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WHITE PAPER

Space: a new European frontier for an expanding Union

An action plan for implementing the European Space policy

(presented by the Commission)

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TABLE OF CONTENTS

WHITE PAPER Space: a new European frontier for an expanding Union An action plan for implementing the European Space policy.....	1
WHITE PAPER Space: a new European frontier for an expanding Union An action plan for implementing the European Space policy.....	2
Foreword	5
1. INTRODUCTION: A new approach to Space policy.....	6
2. Space contributions to policy challenges	8
3. Space actions in support of the enlarged Union.....	11
3.1. Deploy a European asset for satellite navigation, timing and positioning.....	11
3.2. Global monitoring for the environment and security.....	12
3.3. Bridging the "digital divide"	15
3.4. Space as a contribution to the CFSP, the ESDP and to the anticipation and monitoring of humanitarian crises.	17
3.5. Develop international partnerships	19
4. Extending and strengthening Space policy: keys to success.....	23
4.1. Secure strategic independence and common assets for common actions	24
4.1.1. Guarantee independent access to space.....	24
4.1.2. Enhance space technology to meet future needs.....	26
4.1.3. Promote space exploration	28
4.1.4. Encourage more science and technology careers.....	29
4.2. Strengthen European excellence in space science	30
4.2.1. Boost efforts in sciences of the Universe.....	31
4.2.2. Stimulate Earth sciences	31
4.2.3. Support life and physical sciences in space	31

4.2.4.	Facilitate the exploitation of scientific data	32
4.3.	Creating the right environment for innovation and competitiveness	32
5.	Governance and resources.....	36
5.1.	Establish a new approach to the governance of space activities.....	36
5.2.	Match ambitions and resources	38
	CONCLUSIONS.....	40
	ANNEX 1 EUROPEAN SPACE PROGRAMME (<i>framing the White Paper Action Plan</i>)	
	First sketch	41
	ANNEX 2 RESOURCES ASSESSMENT	46
	ANNEX 3 GREEN PAPER CONSULTATION PROCESS: MAIN MESSAGES	52
	ANNEX 4 GLOSSARY	60

Space: a new frontier for an expanding Union

Executive Summary

Building on the successful Green Paper consultation on options for European activities in space, the Commission proposes in this White Paper the implementation of an extended European Space Policy to support the achievement of the European Union's policy goals. The following aspects are developed:

Europe needs an extended space policy, driven by demand, able to exploit the special benefits space technologies can deliver in support of the Union's policies and objectives: faster economic growth, job creation and industrial competitiveness, enlargement and cohesion, sustainable development and security and defence.

*The European Space Agency (ESA), EU and ESA Member States with their national space agencies, research centres, and industry all deserve credit for having established Europe as a key player in space. **This White Paper is a call to action to these partners, including the space industry, to mobilise behind new goals and to rise to new challenges.***

*European Space Policy will be implemented within a **multi-annual European Space Programme** which will be the mechanism for determining priorities, setting objectives, allocating roles and responsibilities and framing annual budgets. Its scope must embrace R&D, infrastructure development, services and technology and it should be reviewed and updated regularly.*

*The policy will require an **increase in overall expenditure to develop and deploy applications and to support the research and development, technology and infrastructures.** In the context of its future Financial Perspectives, the Union should consider adding resources to be allocated in response to the needs of EU policies.*

*If Europe does not adopt the proposed **approach to space policy**, it will decline as a "space power" because of an inability to develop new technologies and sustain applications with serious consequent damage to its overall competitiveness.*

*Europe already possesses many of the capabilities needed to develop the **services and applications that will support EU policies.** It has deployed operational communication and meteorological systems and has adopted an ambitious programme for satellite navigation, timing and positioning (GALILEO) and will present in January 2004 its plan for implementing global monitoring and earth observation system (Global Monitoring for the Environment and Security: GMES). In addition to supporting a wide range of civil policies, space systems can also provide direct contributions to the Union's Common Foreign and Security Policy and its European Security and Defence Policy.*

International co-operation offers good opportunities for building Europe's strength in space technologies and applications through partnerships with the US, Russia and emerging "space nations".

*Implementation of a European Space Policy would come in **two phases**: the first (2004-2007) will consist of implementing the activities covered by the recently agreed Framework Agreement between the European Community and ESA; and the second (2007 onwards) will start after the coming into force of the European Constitutional Treaty which is expected to establish space as a shared competence between the Union and its Member States.*

FOREWORD

This is an important moment in the history of Europe. With the future Constitutional Treaty now under discussion the Union will enter a new and more political phase aiming at a closer relationship with its citizens.

This is also an important moment in the history of Europe's activities in space. The time has come to place them on the Union's political agenda at the heart of the European construction process by putting space applications linked to inspirational goals at the service of the enlarged Europe and of its citizens.

After 40 years of solid European achievement in the development of space sciences, technologies and applications, the Commission proposes in this White Paper to make a qualitative leap forward in the continent's ambitions for, and organisation of, this key sector.

The Commission is convinced of the essential support that space technologies can bring to the Union's policies and objectives and also of their tremendous social, economic, and commercial potential. It recommends: (i) putting additional efforts into a variety of space infrastructures and applications, which will make unique contributions to satisfy the needs of the citizens and to respond to the Union's political objectives, (ii) consolidating the existing scientific and technical basis of space activities. It also urges a change of the governance paradigm so as to give the Union new responsibilities for driving, funding and co-ordinating activities within an extended Space Policy.

The European Space Agency (ESA), Member States and their national space agencies, research centres, together with industry, all deserve the credit for having established Europe as a key player in space. The White Paper is a call to action to these stakeholders to mobilise behind new ambitious goals. It also seeks to spur the European space industry to rise to new challenges. The policy objective is a more secure and predictable framework that will help companies to plan and invest and to build larger share of commercial and institutional markets.

These proposals, which are based on detailed analysis, take into account the outcome of the intensive consultations carried out on the issues raised in the Green Paper on Space Policy published in January 2003. Separate conferences and workshops were organised in ten European capitals and the Commission is grateful to those who sent in the several hundred submissions.

There is a strong will in Europe to put our scientific talents, our technologies and our entrepreneurial skills in the space sector at the service of Europe and its citizens. This White Paper explains why we should do so and how we should do it. On some of the issues addressed, precise conclusions cannot yet be identified, but mechanisms and milestones to pursue them are set.

The White Paper aims to become a point of reference: it provides an Action Plan ("European Space Programme") including a list of recommended actions for the implementation of the European Space Policy. Its success will be measured by the benefits the European Union, its citizens and the space sector derive from this endeavour.

1. INTRODUCTION: A NEW APPROACH TO SPACE POLICY IN EUROPE

Space can support the Union's key policy goals

Europe has equipped itself as a space player over the past 40 years with a wide range of capabilities in rocket launch, satellite technologies, space sciences and applications and user services. This is an impressive achievement.

Although an EU common policy for space will have to await a Treaty amendment, this White Paper considers that key elements of an extended space policy must be put in place at the Union level, ahead of the entry into force of the Constitutional Treaty which, assuming that the Intergovernmental Conference will not alter the conclusions of the European Convention, will enumerate space policy among the competencies the Union shares with its Member States. A number of legal bases can already be invoked which enable existing EU policies to call upon to space as a relevant technology to support their implementation.¹

Until now, several European countries have been pursuing their national goals while also benefiting from a European dimension derived from pooling most of their efforts within the framework of the European Space Agency (ESA).

This White Paper seeks to build on past successes and existing competencies at all levels in order to achieve more cost-effective support for European Union policies and objectives from space technologies, infrastructures and services than is currently being delivered. The political framework of the Union is the only adequate one to provide the appropriate conditions to reap the benefits of an extended policy.

These benefits will emerge through the valuable contributions space technologies and applications will make to:

- **economic growth, job creation and industrial competitiveness**
- **a successful enlargement of the Union**
- **sustainable development**
- **a stronger security and defence for all**
- **fighting poverty and aiding development**

The Commission's recommendations require all stakeholders to work and combine successfully behind a common vision. One of its ingredients should be confidence that the **space policy will help Europe be a better neighbour and a respected global partner**. The Union will be better able to act in defence of its core values of democracy, respect for the rule of law, sustainable development and maintenance of peace and order through dialogue and diplomacy.

In addition, the Union will be more strongly equipped as a global leader in the political, economic and scientific spheres. By investing in the right domains and in effective programmes, **an extended space policy will help raise the Union's political standing in the**

¹ Cf. Articles 70, 154, 157, 163 to 173 of the Treaty of the European Communities

world, sharpen its economic competitiveness and enhance its reputation for scientific excellence. Europe's enthusiasm for international co-operation in space activities means that many of the benefits of space policy can be shared with mankind in general.

Finally, good progress in the economic, social and scientific development of the new Member States must feature prominently in any vision of the Union's future. **An extended space policy can accelerate their climb to higher levels of prosperity and social and cultural achievement.**

Standing still is not an option

This White Paper is not about trying to build Europe's prestige on new foundations. It is about the need to secure new infrastructures and services and to open up new opportunities. Its ambitions are practical and realistic and expenditure must match ambition.

A broader, cost-effective space policy will need an increase in overall expenditure in the medium and long term. Redistributing current budgets will not take us forward. This is not a proposal to climb steadily towards United States' levels of spending – more than seven times higher per capita than in Europe – but to develop concrete actions designed to respond to concrete needs and to deliver genuine benefits, with a progressive increase of budget to match.

Doing nothing will leave Europe vulnerable to two real dangers:

- decline of its capacities as a key spaceplayer, if its growth does not keep pace with the global evolution in the space sector. Ability to develop and sustain new technologies and applications could be jeopardised.
- decline of its leading space companies because of weak commercial markets and lack of public investment in new programmes.

In this White Paper

Section 2 gives a broad account of the applications and technologies that can be matched to the Union's chief policy challenges. Section 3 outlines specific activities that are under development to support key EU policies and objectives. Section 4 recommends detailed actions for securing and building upon Europe's current scientific and technological capabilities and for strengthening its space industry which are prerequisites for realising applications in support of EU policy objectives. Section 5 outlines some necessary changes in the governance and financing of Europe's space activities.

Annex 1 presents a first outline of a possible European Space Programme and a roadmap derived from the recommendations detailed in this White Paper. A first analysis of the resources required for its implementation is provided in Annex 2. Annex 3 summarises the main outcome of the consultation process. A glossary is provided in Annex 4.

2. SPACE CONTRIBUTIONS TO POLICY CHALLENGES

Put Space in Europe's policy toolbox

If Europe devotes more resources to space and organises its efforts in the right way, it can truly improve the quality of life of its citizens and contribute to economic growth and job creation in the process. Worldwide, the space applications-related market is estimated at €350 billion by 2010.²

However, the actual and potential benefits of space technologies cannot be fully secured under present institutional and budgetary arrangements. These are mainly focused on Research and Development and are not appropriate for an optimal exploitation of space assets.

Failure to derive such benefits would have significant consequences for Europe's economy and its role in the world. As a horizontal policy, space is especially relevant for supporting Europe's economic prospects, agriculture policy goals, levels of employment, its management of the environment and its foreign and security policies.

Space technologies lend themselves well to address questions which are of large-scale and global nature. Space is not the answer to every problem, but it should occupy an important place in Europe's policy toolbox. In the transport and agricultural sectors a number of policy challenges are already being addressed with the help of space technologies.

Some other policy challenges, which have become the Union's objectives following their endorsement by European Councils, are listed below. The Space policy will offer valuable contributions to many of them, at an affordable cost and with greater efficiency.

Policy challenges: Invest in the knowledge economy to strengthen economic growth job creation and competitiveness (the Lisbon strategy) and make a success of enlargement by supporting cohesion and economic, industrial and technological growth throughout all Member States

Space tools: Satellite telecommunications are part of a technology portfolio that may deliver broadband access to the 20% of the EU's population where it cannot be made available in the medium term. It can contribute to closing the "digital divide" with the new Member States and beyond in complement of terrestrial solutions.

- **Policy Challenge: Achieve sustainable development goals**

The European Council in Gothenburg adopted in June 2001 a strategy for sustainable development. The Council noted that its objectives had "the potential to unleash a new wave of technological innovation and investment, generating growth and employment." The Council has asked for the establishment in 2008 of a European capacity for global monitoring for environment and security.

Space tools: Earth observation from space supports sound environmental management and protection by providing basic homogeneous observations with unsurpassed coverage on climate and weather, oceans, fisheries, land and vegetation. Space has enabled a weather

² Euroconsult 2002

prediction over 5 days. A sustainable agricultural model could, as well, benefit from the use of Earth observation tools. Likewise, the control of the applications of the Kyoto protocol will require European independent space capabilities.

- **Policy Challenge: The Union is to assume a larger role in the world through a stronger Common Foreign and Security Policy (CFSP) supported by a European Security and Defence Policy (ESDP)**

In the coming years, the Union will have to achieve the Helsinki goals, encompassing capabilities such as the contact with rapid deployment forces and global intelligence.

Space tools: To be credible and effective, any CFSP and ESDP must be based on autonomous access to reliable global information so as to foster informed decision-making.

Space technologies and infrastructures ensure access to knowledge, information and military capabilities on the ground that can only be available through the capacity to launch, develop and operate satellites providing global communications, positioning and observation systems. At the same time, space-based systems can provide a higher level of security for citizens, allowing, for example, a better enforcement of border and coastal control and identifying humanitarian crises in their early stages.

- **Policy Challenge: Strengthen industrial performance by stepping up R&D and technological innovation, while defining Trans-European Transport Network (TEN - T) priorities**

The European Council has set the objective of raising total R&D spending in the Union from 1.8% to 3% of gross domestic product by 2010. Moving ahead with TEN-T is set to rekindle economic growth. Realising the TEN-T priorities is projecting gains for the Union's economy and society, estimated in the long term at 0.23% growth in GDP.

Space tools:

Space R&D and TEN-T development are also part of a larger value chain which stimulates R&D in other sectors and leads to commercial applications, such as GALILEO, with potentially very large revenues and job creation possibilities. Each euro invested into the space applications generates a turnover of €7-8 due to the development of added-value services.³

- **Policy Challenge: Fight poverty and aid development**

Space tools: The Union is the largest provider of development aid in the world. Space technologies can strengthen its development efforts, and help other countries to develop access to information, raise skills levels and better manage their resources.

In addition to supporting the creation of commercial communication infrastructures, space technologies such as Earth observation and global positioning systems can be employed in a variety of tasks including: protecting soils and managing water resources; monitoring crop development and forecasting food production; providing early warning for flood and fire risk;

³ Euroconsult 2002

monitoring the tropical forest; preventing ground-motion hazards; ensuring coastal and maritime monitoring; forecasting, preventing and managing natural disasters.

3. SPACE ACTIONS IN SUPPORT OF THE ENLARGED UNION

The preceding chapter indicated how space tools can help the Union to realise its policy objectives. In the following pages, flagship initiatives of this space policy are presented. They will need financial support from the Union, ESA and Member States in solid partnership with the private sector.

Each of these initiatives directly or indirectly will improve people's lives. They can also contribute to Europe's security and ability to enhance its positive role in international co-operation. Rolling out the three applications set out below is a key element of the European Growth Initiative goal for boosting investments in networks and knowledge.

3.1. Deploy a European asset for satellite navigation, timing and positioning

The Way Forward

The Challenge

To ensure a globally competitive, independent satellite-based European capability for navigation, timing and positioning that will be financially viable in the long term.

The Opportunity

To provide Europe with a navigation and positioning alternative with strong commercial and job-creation prospects that delivers services of direct benefit to citizens and EU policies.

An innovative and indispensable solution

Proposed by the European Commission in February 1999, the GALILEO international programme for radio navigation by satellite is the first large project jointly funded by the Union and ESA. In May 2003, the two organisations cleared the way for implementation of the development phase of the GALILEO programme.

GALILEO is both an important element of European space policy and an innovative solution to Europe's indispensable requirement for navigation, timing and positioning. It directly contributes to the definition of a new global standard and has several novel characteristics. It is:

- the first major space project launched under the aegis of the EU;
- the first time that the European Union will control such a strategic asset that will be a key element of EU strategic transport infrastructure project;
- a new example of public-private partnership: its development phase is being managed by a Joint Undertaking comprising investors' representatives. Later on, private companies will operate and manage the system under a concession scheme.

GALILEO's constellation of 30 satellites and associated ground stations is designed to provide a set of services on a global basis by 2008. The market outlook is promising: demand for satellite navigation services and derived products around the world is growing at a rapid 25% a year and could reach €275 bn by 2020, in the process creating 100,000 skilled jobs. Accession countries will be offered participation in its management structure.

The use of GALILEO signals from space can be combined with other global positioning systems to provide more robust services. A wide range of categories of applications have been identified in a wide variety of commercial services. They cover areas as diverse as transport, energy, finance, insurance, fisheries, agriculture, environment, geology, science and public works. The system will also serve individual needs – for example, its navigation facilities will help the visually impaired and those in the early stages of Alzheimer's disease.

Recommended Actions

- *selecting a concessionaire for the management of the next phase of the programme after a competitive tendering process managed by the Galileo Joint Undertaking;*
- *negotiating with the private sector, after a competitive tendering process, an overall agreement for undertaking further research activities for innovative applications;*
- *ensuring the availability of regulating and certification procedures as well as mechanisms for collecting revenues.*

3.2. Global monitoring for the environment and security

The Way Forward

The Challenge

To maximise the use of space data in support of sustainable development policies with particular regard to the protection of the environment, the management of resources and the quality of life and security of citizens.

The Opportunity

To derive a wide variety of services to support key environmental policies and foreign and security policy goals.

A versatile tool for broad policy support

At the Gothenburg Summit in June 2001, the European Council called for “establishing by 2008 a European capacity for global monitoring of environment and security”. As a response, the Global Monitoring for the Environment and Security (GMES) was set-up jointly by the European Commission and the European Space Agency as an initiative to provide independent, operational and relevant information in support of a range of policies serving sustainable objectives such as environment, agriculture, fisheries, transport, regional development. It will also support objectives linked to the implementation of a Common Foreign and Security Policy as well as to early warning and rapid damage assessment in natural disasters.

GMES ensures Europe's interest to be an actor on the global scene, relying on independent means for gathering data and information. It answers at the same time the recognition that the design, conduct and evaluation of policies must be based on appropriate knowledge.

Its potential value in relation to the requirements of the common European Security and Defence Policy is currently being assessed.

The importance of space data

Over the past 10-15 years considerable progress has been made in supplying data from satellites. Observation from orbiting satellites presents advantages for monitoring, as they are global tools that can repetitively observe every corner of the Earth and provide global assessments as well as detailed views on specific locations.

Space-borne Earth observation technologies contribute to the objectives of GMES, alongside in situ monitoring capabilities, with which they are integrated by information and communication technologies.

Implementing GMES

The GMES capacity is geared towards the delivery of sustainable services supported by observation systems that may be in space, on the ground, in the air or sea-borne. Its potential and range could be significantly increased through combining with positioning systems and telecommunication satellites.

The implementation of GMES will include a structured dialogue with the users and the construction of a pan European partnership, associating owners and operators of existing or planned observation systems with adequate mechanisms for sharing data and information. In first instance, GMES is about bringing together existing and future users in need of environment and security data, such as environment departments, civil protection authorities. The GMES framework should serve to federate user requirements at a European level, to gather sufficient critical mass and to better use existing infrastructures and systems.

Preparatory activities have been undertaken respectively by the Commission under the Framework Programme for Research and by ESA in the context of the GMES Services Element programme. The EU Council has requested the Commission and ESA to report at the end of the initial period (2001-2003). Drawing lessons from this experience, the Commission will present in January 2004 an Action Plan for the Implementation Period (2004-2008), bringing the EU, ESA, Member States, EUMETSAT and other stakeholders into an overall approach.

GMES has the potential to cover a wide range of policies. However, taking into account political priorities and the state of development of infrastructures, priority should be given to developing services in support of:

Land management to support areas including agricultural policies, sustainable development of crops, early warning for food security, soil protection, management of natural resources, monitoring of bio-diversity, and urban planning.

Ocean monitoring to improve understanding of climate change and to support the sustainable management of resources e.g. fisheries. **Maritime** transport requires adequate surveillance for increased safety and environmental protection.

Atmosphere monitoring to contribute to understanding climate change, analysis of weather events and measurement of pollutants that damage human health. Services will provide real time information on atmospheric chemistry, pollution, aerosols and ozone components.

The management of **water resources** as highlighted at the Johannesburg World Summit on sustainable development in 2002 is an issue for the next decades. Services could support human and agriculture access to clean water.

Risk management is required for natural and industrial hazards that threaten peoples' lives and cause significant damages to infrastructures. Services will include the provision of information on industrial hazards, floods, earthquakes, storms, forest fires, landslides and drought.

Humanitarian aid and security policies need tools for support, through the provision of mapping and decision support for aid and reconstruction, de-mining and development of tools for crisis management and conflict prevention.

These various services will require the use of specific Earth **observation systems**, in particular sensor technologies such as: high- and medium-resolution, optical and radar imagers for land surface, coastal zone and ocean monitoring; advanced optical and microwave sensors for atmospheric composition measurements and advanced active and passive microwave instruments for ocean monitoring.

These systems will complement the necessary ground, air and sea-borne observation systems and will also require in situ components for data validation purposes. Activities to establish the GMES capacity will therefore require the promotion and development of interoperable in situ elements and their links to data collection, data management and communications infrastructure, including satellite communications. Particular attention will have to be paid to the promotion of interoperability between existing systems.

The efficient use of data collected by space, ground, air and sea-borne systems and their integration with socio-economic information will depend also on the availability of co-ordinated data policies and appropriate spatial data infrastructures. This will enable services to find, access, share and trade data and information without unnecessary restrictions.

Recommended actions

- *Within the EC/ESA Framework agreement, the Commission and ESA shall prepare a specific arrangement to provide:*
 - *a management structure bringing together the various GMES stakeholders;*
 - *a roadmap for developing and deploying interoperable GMES observation systems, spatial data infrastructure and services;*
 - *a joint European research and development work plan including scenarios for demonstrator projects under the Framework programme.*
- *The Commission should propose scenarios for the interface between civil and security usage.*

3.3. Bridging the "digital divide"

The Way Forward

The Challenge

To achieve the objectives set out in the eEurope 2005 Action Plan and ensure widespread high speed Internet availability and usage throughout the enlarged European Union.

The Opportunity

To use to the full the potential offered by all available broadband technologies (including satellite communications) to bridge the digital divide.

Satellite technologies do not only allow the achievement of the public policy goals presented in the previous two sections, they also constitute an infrastructure for the delivery of electronic communications services. This market is a commercial one characterised by an intense competition between operators and technologies. In the European Union, electronic communications infrastructures and services are subject to the new regulatory framework, which is based on a technologically neutral approach.

Through its eEurope 2005 Action Plan,⁴ endorsed by the Sevilla European Council in June 2002, the Union has set itself the objective of providing a favourable environment for private investment and for the creation of new jobs, to boost productivity, to modernise public services and to give everyone the opportunity to participate in the global information society. To achieve this objective, widespread availability and usage of broadband and high-speed internet throughout the European Union needs to be established.

Still, a large number of European households living in remote areas – as many as 14 million – do not have a realistic perspective of achieving access to high speed internet before many years. This constitutes a serious obstacle to making the benefits of the information society available to all citizens and firms in the European Union.

The prospects for many of the less developed partners of the EU, especially in Africa, are also a concern. Bridging the digital divide at a global level to ensure that all parts of the world can reap the benefits from the information society is at the heart of the World Summit on the information society that will be held in Geneva in December 2003 and Tunis in 2005.

The EU Member States are committed to putting in place broadband national strategies by the end of 2003; in some, there is a dynamic emerging market for the provision of broadband access in remote and rural areas. However, the picture remains fragmented and it may be difficult for local or regional communities in different countries to consider on their own solutions of more global coverage which could generate broader economies of scale. They should, therefore, be encouraged to compare their needs to see whether common solutions can be shared.

⁴ COM (2002) 263: eEurope 2005: An information society for all

Satellite technologies may constitute appropriate solutions, especially for rural, peripheral and island regions, but their adoption should be based on cost effectiveness. The enlargement of the Union puts these opportunities into a new perspective.

Broadband access can be provided through a variety of networks and platforms such as xDSL offered over telephone lines, cable modem over cable networks, fibre optics, satellites, wireless solutions and powerline communications. These technologies can be substitutes, competing with each other, but also complementing and completing and co-existing with each other according to local geographical needs.

In those areas where the market forces alone do not suffice, public funding whether coming from the Community through the Structural funds or from Member States sources, can be made available provided certain conditions are met. These are described in the guidelines on the use of the Structural funds in support of the deployment of broadband access that the European Commission has released in July 2003.⁵

The resulting technological choice will largely depend on the local conditions and on the needed investment (e.g. some schools may only require funding for the connections to the final user, others may even need it for the backhaul).

Recommended Actions

Within the framework of the mid-term review of the eEurope 2005 Action Plan in early 2004, the European Commission will propose to set up a Forum on the Digital Divide. This Forum will bring together all stakeholders in the area of the Information Society and electronic communications, including the satellite constituency and ESA, and will analyse how to bridge the digital divide. This action will imply among others:

- *defining the public and users' needs to be addressed under a digital divide initiative covering the enlarged Union;*
- *carrying out a cost/benefit analysis of the various technological options including the space-based ones;*
- *assessing how the various options fit within the national strategies to be provided by the EU Member States by the end of 2003;*
- *drawing lessons and identifying best practices from running initiatives.*

The Commission will report on the Forum's outcome in the Summer 2004.

In line with the Forum's work, the Commission should encourage the setting up of innovative, pan-European, large-scale pilot projects.

⁵ SEC (2003) 895: Guidelines on criteria and modalities of implementation of Structural funds in support of electronic communications

3.4. Space as a contribution to the CFSP, the ESDP and to the anticipation and monitoring of humanitarian crises.

The Way Forward

The Challenge

To mobilise EU decision making to reinforce space technologies in support of security and defence policy requirements.

The Opportunity

To supplement existing space-based capabilities in Europe and examine new ones needed for establishing a credible security capability with high EU added value.

Space has a security dimension and security has a space dimension

Space technology, infrastructure and services are an essential support to one of the most rapidly evolving EU policies – the Common Foreign and Security Policy (CFSP) including European Security and Defence Policy (ESDP). Most space systems are inherently capable of multiple use and the credibility of the above policies will be significantly strengthened by taking better advantage of space applications.

ESDP needs access to suitable space-based systems and services, both because of their strategic capabilities and because they confer a capacity for autonomous decision-making. Nowadays, most of the information used at the EU level comes from satellites operated in national or bilateral or intergovernmental frameworks. It is essential to guarantee access in the long term to strategic information for collective use by EU Member States by supporting space infrastructures.

Space-based assets can deliver a higher level of security for citizens, especially in an enlarged Union. Their powers of surveillance allow for a better enforcement of border and coastal restrictions and, therefore, more effective controls on illegal immigration and trafficking. They can also enhance conflict prevention by keeping a close watch on potential security threats and identifying humanitarian crises in their early stages.

The European Union Military Committee has clearly stated that space assets can be efficient tools for crisis management operations. For its part, the EU Political and Security Committee has recommended further reflection on how to ensure that security and defence aspects are taken into account in the determination of EU space policy and its programmes.

It is obvious that security and military users have special requirements and protocols will have to be established to reconcile military and civil use of multiple-use assets. This will have to take into account, for example, the military requirement to retain control of exclusive access to certain categories of information, with a real-time capacity for reaction.

No single Member State will ever have the means to develop and support the full range of the necessary capabilities and better value for money could be achieved by various forms of co-operation at the EU level. Approaches should be developed to ensure dual use of space assets in function of user requirements defined at a European level. In addition to telecoms and

observation satellites already used for security purposes, further developments are needed in the field of global monitoring, positioning, navigation and timing and communication, signal intelligence, early warning and space surveillance, to meet the security objectives of the EU and of its Member States.

With regard to Global Monitoring, a large part of the observation requirements stemming from security and defence needs are planned to be fulfilled by the services that will be delivered through GMES. The expected benefits are the development of tools to support:

- *monitoring of compliance with Treaties;*
- *surveillance of borders;*
- *surveillance of critical sites and installations;*
- *anticipation and monitoring of humanitarian crises.*

The EU should establish the organisation necessary for the GMES services to meet the Union's collective requirements for imagery and mapping for security, taking into account existing structures.

Overall, GMES could contribute to humanitarian and rescue tasks, peacekeeping and supporting combat forces in crisis management tasks including peacemaking.

The multinational military initiative, "Common Operational Requirements for a European Global Satellite System" to which six EU countries have subscribed, describes the common operational specifications needed to develop a military global satellite observation system. This agreement, which needs to be extended to other EU Member States, represents a useful instrument for defining a European approach vis-à-vis ground segment and infrastructure.

With regard to signals intelligence, early warning and space surveillance, and in order to build up over the long term a comprehensive EU space-based security capability, Europe will also need developments of systems and services in the fields of:

- *signals intelligence required to monitor electromagnetic activities;*
- *early detection of activities leading to missiles proliferation;*
- *space surveillance allowing the EU an autonomous capacity to detect and identify space objects.*

A specific effort might also be needed to ensure that Europe has the capacity to supply to the different users critical information on solar flares, near Earth objects, space debris, ("space weather" prediction).

A great deal of assessment is still needed about the capabilities and role of space policy in support of defence and security. The Commission, for its part, is prepared to contribute to an overall assessment of existing capacities and future requirements and identification of the additional investments needed for the development of a comprehensive EU space-based defence and security capability.

Recommended Actions

- *The Commission and Member States to establish a report, through an EU dedicated working group composed of relevant representatives drawn from EU, Member States, ESA and space organisations regrouping civil and military space users, at the end of 2004 on:*
 - *the current EU needs for multiple-use capabilities needs;*
 - *the link with the European Armaments Research and Capabilities Agency (currently under definition);*
 - *the organisation of access to imagery taking into account work on the way in the European Capability Action Plan;*
 - *the potential role of the EU Satellite Centre and the role of ESA.*
- *The Commission to ensure its preparatory action on security research is launched early in 2004.*

3.5. Develop international partnerships

The Way Forward

The Challenge

To forge international partnerships that will serve European space policy objectives in support of EU policies across a broad spectrum.

The Opportunity

To weigh up, in the context of the existing political agreements, the benefits of establishing a strategic partnership with Russia, of maintaining and developing Europe's long-standing partnership with the United States, and of exploiting other emerging possibilities of co-operation with new "space powers" such as Brazil, China, India, Japan and Ukraine.

Basic orientations

Space is a privileged instrument for developing international co-operations. Exploration and use of space, by nature, are global ventures. Numerous collaborations have been built up in many fields of space activity. Strong European capabilities in space technologies and applications are essential prerequisites for ensuring balanced and successful international partnerships.

International co-operation within a European space policy is not simply a matter of scientific collaboration on technologies and applications. It should be in function of serving the widest-possible spectrum of the EU's objectives including economic and social development, protection of the environment, education, health, science, technology and security.

Areas for Co-operation

Existing areas of co-operation such as human spaceflight, solar system exploration, space and Earth sciences could be extended into new fields of applications for improving infrastructures, social development and security in their broadest sense. These would include satellite telecommunications, Earth observation and navigation. During the Green Paper process expressions of interest were received from a number of countries.

Partnerships

Partnerships are based on common values to meet common challenges. They can be essential for achieving policy goals. Three main strands of co-operation can be pursued:

- **Co-operation with “space powers”** especially in areas where Europe is unlikely to achieve its goal by acting alone. These collaborations would be coherent with the EU Member States’ and ESA’s bilateral activities with third parties.

The long-standing space partnership with the United States is a valuable one. Although the US space policy aims at establishing US space dominance, this partnership could be further deepened in a number of areas including space science, human spaceflight and sustainable development. However, the possibilities may well be altered by the ongoing revision of US space policy involving fundamental questions to do with the future of space access systems and human spaceflight. Many of these questions should be answered by the end of 2003.

Recognising Russia’s outstanding experience and capabilities in the space sector, Europe should extend current areas of co-operation, which include joint research and development in the field of launcher technology, and build a new strategic and long-range partnership with the Russian Federation. This would have to be based on clear long-term commitments and should build on the framework of the existing Partnership and Co-operation Agreement.

The most recent fruit of Europe’s space co-operation with Russia is the agreement that will bring the medium-class launcher Soyuz to the Guyana Space Centre from 2006. Set up and maintained jointly by ESA and the French government, the Centre already accommodates Ariane 5 infrastructure (owned by ESA) and provides range facilities and systems funded by the French space agency, CNES. Since the Soyuz infrastructure is crucial for collaboration with Russia, it could be appropriate for the Union to cover a share of the relevant costs of the Space Centre.

A diversified approach to co-operation needs to be a key element in Europe’s policy so as to maximise benefits and minimise risks. Candidates for co-operation among other established or emerging space powers are the People’s Republic of China, India and Japan. Ukraine deserves particular attention as a country with a recognised space sector covered by the EU’s Wider Europe policy initiative.

China in particular will emerge as a major space player, mastering the full range of space technologies and is likely to generate the world’s largest demand for space infrastructures, which partly explains its recent commitment to the GALILEO programme. In addition, the number of nations using satellites for peaceful purposes is growing and space co-operation should be on the agenda of bilateral discussions between them and the Union.

- **Linking up new Member States and neighbouring regions**

This co-operation must embrace as a matter of priority those countries about to join the Union and those with whom the Union is promoting a range of neighbourhood policies, notably the “Wider Europe” approach to relations with eastern and southern neighbours and the related Barcelona initiative with countries of North Africa and the Middle East. Both frameworks offer scope for using space applications in support of economic and social development and environmental protection.

- **Co-operation with developing countries**

The benefits of space should also be made available to developing countries. Applications such as Earth observation and telecommunication could help them down the path of sustainable economic and social development. In this context, the EU should examine potential co-operation frameworks with international development banks and UN agencies in order to identify where space assets can best support a developing country’s development strategies and to implement such initiatives in a globally comprehensive and efficient manner. Africa will be considered as one of the geographical priorities in the context of Johannesburg Action plan.

Acting in the Wider International Dimension

The strength of Europe’s capabilities is increasingly enabling it to act as a key space player at the global level. The EU will have to take responsibility for defining and representing the external dimension of the European space programme.

At the Earth Observation Summit in Washington in July 2003, Europe offered to co-operate with participating states and international organisations to develop a 10-year strategy to improve and sustain global Earth observation systems. This followed on from the Johannesburg Summit in 2002 and the G-8 Evian Summit in 2003 which recognised the role of Earth observation and the use of satellite technology for monitoring the atmosphere, land and oceans to produce high-quality data for dissemination to all, particularly the developing countries.

The strategy for Earth observation being defined by the GMES initiative should serve as a basis for co-operation in support of the commitments Europe has made in these global fora. Furthermore, Europe is well placed to significantly contribute to global climate observing systems for which space represents a crucial technology.

Lastly, through its membership of international organisations such as in the United Nations, the EU should participate in initiatives relevant to its space objectives and ensure an appropriate contribution to the development of new global rules and standards.

Recommended Actions

- *The European Commission should develop, benefiting from its collaboration with ESA, a Strategy for international space co-operation for the next decade with particular emphasis on supporting the EU’s CFSP and sustainable development strategies; an international conference on space should be organised before the end of 2004;*

- *The EU should maintain and develop its long-standing partnership with the US and build a strategic partnership with the Russian Federation (including the support for Soyuz at the Guyane Space Centre); it should also contribute to provide a better information to policy makers in the developing countries.*

4. EXTENDING AND STRENGTHENING SPACE POLICY: KEYS TO SUCCESS

Secure the future

Europe's list of achievements in space sciences and applications, largely delivered through collaboration in the European Space Agency and also through national efforts, have established the continent as a competitive actor in many public and commercial markets.

Europe enjoys the means to pursue its own space activities in the field of launchers, satellites, space sciences and applications. In addition, it has deployed operational communication systems, has adopted ambitious programmes for satellite navigation, timing and positioning and for earth observation and global monitoring. This base is today relying upon public investment, mostly national R&D budgets, and commercial resources derived from launchers services and telecommunication satellites sales.

But space policy has to look forwards not backwards. New competitors are aiming for strategic positions in space: China is already a force in satellite launchers and has recently successfully accomplished its first human spaceflight. Brazil and India are about to enter the launcher market. Moreover, the commercial market is well below previous levels and increasingly competitive.

EU enlargement and the European construction process are generating new needs and demands for space systems. Europe has, therefore, to consolidate the fundamental elements on which a space policy depends for its implementation: access to space, the scientific and technology base and industrial capabilities. This chapter outlines specific recommendations for achieving this goal.

Much of the European space industry's potential growth lies in implementation of the EU's policies. The need for the development and exploitation of new space infrastructures and exploitation of existing and new space systems will benefit the overall European space community, and would lay the ground for a competitive and advanced industry able to supply the applications and services for helping to deliver many of the Union's top policy priorities and to be successful on commercial markets.

4.1. Secure strategic independence and common assets for common actions

4.1.1. Guarantee independent access to space

The Way Forward

The Challenge

To achieve independent access to space on an affordable basis.

The Opportunity

Space programmes and services that raise the effectiveness of EU policies and strengthen economic performance and the quality of life of the citizen.

Sustained and affordable access to space

The strategic pre-requisite to implement any space policy in the Union is that the EU must have and maintain independent access to space.

This independence must be sustained on an affordable basis, investments in this field having long lead times. An essential counterpart to public funding is that European manufacturers of launchers must operate competitively and profitably in commercial markets, not least because of the limited volume of institutional launches and the need for a sufficient rate to maintain reliable levels of performance.

Europe's Ariane family of launchers has a good record in operating competitively and successfully in favourable market conditions. However, the lack of institutional demand and the recent, severe downturn in commercial demand, coupled with extremely aggressive pricing by competitors, has put the Ariane system under enormous strain, highlighting in the process its very high dependence on purely commercial business.

US competitors, by contrast, have been consistently supported by a large institutional market and a strict preferential policy of flying government missions only on US-made launchers. This difference of approach is a concern for European authorities.

The European Guaranteed Access to Space (EGAS) programme 2005-2009 recently adopted by ESA Member States in May 2003, is an exceptional measure to provide both a short term recovery for Arianespace and medium term support, in order for the European launcher industry to be competitive by the end of the programme. It highlights the conditions to be met for the long-term stability of this European strategic asset.

In order to assure Europe's long-term independent access to space, sustained government commitment and funding are needed for:

- **Launcher design and development**

ESA is the lead agency for launch vehicle and infrastructure development with national space agencies providing technical support. The heavy-lift Ariane-5 launcher, capable of the most demanding institutional and commercial missions and relying on European technology, is the platform for maintaining Europe's independence as regards access to space.

Launcher development is never static and the business is a risky one. To remain a competitive presence on global launcher markets, Ariane-5 needs constant improvement in performance, reliability and cost through a steady process of new development and technical upgrading. This effort is also vital for retaining critical levels of expertise in the industry.

Europe's range of launcher products is being strengthened by the development of the small-class Vega launcher and by a recent agreement that will bring the medium-class Russian-built Soyuz to the Guyana Space Centre (CSG) from 2006. Both will add greater flexibility and responsiveness to Europe's launch services, in particular for smaller institutional missions.

- **Infrastructure maintenance and upkeep**

As explained above in chapter 3.5, the European launch base in French Guyana has been set up and maintained jointly by ESA and the French government. As the launching state France also assumes the relevant international responsibilities.

While the ESA-CNES range complex has been consistently funded since the early days of the Ariane programme, financial support for the dedicated Ariane-5 launch facilities has been more irregular. The EGAS programme represents an effort to maintain key Ariane-5 assets both in French Guyana and in continental Europe through selected fixed costs funding over the medium-term (2005-2009). This form of government commitment to carrying fixed costs has been used in the US and Russia for no less than four decades and is likely to continue.

Maintenance and upkeep of both the Ariane-5 production facility and the Guyana Space Centre are critical to assured European access to space. These infrastructures must be considered as projects of common European interest and funded accordingly.

- **Launcher technology research and development**

The ESA Future Launchers Preparatory Programme prepares for mid-term evolutions of existing launch systems and for a decision around 2010 on the next generation of European launchers. It does not, however, cover basic launcher, reusable launch vehicle and propulsion technology research, which remains dispersed among national and ESA programmes and not properly funded. Establishing an integrated European approach and restoring an adequate level of effort in the preparation of a new generation launch vehicle is the most promising and affordable way to ensure the long-term competitiveness and reliability of European access to space.

Recommended Actions

- *EU to express a firm commitment to independent, reliable and affordable access to space and establish guidelines encouraging the use of European launchers by European institutional customers;*
- *EU to develop and negotiate a worldwide harmonised regulatory framework governing procurement and competition;*
- *ESA to remain the lead agency for launcher development while the EU should commit funding for sustaining operational ground infrastructure as an area of common European interest complementing a coherent European launcher initiative (notably in view of a strategic partnership with Russia).*

4.1.2. Enhance space technology to meet future needs

The Way Forward

The Challenge

To optimise and co-ordinate the use of R&D resources to close technology gaps jeopardising Europe's independence and worldwide competitiveness.

The Opportunity

Much improved exploitation of European sources of space technologies in support of EU policies (including security).

Europe needs to be better equipped

Europe needs a broad technological base if it is to be capable of acting independently in space and sustain a space industry that is competitive in global markets. Public support for R&D in space technologies is imperative because of the high costs and risks involved, and the comparatively low returns from commercial and institutional markets.

Thanks to the investments of Member States through ESA, the EU and national agencies and research organisations, Europe has access to a solid technological and industrial base, mastering most of the critical technologies.

However, the mechanisms driving the technology in support of short-term competitiveness are different from those driving technology for strategic independence and longer-term preparation. Europe is not as well equipped for this as it needs to be:

- *Europe depends on others for some critical space components (e.g. radiation-hardened components, etc.). It is at the mercy of stringent US export-control regulations;*
- *There are gaps in its development of future technologies mainly caused by inadequate funding. A number of technological breakthroughs must be targeted, such as new propulsion techniques - which could induce radical changes for space transportation systems - and nanotechnologies;*
- *Europe's limited commitment to defence-related space activities leads to technological deficiencies due to insufficient investments in some areas.*

Technology dependence may limit the capabilities of European industry to respond to the challenges inherent in supporting EU policies and competing in commercial markets, in particular in the field of security and defence.

Autonomy and independence can be served by a joint effort between the EU, ESA, national agencies and industry. In their definition and development, space technologies have to anticipate future needs if they are to deliver applications and services in a timely fashion for the Union and for the market.

Timely delivery requires continuous dialogue and co-ordination between technology providers and users and the full exploitation of the dual-use nature of space technology through joint civil and defence technology R&D, to the benefit of an expanding institutional market.

In order to address the challenges and to ensure the coherence of continued investment, Europe has recently established a set of technology foresight and harmonisation processes for co-ordinating all players - ESA, the EU and national agencies and research organisations as well as industry.

These activities are organised in the framework of the European Space Technology Master Plan (ESTMP). They identify next-generation space technology requirements, the corresponding gaps and unwanted overlaps in current assets, establish priorities for the actions that are needed and lines up the players committed to developing these technologies.

ESTMP will also allow new EU Member States to plan and develop their competencies and to participate, with institutional support, in joint research activities.

European resources can be used more efficiently and synergies maximised across the whole value chain if this process is opened up to international co-operation, expanded to both civil and defence related R&D, and if links to applications and services are included. Promotion of technology transfer will further leverage the investment made in space R&D.

But this alone will not be a sufficient response to the increasing budgets other space nations are allocating nor to rising competitive pressures.

Recommended Actions

- *EU should reinforce total public spending on technology in accordance with the European Space Technology Master Plan with special attention to applications and multiple-use technologies;*
- *The Commission and ESA should promote transfers of technologies;*
- *New EU Member States should be associated with the overall harmonisation actions.*

4.1.3. Promote space exploration

The Way Forward

The Challenge

To push forward the boundaries of human capabilities, explore beyond the limits of today's knowledge and inspire the coming generation.

The Opportunity

To prepare Europe for a possible contribution to future exploration of the solar system to be performed in an international context.

Exploration of the solar system: What scenario?

Solar system exploration and human spaceflight catch the public eye. Astronauts are subjects of admiration and fascination because they are courageous symbols of mankind's deeply rooted desire to extend the boundaries of knowledge and experience.

Human spaceflight and space exploration emerged as a special issue from the consultation process on the Green Paper. The European Parliament's report on the Green Paper was also broadly positive. There are balanced arguments as to whether Europe should contribute to exploration of the solar system with its own human spaceflight capability or whether it should concentrate more on automated exploration.

The Commission and the Member States need to take the initiative in organising a consultation at high level with key actors of different disciplines to develop a scenario able to stimulate the public opinion's interest. The Aurora long-term vision as currently under definition by ESA for solar-system exploration will have to be taken into account and properly supported.

The role of the International Space Station

Europe has been sending astronauts into space for some years, but not on its own launchers. There is a body of work and achievement upon which it could build if it opted for a spaceflight programme. Europe has its own Astronaut Corps, created by ESA, and several of its members have travelled to the International Space Station (ISS), which is an orbital outpost.

The ISS is the first major cooperative undertaking (involving the US, Russia, Europe, Canada and Japan) since the cold war, based on operating joint scientific programmes and sharing technologies. Even though the project is behind schedule and has not yet fully lived up to expectations, Europe is strategically committed to the ISS following a decision of the ESA Ministerial Council in 1995.

Contributing to the ISS permits the development of system engineering and mission control capabilities in space while also offering experience of long stays in space and the opportunities to counter their debilitating effect on humans. As such, the ISS is also a precursor to the future exploration of our solar system, possibly to the Moon and Mars. This is an asset for Europe, in particular the European Columbus laboratory module, the utilisation of which should be opened to all European countries.

However, Europe is critically dependent on the US and Russia for the full exploitation and utilisation of the ISS, and particularly for transporting astronauts to and from the Station. In the field of human spaceflight, the future European Space Centre-based Soyuz launcher could give a potential additional capacity to Europeans. Over the next 10 years a series of European-designed and built automated transfer vehicles will be launched on Ariane 5 to carry materials to the ISS.

Recommended Actions

- *The Commission to solicit a wise men group to deliver within 12 months a vision for space exploration as a basis for ESA to examine the potential feasibility, costs and opportunity for Europe to participate in the exploration of the solar system by mankind;*
- *Consistent with the outcome of the previous recommendation, the European Union with ESA to assess and ensure the availability of core capabilities and know-how in Europe which are indispensable for the preparation of human spaceflights activities and exploration. Continue the exploitation of the ISS as a common infrastructure, were possible, also in the context of the 6th Framework Programme.*

4.1.4. *Encourage more science and technology careers*

The Way Forward

The Challenge

To rejuvenate an ageing scientific population by increasing the flow of young scientists and engineers into the space sector.

The Opportunity

To use space policy to contribute effectively to current efforts to increase recruitment into technical and scientific training (part of the European Research Area strategy).

Young talents needed

The right sort of human capital is critical for achieving Europe’s ambitions in space. But its supply is far from assured given the declining interest in scientific studies across the continent which, in the space sector, is resulting in an ageing community of scientists and a lack of young talents. The highly motivated generation that started its career in space during the 60s is now retiring, while the number of under-30s in Europe’s space science and technical community is sharply decreasing. There is now a serious risk of losing precious competencies and know-how. The US is encountering similar problems, and this has led NASA to spend about \$160M a year on educational programs.

Shortages of researchers in science and technology pose a serious challenge for the Union. In recent Communications, the Commission has underlined the need to increase recruitment into technical and scientific training as an important element of its strategy for building a European Research Area (ERA).

By its very nature, space offers an international working environment and needs a mobile workforce to ensure its supply of scientists and engineers. In its ERA implementation strategy, the EU has proposed a wide range of measures aimed at facilitating the mobility of researchers and at raising the extra attractiveness of scientific careers that need to be applied across a broad range of policies at both European and national levels.

Recommended Actions

The European Commission, with the technical support of ESA, should build up an education and promotion action for young Europeans and students to be composed of:

- *actions to include space themes in school- and university studies;*
- *an overall promotion of careers in space science;*
- *measures to make the best use of mobility programmes (i.e. Marie Curie);*
- *targeted media campaigns to improve people's understanding of space.*

4.2. Strengthen European excellence in space science

The Way Forward

The Challenge

To enhance European leadership in space sciences and its ability to develop capabilities in support of EU policies.

The Opportunity

To strengthen Europe's knowledge-based society through cutting edge research into the Universe, Earth systems and life and physical sciences.

Safeguarding excellence

Space research is science conducted in, on and from space. It not only provides far-reaching insights into the structure of the universe, improved understanding of Planet Earth, and a new approach to life and physical sciences, it is also a strong driving force for new technology developments with many subsequent applications of benefit to society and the environment.

Space research has demonstrated an ability to attract young people into professions that strengthen Europe's technological capabilities across the board. It leads, by excellence, in the field of international space co-operation and is essential to Europe's identity and leadership as a knowledge-based society.

ESA is the lead agency in Europe for space research programme definition, technology and system development, and in-orbit operations. Together with national agencies, scientific institutes and industry, it has striven for efficiency and competitiveness within the limits of a global budget for space research sciences that is only one sixth of the US equivalent.

Major successful space research missions under European leadership have placed the European science community and industry at the forefront and created a strong position from which to negotiate co-operative projects with international partners. But confronted with the challenge of responding to an increasing demand for applications, more efforts are needed to enhance scientific knowledge and to develop innovative technologies.

4.2.1. Boost efforts in sciences of the Universe

Europe's stature on the world scene in sciences of the Universe has been established through strict reliance on scientific merit for project selection, ESA's careful planning and associated GNP-related funding by its Member States. However, this funding has been continuously eroded over the last decade. In addition, Member States have found it increasingly difficult to fund on a national basis more and more complex scientific payloads.

This budgetary pressure has now reached the point where it is beginning to disrupt the careful balance between disciplines and missions of different size. A progressive increase in funding would yield a high return on investment by optimising the industrial development costs of future large-scale satellites, while providing the required short-term flexibility for new small missions and satellites. A corrective action in this direction is urgently needed.

4.2.2. Stimulate Earth sciences

Observation of the Earth from space is a striking example of the continuous link and strong synergy existing between upstream research missions and operational applications. As clearly illustrated by EUMETSAT in the case of space meteorology, new instrument concepts must be experimented in orbit before their integration into a future operational application. At the same time, the Earth sciences research community consistently relies on operational systems for continuous and homogeneous access to data.

ESA's Envelope Programme, dedicated to the basic understanding of Earth's processes through a family of explorers, constitutes an appropriate effort to structure the research in this field. It remains, however, poorly funded and can only support the early scientific use of Earth observation data. This endangers the existence of future European operational capabilities without which the basis for environmental policy decisions would be weak unless dependence on US capabilities was increased.

Europe needs a sustained European programme to study the Earth from space, with an adequate level of funding and long-term stability, enabling the proper exploitation of space data by the science community.

4.2.3. Support life and physical sciences in space

Predominantly carried out on the International Space Station (ISS), the European space research programme in life and physical sciences addresses fundamental questions and has the potential to produce useful applications on Earth, while laying the foundation for future human planetary exploration.

However it faces two limitations: adequate support is lacking for the ground-based activities which complement the space experiments, from preparatory research to downstream applications; and the implementation of the programme on the ISS is severely limited by a small share of ISS resources (5%) and limitations on ISS operations under the current NASA plans.

4.2.4. *Facilitate the exploitation of scientific data*

Space science data represent a significant long-term investment. They have to remain affordable and accessible over a period extending well beyond the nominal lifetime of the missions. There is a need to develop and sustain new infrastructures – thematic centres and networks – for long term archiving and distribution of European space data. This infrastructure development should allow for integration of space and non-space data archives, a key issue for multidisciplinary work.

Recommended Actions

Progressively increase ESA and national funding for space research: EU and ESA and Member States should jointly review the strategic plan and resources for European space sciences in particular with the objectives of:

- *strengthening upstream R&D;*
- *developing the supporting infrastructure for data acquisition, long-term archiving and dissemination;*
- *supporting the operational exploitation of Earth observation data;*
- *supporting ISS utilisation and fostering technology transfer to non-space applications.*

4.3. Creating the right environment for innovation and competitiveness

The Way Forward

The Challenge

To establish the basis for a globally competitive and entrepreneurial space industry in Europe.

The Opportunity

A credible space policy that places European industry on the same footing as its competitors and attracts new investment to the sector, so as to encourage consolidation in a way which serves the demand in line with institutional and market needs.

Space activities contribute to employment and competitiveness in many sectors of the economy. However these benefits depend on the existence of an innovative and competitive European space industry.

As part of its call for an integrated strategy for European competitiveness the European Council⁶ has asked for policies to be pursued as to contribute consistently to the goal of enhancing the competitiveness of enterprises and industry.

While industrial policy is horizontal in nature and aimed at securing framework conditions favourable to industrial competitiveness, it needs to take account of the specific needs and characteristics of individual sectors⁷.

In line with this approach to the aerospace sector, a European policy which deals with all aspects of the space business⁸, and fully exploits the specific capabilities of all the institutions involved is essential for the sector's future competitiveness.

Through past institutional programmes and the efforts of companies in the sector, Europe developed leading space capabilities and a world-class industrial capacity in launchers and satellites. However, this position is now threatened by the sharp and sustained downturn in the commercial market whose past growth had allowed European industry to achieve the critical mass needed to maintain and expand capacities and to compete internationally with foreign companies which benefited from much larger, protected, institutional markets.

To overcome these difficulties and maintain a competitive European space industry and the freedom of action which it provides, Europe needs a consolidated industrial and institutional approach to space-related activities in line with the Commission's recent Communication⁹ on a coherent framework for aerospace. This includes the efficient allocation of resources and the elimination of outdated national restrictions on space-based services and a suitably adapted spectrum policy.

In setting out a comprehensive European space policy that takes account of the strategic character of the sector and provides a common framework under which the European industry and the different national and intergovernmental agencies involved can optimise their activities, this White Paper identifies many of the steps which are required to create the most favourable environment possible for industry to preserve and further develop its capabilities.

These should be complemented by a coherent approach to policy internally and externally in order to create a predictable and rational environment for innovation and industrial competitiveness.

Industrial adaptation and attracting investment

The slowdown in the commercial market is forcing the space industry to restructure its operations. Since the European space industry is more dependent than others on the commercial market, it is essential that there are no unnecessary hindrances within Europe to the rationalisation and reshaping needed to make the industrial structure more appropriate to market requirements. Thus, in applying competition policy the particular features of the space industry, such as its dual-use nature, have to be taken into account in individual cases.

If the industry is to be able to attract the necessary investment for the future, it will also need a stable flow of activity generated by a strong institutional market. That implies overcoming

⁶ Meeting of 16-17 October 2003

⁷ COM (2002) 714: Communication on an Industrial Policy in an enlarged Europe

⁸ COM (2003) 600: A coherent framework for aerospace – a response to the STAR 21 report

⁹ COM (2003) 600 final

fragmentation within Europe on defence-related programmes and better co-ordination of civil and defence activities.

However, it is clear that especially in the current economic climate, even the most optimistic view of the possible evolution of public space budgets means that European companies will not benefit from the same scale of institutional market support as their US counterparts.

To develop a stronger institutional market in Europe is likely to mean further recourse to public/private partnerships. In this context, the implementation of GALILEO plays a key role as the first major public/private partnership undertaken at EU level. It will be important to draw the lessons from GALILEO, to help determine the best approach to public/private finance for future space projects.

Demand swings in the worldwide space market create particular problems for smaller companies. Small and medium-sized companies bring creativity and innovation to the space industry. Accordingly, the EU and ESA should continue to develop their programmes for technology incubators and industry days to promote the role of SMEs in the space industry. These companies, mostly active in “niche markets”, should be taken into account by the primes in their overall strategy. This would avoid unnecessary duplication of R&D efforts and make it possible to spread the benefits and return on investment all over Europe. “Space incubators” is a mechanism which can be used to foster innovation and SME participation, providing the necessary assistance to make technology based ventures succeed commercially.

Using procurement more effectively

Undoubtedly the industry would benefit from more flexibility in Europe’s approach to space procurement. The geographical return principle (*juste retour*) – irrelevant in the EU context which aims at optimising collective interests – generally motivates national investments. It guides a great deal of ESA procurement but could benefit from being used both with more flexibility and a broader definition of return, and more creatively so as not to discourage companies from making more cross-border investment, particularly in the new Member States avoiding, however, unwarranted duplication of efforts. In addition, part of the procurement effort will be aimed at ensuring that strategic technology remains at Europe’s disposal.

Ensuring a level playing field and more balanced regulations

Since many countries in the world view space technology and a space industry as strategic assets, they often have an interest in developing space capabilities and in entering the world space market. This consequently leads to public support from civil and defence budgets for projects which also serve the commercial market.

The EU should work with other space-faring countries to eliminate these distortions of the commercial space market in order to create a level playing field. This includes encouraging the further efforts which are needed to address the inefficiencies and adverse effects arising from the current US export controls which constrain the expansion of the world commercial space market.

At the same time it must be recognised that competition has become increasingly international and Europe can benefit from joint ventures and other forms of co-operation which take advantage of the different industrial strengths such as technology leadership, human spaceflight technology or lower manufacturing costs available in various countries.

The EU should foster such international industrial co-operation which can be mutually beneficial if it reinforces the competitive advantages of Europe's space industry, promotes the mastery of essential technologies or encourages the development of attractive programmes.

Recommended Actions

- *Commission to stimulate faster progress to be made towards a harmonised market for space services in the EU through a better co-ordination on spectrum policy as foreseen by the new decision on spectrum¹⁰;*
- *Commission and ESA to ensure that SME's have the opportunity to participate and innovate in the space sector e.g. through the space incubators;*
- *Commission to draw on the lessons from GALILEO to shape useful guidelines for future public/private financing initiatives with commercial possibilities.*

¹⁰ Decision 676/2002/EC on a regulatory framework for radio spectrum policy in the European Community

5. GOVERNANCE AND RESOURCES

A number of factors are arguing for new ways of defining and implementing a space policy in Europe, including the EU's imminent enlargement and its prospective adoption of a Constitutional Treaty, pressure from the space industry (including manufacturers, operators and service providers) for restructuring and a general reassessment of their policies by other space powers, most significantly the US.

5.1. Establish a new approach to the governance of space activities

The Way Forward

The Challenge

To identify and encourage the most effective sharing of tasks and responsibilities between the EU, ESA, Member States, national agencies and industry for determining and continuously delivering the benefits of space to the Union and its citizens.

The Opportunity

To give the institutions of the Union, working in collaboration with ESA, other European organisations and the Member States, a lead in fostering the services and applications to support EU policies and priorities.

Changed governance

Objectives must be ambitious and organisational arrangements must be consistent with these objectives.

The European Space Policy outlined in the preceding pages carries the promise of substantial economic, social and environmental benefits for the Union and its citizens. The policy will also bring new qualities to the Union's external actions, especially in defence, security, environment and development. However, successful delivery of these benefits is not guaranteed unless the roles and responsibilities of the relevant actors are adapted.

In turn, successful implementation requires a system of governance in which the roles of the players are clearly understood, the tools for careful coordination properly provided and processes of accountability put in place. Duplication of work and structures must obviously be avoided. This system should command the consent and support of all stakeholders, respect their mission objectives and complementarity and conform to the principle of subsidiarity.

The coming into force of the new Constitutional Treaty will open up a long term perspective in which the Union becomes the natural point of reference for a European space policy driven by demand, a view strongly supported by the European Parliament in a recent report.¹¹

As a key component of the European space policy, ESA must eventually acquire legitimacy in the EU framework. Movement in this direction should be conducted in a pragmatic and

¹¹ Report A5/2002/294

evolutionary way and be subject to regular review so as to ensure that stakeholders can adapt their structures and procedures progressively.

A two-phased approach

This White Paper has set down the measures needed to implement the European Space Policy. This would be applied in two phases:

(1) Phase one (2004-2007) will in particular consist of implementing the topics covered by the recently agreed Framework Agreement between European Community and ESA. This will enable the two organisations to set common objectives and to mount joint initiatives, whilst retaining their respective rules. ESA should be the implementing agency of the Union for space matters.

(2) Phase two (2007-onwards) will begin with the coming into force of the proposed European Constitutional Treaty, establishing space as a shared competence between the Union and the Member States, if the draft Treaty of the Convention on the future of Europe is followed. ESA should then be positioned within the EU framework and its Convention modified accordingly.

A first review of these new provisions and their effects should be planned a few years after the entry into force of the new Treaty.

European Space Programme

The European Space Policy will be implemented within a multi-annual European Space Programme. The Programme, acting like a strategic agenda for Europe, will be the platform for determining priorities, setting objectives, allocating roles and responsibilities and framing annual budgets. Its scope must embrace R&D, infrastructure development, services and technology. This programme should be articulated as a response in the form of space infrastructures to demands and needs expressed by the citizens through the policies of the European Union. As a “living document”, it should be reviewed and updated every five years.

Such a Programme will provide the stability of outlook that Europe’s various actors need. It will have to be prepared by the EU, benefiting from its collaboration with ESA, through an interactive process driven by demand, involving the consultation of space stakeholders.

Key public actors include national space agencies, national research centres, European organisations such as EUMETSAT, ESO, etc. The private sector will be a key interlocutor since so much of the Programme’s implementation will depend on its efforts. A first outline of the European Space Programme is attached as annex 1.

Design and implementation of the Programme should lead to greater coherence and stability, and a substantial improvement in the match between ambitions and public resources, thus ensuring better value for tax payers’ money and providing a strong rationale for new investments. It should also provide the framework to encourage common initiatives involving a collective effort by all Member States, or of a smaller group. Its impact should be regularly assessed.

Stakeholders’ responsibilities

With the one articulating demand for space-based solutions and the other acting as supplier, the **European Union** should have the lead responsibility for federating society’s needs for

space-based services relevant to EU policies and for co-ordinating their delivery, while the **European Space Agency** should take the lead in elaborating, proposing and developing the required solutions.

The European Union should also ensure that ethical aspects are taken into account when implementing the European space policy and elaborating the European space programme. It should also elaborate proposals and represent Europe's interests when addressing space laws issues in international fora.

Member States and their relevant space/research agencies should be associated with the revision and ultimate adoption of the European Space Programme. **National space agencies** and **research organisations** will be largely responsible for implementing the Programme's lines of action relevant to them.

Fully in line with the European Research Area objectives, the establishment of a network of specialised technical centres working together would represent a cost efficient way to associate the various national actors with the implementation of the European Space Programme. Such a network should not only encourage further integration and improved co-operation but also increased specialisation and a reduction of overall costs and overlapping activities. This will call for a restructuring of the European public technical infrastructure based on pilot networks currently involving ESA and national capabilities in the implementation of on-going programmes.

Recommended Actions

- *EU to establish the European Space Policy as a horizontal policy (serving all other Union policies); the responsibility for space could be a clearly attributed competence within the European Commission;*
- *The Commission to elaborate in collaboration with ESA the first draft of the European Space Programme by the end of 2004. It should then report regularly to Council and Parliament on key issues including the situation of the European space industry, the execution of the Action Plan and the general state of the space sector;*
- *The Commission to make use of ESA proposals for a network of technical centres combining available national and ESA capacities, including the roles of the partners and a timetable for their creation;*
- *The Commission to review the institutional setting for space policy after some experience with the present EU space policy and in light of the new Constitutional Treaty.*

5.2. Match ambitions and resources

Resources available today will not be sufficient to meet the objectives assigned to the overall European space policy as defined in this White Paper.

Maintaining the budgets mobilised by the different stakeholders involved in space activities at national and inter-governmental levels is a pre-requisite in order to preserve the capacities built up over the last 40 years. It is only in very limited cases that there could be an added value in transferring some of these tasks to the EU level.

Bringing the benefits of space closer to the citizens and the Union will require further investments in R&D, technology, infrastructures and corresponding services. These would contribute both to strengthening Europe's capabilities as a space player and to the various initiatives to promote faster growth in the European economy.

Public investments in space have been proven capable to induce a leverage effect mobilising resources by the other EU actors. This is why the Union should, in the context of its future Financial Perspectives, consider devoting additional resources to supplement existing ones.

These extra-resources would have to be allocated above all in response to users' demands, as defined by the needs of the different EU policies. The logical consequence is that an "EU space budget line" should be a virtual one, with the actual resources being made available to the relevant EU policies and only a fraction remaining at horizontal level for activities of general interest.

To complement ESA's efforts in particular, the Union should act both upstream – to support basic research and research infrastructures- and downstream, to facilitate the inauguration and deployment of space infrastructures and the sustainability of the corresponding operational services, particularly those that involve international co-operation.

Some of these initiatives may give rise to public private partnerships as it is frequently the case when infrastructures for general public interest have to be deployed, which in turn give rise to a number of services some of which are of a commercial nature. GALILEO is such an example.

The intensity and timing of public intervention must of course depend on the public interest and risks involved and be based on sound cost/benefit arguments. A number of scenarios for raising Union spending on space can be envisaged. But the actual volume of resources eventually committed will depend both on the ambitions of Member States and the capacity of the Union's "space system" to react and absorb them.

The risks may be high, but so also may be the public and commercial benefits. This is a good reason why pooling resources and sharing investments at the European level is the sensible way forward, not least because of the guaranteed access for commercial providers to a huge market of more than 450 million people.

A first analysis of the resources required to implement the White Paper objectives as well as possible scenarios are provided in annex 2.

CONCLUSIONS

Space is a must for an enlarging Union and the EU is a key to the further development of space in Europe.

With the publication of this White Paper, Europe has taken its first step towards adding important new dimensions to its space policy, strengthening EU policies, suggesting new ambitious and inspirational goals and contributing to its initiatives for growth.

The proposed European Space Programme will be one of its cornerstones for implementing many new initiatives, in particular those undertaken in co-operation between the EU and ESA, such as “Global monitoring for environment and security” (GMES) to be presented in more detail in a subsequent Communication.

Achievement of the longer term objectives set out in these pages is very much predicated upon two pre-requisites. Europe should aim at increasing progressively its space budget; and the ongoing Inter-governmental Conference should confirm the results of the European Convention and grant the Union shared competence on space matters in the future Constitutional Treaty.

Growth in total space spending should be tied to a long-term vision. The returns will be more effective policies and opportunities for a revived space industry to expand Europe’s share of fast-growing markets in space-based services.

The EU needs more responsibility for policy-making and executing if it is to gain the benefits space technology and applications can bring in support of its own policies. Space is transnational by its very nature because services and applications beamed to earth from space can cross any and all borders. Placing some authority for space activities at the European level closes the governance circle. The issues – as a whole – raised in this White Paper should now be discussed and decided upon in the relevant European institutions.

The potential gains are real ones for the citizen, for Europe and the world. Space is not only an adventure, it is also an opportunity. Europe cannot afford to miss it.

ANNEX 1

EUROPEAN SPACE PROGRAMME (*framing the White Paper Action Plan*)

First sketch

The “draft Treaty establishing a Constitution for Europe” prepared by the Convention for the future of Europe refers in its article III-155 to a European Space Policy and the corresponding measures to be established, namely a **European space programme**.

The aim of this annex is to outline some essential features of such a programme and to indicate how it should be prepared.

1. DEFINITION

The European Space Programme (ESP) has to be seen as the implementation and benchmarking instrument for the European Space Policy. It should:

- provide a synthetic overview comprising all appropriate public and private space activities performed in Europe which contribute to EU policy objectives;
- constitute a co-ordination and harmonisation platform for the actions derived from the European Space Policy.

In particular, the ESP should:

- provide guidelines for the implementation of the programmatic and technical part of the Action Plan described in this White Paper;
- identify existing technological and financial gaps in the different areas;
- prioritise activities with regard to EU policy objectives;
- define the responsibilities and tasks of the different actors;
- indicate the timetable attached to the different tasks.

The ESP should be elaborated through a process of dialogue and consensus-building including all stakeholders (EU, ESA, Member States with their national space agencies, European organisations such as EUMETSAT, research organisations and European industry) following the “Technology platform” concept promoted by the EU.

2. INITIAL RELEASE

The first release of the ESP should in particular build upon:

- current EU political priorities;
- lessons drawn from the Green Paper consultation process;
- the ESA Executive plan “Agenda 2007”.

The template below lists some key rubrics that would have to be considered when preparing the ESP. It (tentatively) allocates roles for carrying out the actions.

For each of the White Paper’s main lines of action mention is made of:

- the actors involved in implementation;
- three time periods (ongoing, short and medium);
- EU policies which directly benefit from the corresponding activities.

A number of key stakeholders have been identified who would be in charge of the implementation of the respective lines of action (this list is only preliminary; several other actors should also be considered).

EU	European Union
MS	Member States
EC	European Commission
ESA	European Space Agency
F.A.	The European Commission and ESA implement this line of action in compliance with the Framework Agreement (other actors can also be involved, such as Eumetsat).
Joint Undertaking/ Supervisory Authority	Entity created in accordance with the EU Treaty article 171 under the supervision of a public structure being in charge to protect public interests
Public Private Partnership (PPP)	Joint public/private investment
Private Sector	Manufacturers and service providers
Concessionaire	(Private) Operator identified to be in charge of the maintenance and operation of the infrastructure services considered

LINES OF ACTION		On-Going (2003-2004)	Short Term (2004-2006)	Medium Term (2007-2013)	Policy Objectives covered *
1. SUPPORT OF THE ENLARGED EU					
APPLICATIONS	“digital divide”	<i>EC / ESA**</i>	<i>EC / ESA</i>	<i>PPP</i>	1 / 2 / 3
	Global Monitoring for Environment and Security	EC / ESA	EC / ESA	<i>Joint undertaking</i>	1 / 2 / 3 / 4
	Positioning, Navigation and Timing	Joint undertaking/ Supervisory authority	Joint undertaking / Supervisory authority	<i>Concessionaire/ Supervising authority</i>	4
	Security (Contribution to CFSP/ESDP)	<i>EU / MS</i>	<i>EU / MS</i>	<i>EU / MS / (ESA)</i>	4
International Partnerships					
Specific Actions for Third Countries (Eastern/Southern neighbours...)		EC / ESA	EC / ESA	EC / ESA	3 / 4
Specific Partnerships (Countries and international Organisations)		EU / ESA	EU / ESA	EU / ESA	1 / 2 / 3 / 4
2. EXTENDING AND STRENGTHENING SPACE POLICY					
Guaranteed and Independent Access to Space					
Contribution to European Space Launch Base Maintenance		MS / ESA	<i>EU / MS / (ESA)</i>	<i>EU / MS</i>	All
Launcher R & D		ESA	ESA / <i>EC</i>	ESA / <i>EC</i>	All
Technology		<i>EC / ESA / MS</i>	<i>EC / ESA / MS</i>	<i>EC / ESA / MS</i>	1 / 4
Space Exploration (incl. Aurora and ISS)		MS / ESA	MS / ESA	MS / ESA / <i>EC</i>	1
Vocations, Careers & Education		ESA / EC / MS	ESA / EC / MS	ESA / EC / MS	1 / 2 / 3
3. SPACE SCIENCES					
Sciences of the Universe		<i>ESA</i>	<i>ESA / EC</i>	<i>ESA / EC</i>	1
Earth Sciences		MS / ESA / EC	MS / ESA / EC	MS / ESA / EC	1
Life and Physical Sciences		MS / ESA / EC	MS / ESA / EC	MS / ESA / EC	1
* Policy Objectives as outlined in the White Paper are : 1: Knowledge-Based Society & Economic Growth; 2 : Enlargement; 3 : Sustainable Development; 4 : CFSP/ESDP.					
** Entities mentioned in bold/italic characters are proposed to be assigned an additional role and corresponding resources as defined in the White Paper.					

ROADMAP

Recommended Actions	Responsibility	Timetable
SUPPORT OF THE ENLARGED EU		
“digital divide”		
<i>Setting-up a forum on Digital Divide</i>	EC	early 2004
<i>Reporting on the results of the forum</i>	EC	Summer 2004
<i>Assessing of possible solutions</i>	EC / MS	by the end of 2004
<i>Setting up of pilot projects</i>	EC	short/medium term
GLOBAL MONITORING FOR ENVIRONMENT AND SECURITY		
<i>Communication on GMES (2004-2008 Action Plan)</i>	EC	January 2004
<i>Proposing scenarios for the interface between civil and security usage</i>	EC	short / medium term
POSITIONING, NAVIGATION AND TIMING		
<i>Negotiating overall agreement for the management of the next phase</i>	JU / SA / C*	short term
<i>Undertaking further research activities for innovative applications</i>	JU*	short / medium term
<i>Ensuring the availability of regulating procedures</i>	JU / SA*	continuous
SECURITY (CONTRIBUTION TO CFSP/ESDP)		
<i>Establishing a report, through an EU dedicated working group</i>	EU / MS / (ESA)	by the end of 2004
<i>Launching of preparatory action on security research: Communication (with work programme)</i>	EC	January 2004
INTERNATIONAL PARTNERSHIP		
<i>Developing a strategy for international space co-operation</i>	EU / ESA	2004
<i>Organising an international conference on space</i>	EC	end 2004
<i>Building specific partnerships (with countries and international organisations)</i>	EU/ESA	continuous
<i>Co-operating with developing countries</i>	EC / ESA	continuous
EXTENDING AND STRENGTHENING SPACE POLICY		
GUARANTEED AND INDEPENDENT ACCESS TO SPACE		
<i>Contribution to European space launch base maintenance</i>	MS / (ESA) / EU	continuous
<i>Launcher R & D</i>	ESA / EC	continuous
<i>Technology , network of centers</i>	EC / ESA / MS	continuous
SPACE TECHNOLOGY		
<i>Reinforcing European Space Technology Master Plan</i>	EU/ ESA/ MS	continuous
<i>Promoting technology transfer</i>	EU/ ESA/ MS	continuous
SPACE EXPLORATION		
<i>Setting up of a wise persons group to deliver a vision for space exploration</i>	EC / ESA	early 2004
<i>Accessing/ensuring the availability of core capabilities</i>	EC / ESA	continuous
VOCATIONS, CAREERS & EDUCATION		
<i>Actions in support of education and promotion of careers</i>	EC / ESA / MS	continuous
<i>Organising an information and promotion campaigns</i>	EC / ESA / MS	short / medium term
SPACE SCIENCES		

<i>Scientific research</i>	ESA / EC	continuous
<i>Supporting infrastructure for data acquisition and archiving</i>	EC	continuous
CREATING THE RIGHT ENVIRONMENT FOR INNOVATION AND COMPETITIVENESS		
<i>Progressing towards an harmonised market for space services</i>	<i>EU / MS</i>	<i>continuous</i>
<i>Ensuring the participation of SMEs</i>	<i>EU / ESA / MS</i>	<i>continuous</i>
<i>Shaping guidelines for future public/private financing initiatives</i>	<i>EC</i>	<i>short term</i>
GOVERNANCE AND RESOURCES		
GOVERNANCE		
<i>First phase (implementation under the recently agreed Framework Agreement)</i>	<i>EC / ESA</i>	<i>2004-2007</i>
<i>First draft of the European Space Programme</i>	<i>EC / ESA / MS</i>	<i>end of 2004</i>
<i>Proposals for setting up networks of technical centres</i>	<i>EC / ESA / MS</i>	<i>by the end of 2004</i>
* <i>JU : Joint Undertaking; SA : Supervisory Authority; C : Concessionaire</i>		

ANNEX 2

RESOURCES ASSESSMENT

The aim of this annex is to provide an overview of the financial resources which would be required for implementing the European Space Policy presented in this White Paper, preserving the European Space “acquis” while developing future opportunities. After a brief overview of the resources currently earmarked, several key scenarios are presented.

Numerous voices (e.g. through the Green Paper consultation, the recent reports from the European Parliament and European Economic and Social Committee) have stressed that the investment on space has to be seen as a source of innovation.

As such, it contributes to the EU and national initiatives for growth¹², because the deployment of advanced infrastructures will enable the emergence of new added-value services. Investment in the space sector is also part of the objective of having the EU invest 3% GDP on R&D by 2010¹³ (although several dimensions of the space policy address non-R&D aspects)¹⁴.

A more vigorous investment on space-related activities in Europe in the period to come should be reflected by a proper EU budget appropriation. This should help to exert leverage on other public activities in the space field as well as on the private sector, and to encourage them to intensify their investment.

1. Past and foreseen EC financial expenditure on space (1995-2006)

Table 1 summarises the evolution of EC expenditure on space over the period 1995 to 2006, which shows a significant increase over the years (although the absolute amounts remain modest when compared to the national and inter-governmental efforts).

Most of the investment is to be qualified as R&D resources, either directly drawn from the R&D 5th and 6th Framework programmes or from the Trans-European networks – Transport budget line. GALILEO is the main application developed during that period.

Table 1:			
EC expenditure on space-related activities – 1995 -> 2006 (in M€)			
	(1995 – 1998)	(1999 – 2002)	(2003-2006)
FRAMEWORK PROGRAMME + JRC	~150	~280	475
GALILEO		270*	280**
TOTAL	~150	~550	755
*: Definition and development **: Development			

¹² Space applications like GALILEO, GMES are foreseen to be part of the Commission’s “Quick-start” initiative to be presented at the next European Council. A “Digital Divide” initiative is also proposed.

¹³ COM(2003) 226 final: Investing in research: an action plan for Europe

¹⁴ in 2003, the total European public investment devoted to space-related activities amounted to 0.06% of the EU GDP

2. Estimated annual public funding in Europe in 2004

Annual public sector expenditure in space in 2004 in Europe is estimated at the level of 5380 M€, from five main sources:

Table 2: Estimated public expenditure in Space in Europe (M€) (2004)		
European Space Agency	2700**	(national civil activities) (national military activities)
Member States	1600	
	550	
Eumetsat	300	
EC*	230	
TOTAL	5380	
*: corresponding figures only include earmarked budgetary resources		
**ESA expenditure in recent years: 1999 (2400); 2000 (2299); 2001 (2522); 2002 (2812)		

The EC contribution presented in Table 2 is exclusively composed of resources drawn from the following financial instruments:

- **Trans-European networks** – Transport (5 years): 550 M€/year
- **6th Framework programme (2002-2006)**: priority “*information society*”: p.m.; priority “*aeronautics & space*”: 235 M€ ; priority “*sustainable environment, transport and energy*”: 50 M€; Joint Research Centre space-related activities : 50 M€; priority “*nanotechnologies and materials*” or “*research infrastructures*” for an estimated total of 40 M€. The total expenditure is about 475 M€.

Other investments may be used, on an individual project basis: Structural funds, TACIS, FED, MEDA, although there is no pre-determined allocation for space-related activities.

3. Possible scenarios (2004-2013)

Following the Green Paper consultation and in line with the European Parliament recommendation, the White Paper highlights the need to develop an ambitious European Space Policy.

In order to reach its objectives, the Union must support in priority space applications. Additional resources will also have to be devoted to the “enablers” of such applications (e.g. technology and access to space in particular) with special attention given to international co-operations.

For the Policy to be successfully deployed, a programme of actions - which is described in the White Paper - would have to be implemented to complement the ongoing and planned activities in Europe.

Two phases have been identified for the implementation of the European Space Policy, taking into account the current (2000-2006) and future (2007-2013) EU Financial Perspectives:

- first phase (2004-2006), based on existing Financial Perspectives. Resources during this phase will have to be managed through the existing financial instruments and within the current budgetary constraints. Additional budgetary resources might be made available through the sectorial policies on case-by-case basis. Opportunities

might also occur under the future initiative for growth to be proposed for endorsement at the next European Council in December 2003;

- second phase (2007-2013), to be part of the future Financial Perspectives, which are currently the subject of initial reflections within the Commission. These could lead to the identification of a “space virtual budget line”, supporting the shared competence between EU and Member States on space granted by the future Constitutional Treaty.

The analysis of global economic factors and of the projections about the future EU growth rate suggest several possible scenarios. These must also take into account considerations which are more specific to the European space sector, in particular:

- the outcome of the Green Paper consultation (including the declared objective of doubling public investment on space in Europe by 2010);
- ESA Executive plans (“Agenda 2007”);
- the analysis of the EC expenditures on space over the last 10 years.

An additional issue concerns whether the EU decides to intervene in security/defence on a larger scale. Variants of the key scenarios are presented in graphic 1 to single out this option.

Last, any progression of the resources must be gradual, to ensure absorption capabilities are developed in a sustainable way.

On that basis, three main scenarios are described, together with an estimate of the resources which they would require.

Scenario A is the “**Green paper**” scenario. It reflects the needs identified during the Green paper consultation. This package represents an annual expenditure growth rate of 4.6% with respect to the overall public level of funding in 2003 (5380 M€). This is an aggressive/ambitious scenario, which would require a high level a global economic growth in order to be sustainable for the public contributors. Scenario A is compliant with all objectives identified, including space exploration and significant security/defence related space developments. This scenario is consistent with the ESA executive objectives described in its “Agenda 2007”.

Scenario B is the “**political act**” scenario. It corresponds to an annual expenditure growth rate of 3.4% and marks a new departure for space in Europe, with the entry into force of the new Constitutional treaty of the EU. This is an ambitious scenario, with a growth rate higher than the global growth rate of the EU economy. Scenario B is compliant with the overall EU objectives.

Scenario C is the “**linear natural**” scenario, built as a linear expansion of the current level of EC expenditures. It corresponds to an annual public expenditure growth rate of 2.3 %. Scenario C does not fully guarantee independence vis-à-vis technology and access to space.

A first estimate of the European public expenditure needed to implement the White paper action plan is presented in Table 3; the evolutions of the different options are shown in Graphic 1 (without inflation). Like for all activities with a long lead time, it is important to embed these expenses in a multi-annual plan and budget.

The corresponding estimated increase in the multi-annual European expenditure is presented in Table 4.

Evolution of European public expenditure (in M€)

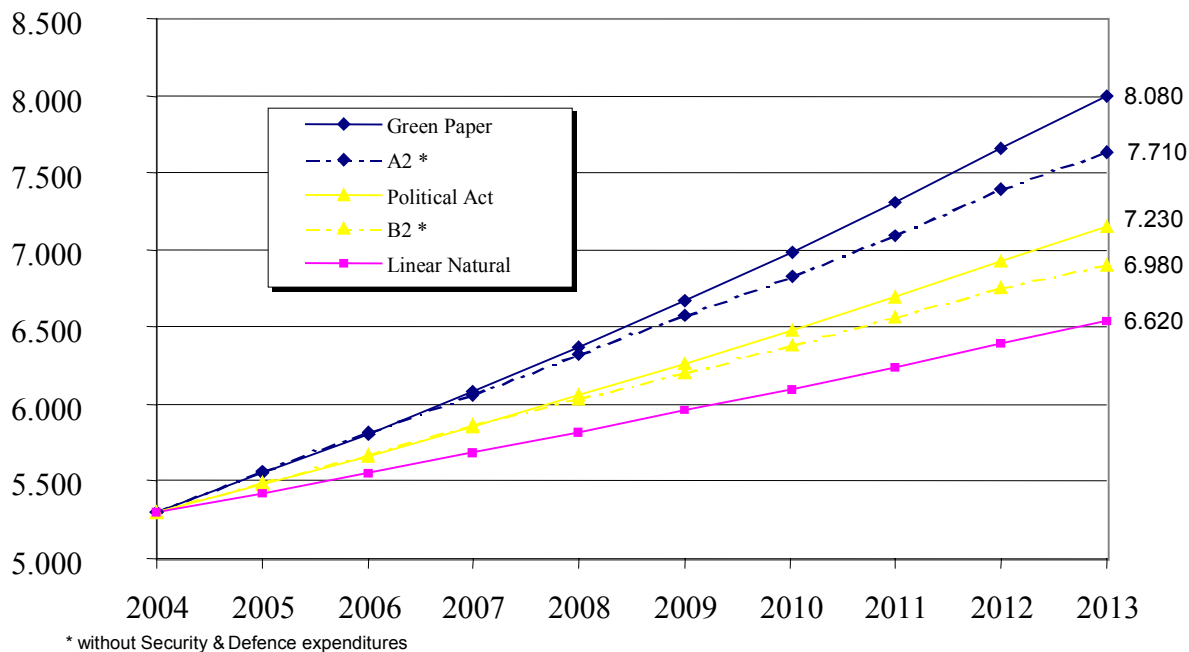


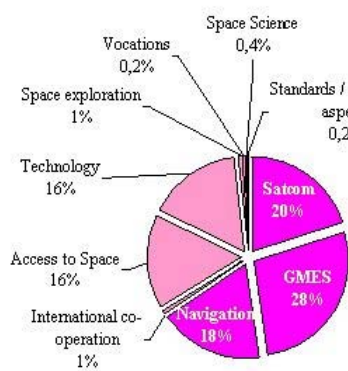
Table 3:
Estimated European public annual expenditure on space activities (in M€)

Scenarios ->	On-going (2004)	In 2006			In 2013 (projections)		
		A	B	C	A	B	C
INCREASE IN COMPARISON WITH 2004	-	500	400	300	2700	1850	1240
ANNUAL PUBLIC EXPENDITURE	5380	5880	5780	5680	8080	7710	6620
Scenarios for different annual expenditure growth rates: A) 4.6 % B) 3.4% C) 2.3%							

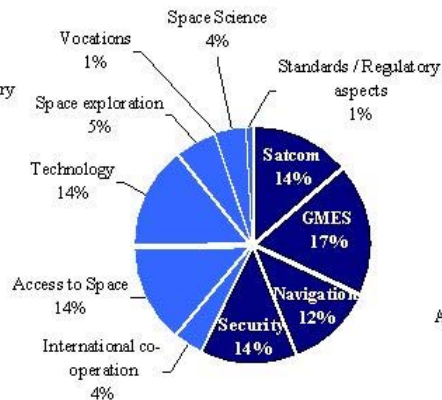
Table 4: Additional* annual public expenditure in 2013 (in M€)				
		scenario A ⁽ⁱ⁾	scenario B ⁽ⁱⁱ⁾	scenario C ⁽ⁱⁱⁱ⁾
APPLICATIONS	SATELLITE COMMUNICATION**	250	250	250
	GMES**	340	340	340
	POSITIONING, NAVIGATION, TIMING**	220	220	220
	SECURITY	750	250	0
INTERNATIONAL CO-OPERATION		200	70	10
ACCESS TO SPACE **		250	250	200
TECHNOLOGY **		270	270	200
SPACE EXPLORATION		220	100	10
VOCATIONS		30	20	3
SPACE SCIENCE		140	65	5
LEGISLATION, REGULATORY ASPECTS, STANDARDS		30	15	2
TOTAL		2700	1850	1240

⁽ⁱ⁾:annual expenditure growth rate of 4.6%
⁽ⁱⁱ⁾:annual expenditure growth rate of 3.4%
⁽ⁱⁱⁱ⁾: annual expenditure growth rate of 2.3%
*:additional to the present expenditure of 5380 M€
**:EIB possible additional intervention under discussion; funding plan already decided for GALILEO

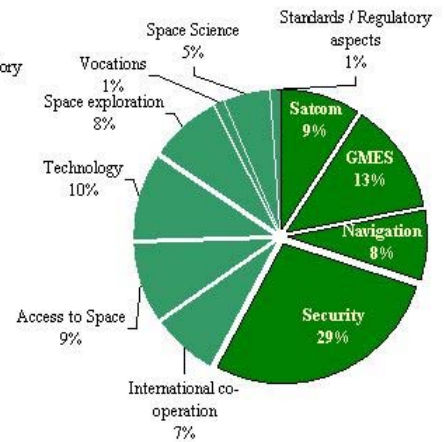
The darker areas of each pie chart show the “applications” while the lighter ones represent the “enablers”.



Linear natural



Political act



Green paper

Concluding remarks

Whatever scenario is retained, the following remarks apply:

There should be no simple transfer of funds: an extra effort from the EU in the field of space, driven by the need to support applications of EU interest at the service of EU policies, should not be considered as a pretext for Member states to “pass the burden” to the EU budget and to reduce accordingly their own expenditures. On the contrary, this should act as an incentive to match EU’s new investments.

Actions undertaken under the EU framework are optimised for the collective benefit of the EU as a whole. The optimisation of national interest is to be sought under national or inter-governmental investments and mechanisms.

Apply more innovative types of support: space has, up to now, been mostly confined to R&D budgets, with their inherent limitations. Complementary sources of funding and mechanisms should be more systematically considered in the future such as: Public Private Partnership (already in use for GALILEO, it could be applied for the “Digital divide” initiative); a larger role for the European Investment Bank (cf. “Innovation 2010 initiative”); innovative investments under Structural funds.

Last, **the level of resources devoted to space-related activities cannot grow indefinitely.** Depending on the type of scenario retained for implementing the set of actions recommended in this White paper, one would expect the level of public investment to enter a stabilised “cruising regime” between 2013 and 2020.

The **leverage effect** of the public funding in the space sector represents an added value this sector can generate vis-à-vis other EU policies.

ANNEX 3

GREEN PAPER CONSULTATION PROCESS: MAIN MESSAGES

The Green Paper on European Space Policy was adopted by the European Commission on 21 January 2003. Its aim was to initiate a debate on the medium- and long-term future use of space for the benefit of Europe.

The Green Paper process has encompassed a series of events, workshops and meetings spanning the continent and drawing contributions from hundreds of representatives of the space community.

The debate was open from the industrial and institutional players down to the ordinary citizen.

The Joint Task Force composed of representatives of the Commission services and ESA organised joint workshops in several European capitals, focussing on specific themes and communities. The consultation was complemented with an open website forum.

The following table summarises the most relevant messages received:

Consultation workshop/event	Main messages
The Industrial View	Revitalise the current situation for the European space industry Need for a wider institutional market with greater EU engagement Guarantee access to space as a strategic need Stimulate new vocations by new European flagship programmes in space Need for EU regulations (harmonisation) Fill the gaps of strategic space technology
The View of the Scientific Community	Stop the reduction of funding; double the budget for Space sciences Need for a coherent data policy (harmonised dissemination) Support to horizontal and infrastructure activities Support ISS utilisation and operations
The Institutional View	Need for a European Space Policy discussed at the highest political level A legitimate role for the EU in the context of European Space Policy A legitimate role for ESA in the context of European Institutions Support to the shared competence principle (Constitutional Treaty)
Security and Defense Aspects	Space as key element supporting CFSD/ESDP Develop multiple-use capabilities Co-ordinate present activities in view of the future European Armaments Agency
The View of the Operators and Service Providers	Space applications key components of European space policy, bringing concrete benefits to European citizens Need for a joint ESA/EU initiative on broadband communication (bridging the “digital divide”) Importance of Earth observation (a strategic issue) Use of satellite navigation for the benefit of European citizens’ life
The International Context	Space as a contributor to the success of Enlargement Russia and Ukraine as the closest partners of the enlarged Union

	Space as a strategic tool to develop/implement international co-operation
The Website Forum	Need for flagship programmes in space Support to the exploration of the solar system Need for long-term vision including human spaceflight

The complete EC/ESA report on the outcome of the consultation process is available on the following website: http://europa.eu.int/comm/space/index_en.html

The list of the contributors having responded or participated to the Green Paper consultation process is enclosed.

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NPA Satellite mapping and exploitation United Kingdom	SESO - Société Européenne de Systèmes Optiques France	Terma A/SDenmark
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ANNEX 4

GLOSSARY

Aurora: the European space agency programme for the exploration of the solar system. The objective is to formulate and to implement a European long-term plan for the robotic and human exploration of solar system bodies holding promise for traces of life. The Aurora programme aims at bringing about a coherent European framework for exploration and to progressively develop a unified European approach; it is open to international co-operation.

CFSP: Common Foreign and Security Policy.

Concessionaire: Operator identified as in charge of the maintenance, operation and viability of public owned infrastructure.

CSG (Centre Spatial Guyanais): Europe's spaceport operated by Centre National d'Etudes Spatiales under an agreement with the European Space Agency. Strategic facility aimed at providing Europe with access to space with the optimal geographical conditions for launching.

Digital Divide: Inequality in the capability of access by broadband technology connectivity (i.e. Internet services) to knowledge society. It is measurable in terms of widespread availability of the connection or in cost of the connection in comparison to a benchmark.

EGAS (European Guaranteed Access to Space programme): Approved by ESA Ministerial Meeting and planned for 2005-2009, the programme provides short and medium term support for the European launcher service both in French Guyane and in continental Europe, and stresses the conditions required for its long-term stability.

European Space Agency (ESA): Intergovernmental Organisation constituted in 1975. Currently composed of the following Member States: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

ESDP: European Security and Defence Policy.

European Space Policy: In order to create a more secure framework for the benefit of space in Europe, the EU seeks to build a European Space Policy which is demand driven and supports other EU policies.

European Space Programme (ESP): A multi-annual programme to develop the European Space Policy.

ESTMP (European Space Technology Master Plan): This plan consolidates the overall process for space R&D through a joint effort involving ESA, the European Commission and industry, and highlights a number of separate harmonised technology areas. The new ESTMP refers to all the institutional actors, describing technology activities in Europe, strategies and funding

approaches, readiness level and relationship with European partners, including a database of technology activities.

EU (European Union): Formed by the following twenty five Member States (as of 1st May 2004): Austria, Belgium, Cyprus, Czech Republic, Estonia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Spain, Slovakia, Slovenia, Sweden, and the United Kingdom.

European Union Satellite Centre (EUSC): Located in Torrejón de Ardoz in Spain, it is the direct successor of the Western European Union Satellite Centre.

Framework Agreement: A formal agreement between the European Community and the European Space Agency, defining the principles and mechanisms of a reinforced co-operation on space-related matters.

GALILEO: Europe's global radionavigation satellite system. Joint EU/ESA project composed of a constellation of 30 satellites in medium Earth orbit. GALILEO will provide users with highly accurate timing and positioning services.

GMES (Global Monitoring for the Environment and Security): GMES is a joint EU/ESA initiative combining space and in-situ observing systems to support EU's goals regarding sustainable development and global governance.**Joint undertaking:** Legal entity created in accordance with Article 171 of the European Community Treaty. A joint undertaking is mandated for the efficient execution of research, technological development and demonstration programmes.

Networks of centres: a cost efficient way to associate the various space national actors for the implementation of European activities under the same umbrella. The network encourages integration and improve co-operation; it also increases specialisation and reduction of overall costs.

PPP (Public Private Partnership): Structure composed of representatives from the public and private sector for the operation of infrastructure and the provision of services. This structure determines that the responsibilities, roles and risks are shared between the public and private sectors.

Shared competence: Field of competence that is shared between the EU and its Member States.

Supervisory Authority: Structure created by an EU Council Regulation aiming at managing the public interest in a PPP type of project.

White Paper: White papers are documents containing proposals for EU action in a specific area. While Green papers set out a range of ideas presented for public debate, White papers contain an official set of proposals in specific policy areas and are used as vehicles for their development.