy in this sector.

  Other activities exist, notably based on:

  – competence and capabilities for initiative which particular Member States have wished to preserve through **national space agencies and national research centres;**

  – the role entrusted to **the structures responsible for running operational systems** developed by ESA and ensuring continuity of long-term services (e.g. EUMETSAT) and various **specialised instruments** (e.g. the European Southern Observatory);

  – initiatives taken by the **Community** to include a space dimension in Community policies, some pursued jointly with the ESA (e.g. Galileo, GMES).

Photo: ESA

ESA and national space agencies: ESA programmes function in liaison with national agencies. In order to avoid gaps or redundancies between ESA's and national technical centres, the Agency has undertaken to organise the whole in a coherent network of European and national centres. An optimisation of the competencies and means must permanently be sought in permanence, in the spirit of the European Research Area.

European Union and ESA: Space is the reason for the existence of ESA, a strong priority being given to the scientific and industrial mastery of the technology and systems ("technology push"). The Union, however, has recourse to space as a generic tool when it provides useful support for various Community policies ("demand pull").

The combining of the two approaches in a common vision of European space can be particularly fruitful. The efforts of co-operation and closer working relations already undertaken underline however, differences and the absence of certain links between the two organisations on the institutional and procedural plan complicates relations and decisions. As for the question raised – of which certain can not be resolved under existing conditions – one can note the following examples concerning:

– the membership (for example, the case of the two States of the Union which are not members of ESA, for which it is necessary to consider if they intend to join it, ESA countries which are not members of the Union and the possible welcome in the ESA framework for enlargement countries);

– working principles (for example, the principle of *"juste retour"*);

– the decision (notably, in the absence of a common decision-making body).

3.2. Space policy and programming frameworks

The current diversity of the institutional and programming framework in the space sector and current discussions on evolutions to the way the Union is governed call for a review of the decisional architecture in Europe. The first movements in this direction have recently been undertaken in the framework of ad-hoc structures such as the ESA/Commission Joint Task Force on space. Permanent institutional solutions should now be introduced.

The scope which space technologies cover in Europe, the diversity of the relevant structures and the increasing need for more coherent action between them are arguments in favour of a globalisation of the European space policy.

This global space strategy must also establish guidelines ensuring convergence of the contributions made by various institutional players, in first place the Member States towards common objectives. In doing so, it should cover all civilian, security and defence aspects.

The expected benefit will be genuine homogeneity of decisions taken by the Member States in the various corresponding programming frameworks. Globally, and on a common strategic agenda, this forms a European Space programme, an essential tool of the implementation of the chosen policy.

One objective to be attained is that of a more precise definition of the responsibilities of those involved and the mutual relationships of institutional actors in respect of space - in particular development agencies and operational structures - and their relationship with the private sector.

Q10: How may the political and juridical bases necessary for an efficient action by the Union and Europe in the space field, in particular with regard to the definition of the future Treaty of the Union, be reinforced?

Future Union Treaty

Several reasons argue in favour of the inclusion of arrangements on space in the future Treaty of the Union. Firstly, space is by nature extra-territorial, which often requires human and financial resources going beyond purely national constraints.

As seen in the previous chapter, it is a field which can offer unique capability in the service of the Union for the development and implementation of current and future policies either civil or for security.

This presents the advantage of providing a more global political framework to treat the whole range of questions relating to the space field.

With a new Treaty currently in the course of definition, it is appropriate to consider the possibility of providing the Union with a space policy as well as the division of responsibilities and future roles between the Union, the Member States and ESA in this field.

3.3. Developing space industry within a transparent and stable regulatory framework

Investment in the space sector is often considerable and fraught with risk, requiring a long planning and implementation period. Taking account of these characteristics, it is important to establish a stable and transparent regulatory framework to motivate decision-makers and investors. A number of administrative obstacles remain to be overcome at national and European level.

Evolution in the industrial landscape

Space is a strategic "pioneer" market involving extreme technical and financial risks and very high entry costs for new players, justifying the major role played by the public authorities in this area.

The competition objective in this context is particularly important to ensure optimum allocation of resources, maintenance of transparency, a high level of competitiveness and a reduction of costs.

New regrouping trends in the space sector are not be excluded, in particular in Europe. The course taken by this industry has been largely determined by the will of the public authorities expressed through an industrial policy of the ESA.

Q11: Economic pressures are driving aerospace industries in Europe and elsewhere to restructure. What are the consequences of such restructuring? How may the actions of public bodies be best organised to support the competitiveness of the space industry?

Regulation and standardisation

Operating global space systems and networks poses complex problems. Efforts towards simplification and expediting procedures appear necessary in particular in three areas:

– Frequency spectrum, orbital positions: The allocation of frequencies and orbital positions of satellites are increasingly scarce resources shared at international level. They are assigned to states by a specialised United Nations Agency, the International Telecommunication Union (ITU). The relevant decisions are taken at World Radiocommunication Conferences.

  It is in the interest of Member States to act jointly within these bodies, which is in fact already partly the case, in particular through the European Conference of Postal and Telecommunications Administrations (CEPT), but these efforts should be further intensified in order to better present European positions in the framework of international bodies.

– Standardisation: Apart from a number of rare cases, space systems are developed in accordance with specific industrial standards which are authorised, virtually automatically, by the European Telecommunications Standards Institute (ETSI). Open and shared standards would be conducive to a wider response of systems to the demands of the general public, thereby enhancing commercial efficiency[6]. It is necessary to stimulate the worldwide industry to make use of these standards.

(6) For example, the European Co-operation for Space Standards initiative intended to promote industrial standards.

– Licensing: The aim should be to eliminate regulatory barriers hampering the swift settlement of problems of licences for operating and installing terminals, which is an indispensable condition for attracting investment in European space telecommunication services, and to develop the market for new services such as broad-band internet via satellite. Organisations wishing to establish a commercial satellite system in Europe can do so through a "one-stop shop" by submitting a single request to the regulatory authorities of a country, which should facilitate the licensing process. Under the provisions in force, this remains within the competence of the Member States. It will be necessary to examine how the current system of allocation of licences can be adapted to develop the space sector, notably to ease the installation of satellite systems with a pan-European coverage. In particular those who propose new services.

Q12: Are there regulatory barriers, which slow the development of new space communication services? What are the measures likely to improve regulatory environment notably with a view to the development of the information society?

CONCLUSIONS

The Green Paper puts forward a number of questions, which Europe will have to face in the medium and long term. The answers given and the choices made will determine the future of Europe as a space power. This will in turn impact on the aspirations and development of the Union itself.

The publication of the Green Paper marks the beginning of an official consultation period. This will extend until 30 May 2003. The framework will be provided by the joint Commission/ESA Task Force which will organise a series of seminars, workshops and hearings to facilitate the process. An internet site will also be available for the submission of the answers that interested parties are requested to give to the questions raised.

Subsequently, an action plan ("White Paper") will be drawn up by the Commission, detailing the action to be undertaken and the role of each partner in ensuring that they are successfully implemented. This plan will be presented before the end of 2003.

Green Paper on the future of Europe in the space sector: Consultation process

Start of consultation: **22 January 2003**; *end of consultation:* **30 May 2003**

Contributions should be sent to:

c/o Commission/ESA Joint Task Force
"Green Paper on space"
rue Joseph II n° 79 - Office 02/06 - 1049 Brussels
E-mail: space-policy@cec.eu.int

A dedicated website and an on-line Forum enabling all those interested to express their views can also be accessed via the following website:

http://europa.eu.int/comm/space

Information: A number of workshops are being planned to take the debate to various places in Europe. The cities currently foreseen are: Brussels, Madrid, Rome, Berlin, London, Prague and Paris. For more details, please refer to the website above.

Additional events may be organised as part of conferences already planned.

These workshops will permit an open exchange of views. Presentations prepared by the Commission/European Space Agency joint Task Force will launch and structure the debates.

European Commission

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