ANNEX I

THE EUROPEAN SPACE SECTOR IN THE WORLD

CONTENTS

1 SIZING THE WORLD-WIDE SPACE SECTOR

The world's total space expenditure amounted in 1998 to approximately $68 billion. These expenditures are exclusively related to space products and do not include the associated ground hardware and services, which, for example in telecommunications, can reach up to ten times the space products expenditures.

This budget, for comparison is close to the GNP of Singapore, or of the Philippines, or Iran, and it is slightly less than IBM Corp.'s 1997 sales.

Of these $68 billion, half corresponds to direct investments from governments through space agencies or similar organisations and half corresponds to market type investments. The $34 billion coming from direct investments of governments represent the investment of 32 countries, which have space agencies or other government bodies with identified space activities. More than 75% ($26 billion) is coming from the US (civil + military) government. Europe is a very distant second, with a total of $4,76 billion public space expenditure (civil + military). Japan is the third with $1,932 billions public (only civil activities) space expenditure.

It is difficult to place Russia and China, considering the difficulties of comparing economic conditions, while in terms of technical competencies they are high in the ranking.

In terms of employment, the totality of the workforce working in the European space industry (including Arianespace) is estimated about 30,000 people, i.e., well below one half of those employed by top 8 US companies (see table page 9).

Looking at the above figures, the US is clearly to be considered as the world reference in analysing the Space sector situation and evolution against which the European space sector should be analysed. Budget and employment figures are objective criteria of comparison, but they are not enough for providing a complete assessment of the space sector. Aspects as political guidelines, legal instruments, organisation and distribution of roles are also instrumental for the conduct and the implementation of an effective space policy.

2 THE EUROPEAN SPACE SECTOR VERSUS THE US SPACE SECTOR TO-DAY

2.1 Governments' policies

2.1.1 US

The US claims a leadership role in space matters throughout the world (US National Space Policy, September 1996) and calls for an integrated national security space architecture, the protection of US space systems, a robust US space industry and a strong forward looking technology base (US DoD Space Policy, July 1999).

Addressed at the highest political level, the US leadership role in Space has been supported by different types of co-ordinated policies, leading to:

- Stimulate private-sector investment
- Capitalise defence-developed technologies (dual use)
- Invest in technologies and end-to-end systems
- Have proper regulatory organisations (FCC, transfer of technologies)
- Obtain bilateral agreements with emerging Countries (i.e., China, Russia, etc.)

2.1.2 Europe

In Europe Space still lacks of co-ordination between national and European space policies, that directly influence space expenditures and associated programmes, but also lacks of co-

ordination between space policies and wider social, economic, and industrial policies indirectly related to Space.

In addition synergy between civilian and military programmes exists only at national level, while a European defence policy addressing space systems is still to come.

Further, no centralised regulations take place and co-ordination between national representatives in international fora can be significantly improved.

These drawbacks are clearly identified and recent actions such as the development of a European Strategy for Space by ESA and the EU will certainly contribute to improving the situation.

2.2 Organisation of the public sector

2.2.1 US

US have ONE coherent space policy, leading to a clear share of responsibilities among two major public actors, which manage the most of the space budget.

- **NASA** for science, advanced and risky technologies, and manned programmes;
- **DoD** for end-to-end navigation, telecommunications, and Earth observation systems, and for operational expendable launchers.

It is to be recognised that DoD is acting as a user, i.e., the largest user of space technologies in the world, while NASA is rather an agency for research and development.

In addition to these two major actors, more specialised actors, such as NOAA for meteorology, play a dedicated role, closely co-ordinated with the other's one.

NASA and DoD play complementary roles in all the space fields, with a continuous exchange of technologies and developments on telecommunication and Earth observation systems.

In the field of launchers, there is an agreed distribution of role between DoD, taking care of supporting new expendable launchers, and NASA, supporting the development of re-usable launching vehicles. Furthermore, US companies such as Boeing and Lockheed Martin can benefit from a large captive market provided by military payloads (DoD). They have also been protected from foreign competition (Russia and China) through bilaterally negotiated launch quotas.

2.2.2 Europe

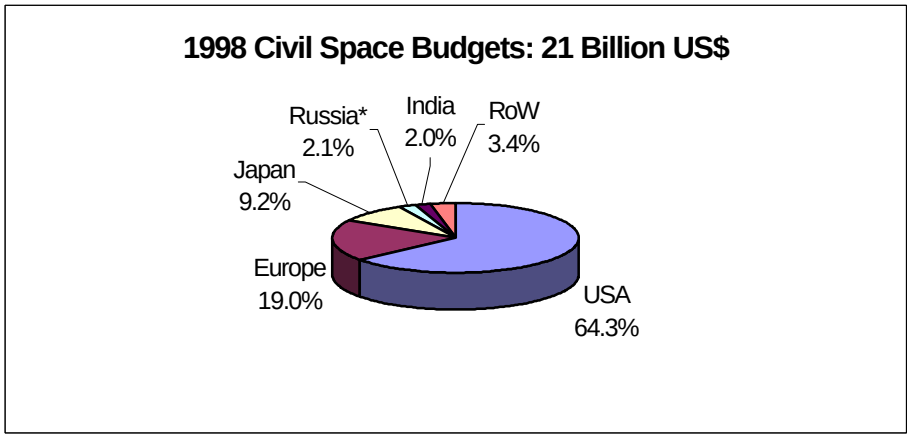
The European public Space sector has a more diversified organisation with a lot of public actors responding to different policies (see chapter 3). The European Space Agency does represent a co-operative approach of fifteen European States for jointly developing space technologies and systems for exclusively peaceful purposes.

Besides the ESA activities, most of European countries have their own space activities managed through either established Space agencies or dedicated public bodies.

Further, not all those public bodies are responsible for defence activities, which are developed in at least five European countries, i.e., France, Germany, Italy, UK, and Spain. In other European countries, military space activities are difficult to be traced.

Last, the European Union, through the EC R&D Framework Programme for civil applications, and, in the future, through the WEU Satellite Centre for defence-related activities, is also playing an emerging role in financing space-related projects.

2.3 Public civilian budgets



**Figures concerning Russia's investments are not comparable with US and Europe's figures. (Source: Euroconsult)*

Civilian programmes include:

- **Space Science**: space-based astronomy and exploration of the Solar system. NASA and ESA cover most of this field, given the financial problems of the Russian programme. NASA has traditionally an advantage in planetary exploration thanks to the availability of nuclear power sources and heavier launch vehicles. However, with just one fifth of the budget of its American counterpart, ESA has managed to achieve world leadership in specific fields of space science such as cometary science or astrometry.
- **Telecommunications/Navigation**: relaying, broadcasting and generating signals from space is the main commercial field in space activities. However, public investments are still significant, whether for fulfilling public services (e.g. the ESA Galileosat would be the first civilian developed and run Global Navigation Satellite System) or for sharing advanced technologies development in partnership with industry.
- **Earth Observation**: space-based optical, infrared and radar sensors have become a fundamental tool in weather prediction, resource management, agricultural and urban planning, and environmental monitoring. The field also holds commercial promise, but is not yet mature (see below).
- **Launchers**: while the earlier generation of launchers was directly derived from strategic weapon systems, the growth of space activities drove civilian launcher developments. As the cost of space access remains one of the main cost drivers, R&D in this field is one of the main chapters in all agencies spending.
- **Manned Space**, the International Space Station developed by the American, European, Russian, Japanese and Canadian Space Agencies is due to orbit Earth with permanent astronaut presence as of 2004. Today only the USA and Russia have the capability of transporting man to space.

2.3.1 US

The US space civilian budget for 1998 was estimated to be $13,5 billion, of which $12,7 billion for NASA, and approximately $800 million for other organisations involved in space (i.e., DoC, DoE).

The NASA budget could be initially split into three main parts:

- Human Space flight ($5,679 billion)
- Science and technology ($4,645 billion)

- Mission support & Inspector General ($2,407 billion)

2.3.2 Europe

The total European public expenditure for civilian activities is the sum of the ESA budget and the national budgets. It raised about $4 billion in 1998.

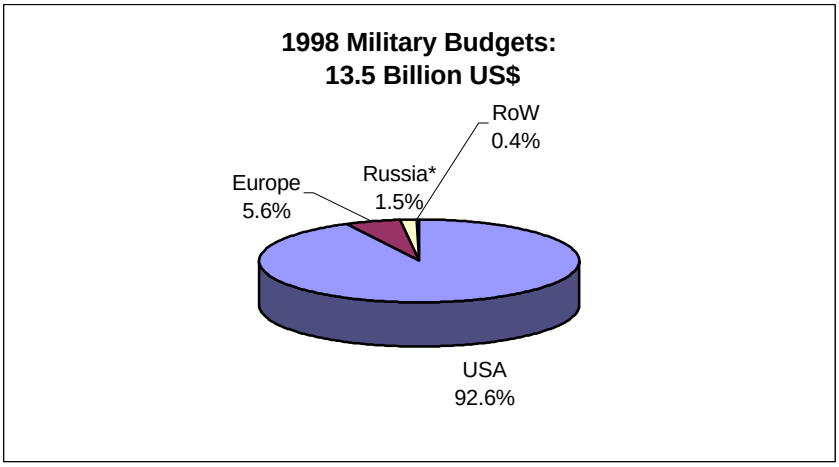
In the following table a comparison between the US 1998 civil space expenditure (NASA+NOAA) breakdown and the European ESA and national one is given.

Activity	USA (NASA + NOAA)	Europe (ESA + national)
Human Space flight[1]	42.9%	11.4%
Space Science	14.9%	12.9%
Launchers[2]	4.3%	23.0%
Earth observation	10.3%	16.0%
Meteorology	4.1%	4.2%
Telecommunications[3]	3.0%	5.7%
Technology[4]	0.0%	2.6%
Microgravity	1.6%	2.2%
General budget	18.9%	14.8%
Other	0%	7.2%

Source: Euroconsult and ESA elaboration

2.4 Public defence budgets

Military programmes have been at the core of US and Russian space systems development.



**Figures concerning Russia's investments are not comparable with US and Europe's figures. (Source: Euroconsult)*

[1] US: ISS and Shuttle.
[2] Europe: Ariane and CSG. US: excluding Shuttle and expendable launch vehicle developed by DoD.
[3] Europe: including Navigation.
[4] US: no specific technology budget.

Still today, the US Department of Defence (DoD) is the second largest "official" space agency, without accounting for "black" budgets. The US DoD has developed space systems in the whole range of the following applications for defence:

- **Intelligence satellites**: these include all the typical Earth Observing sensors, plus electronic listening of telecommunications. The only European capability in this field is represented by the French led Helios optical imaging system.
- **Navigation**: all current space-based navigation systems were developed primarily to guide weapon systems. The US tries to impose DoD's GPS as the only system for both defence and civilian applications in the world.
- **Secure Telecommunications**: geostationary and low Earth orbit (LEO) telecommunication systems for exclusive military/strategic use. Three European systems are currently fielded, the British Skynet, French Syracuse and Italian Sicral.
- **Early Warning**: systems able to detect the launch of strategic weapons. Europe does not have this kind of systems.

2.4.1 US

Current estimates for the US military budget is of $12,5 billion in 1998, about the same amount of civilian expenditure for the same year. The Air Force provides over 90% of the military space budget and 93% of space personnel.

The overall estimated DoD budget is hard to be divided into different activities, about two thirds of it being allocated for classified projects.

- ***Classified projects*** ***$8,060 bn***
- ***Procurement Non Classified (NC) projects*** ***$1,350 bn***
- ***Research, Development, Test & Evaluation NC projects*** ***$2,006 bn***
- ***Space operations and maintenance*** ***$1,084 bn***

(Source: Euroconsult)

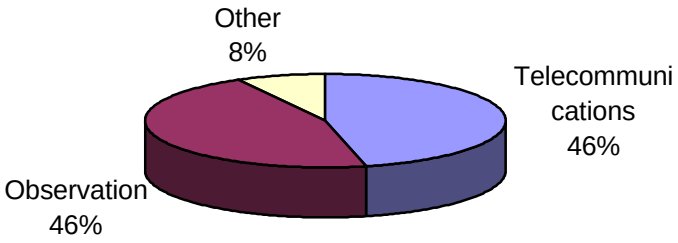
2.4.2 Europe

The estimated European budget for space military activities is about $760 million in 1998. These activities are developed by only five Countries, which have declared space projects for military purposes.

This budget is almost equally divided between Earth observation and Telecommunication programmes, with a balance of national and limited multinational (2 or 3 countries) activities.

It should be noted that, launchers excepted, European military systems often derive their technology from civil ones (Helios from Spot, Skynet from ECS), while the US make the contrary.

1998 Breakdown of European military activities



Source: Euroconsult

2.5 Organisation of industry

Space industry restructuring is not over, yet. US industry started several years before the European one, and results are to be considered more consolidated. A real capability to provide customers with complete space systems including launch services (vertical integration), is achieved in two companies, i.e., Boeing and Lockheed Martin, even if the share of EADS in Arianespace could allow considering the Space Division of EADS as vertically integrated.

The table in the next page shows the top 10 companies, excluding operators and service providers, around the world ranked according to the declared 1999 space sales.

2.5.1 US

With the current acquisition of Hughes Space & Communication by Boeing, recently approved by both US Federal Trade Commission and European Commission, the US space industry has three companies with the capacity of building satellites, two vertically integrated.

The **Boeing Company**, with $58.0 billion operating revenues in 1999, is the world leader Aerospace Company. The Boeing Space and Communications Group, fully vertically integrated, with a total turnover of $6.8 billion in 1999, is active in manufacturing space systems for civil and military purposes, launch vehicles. Boeing, already providing services associated to its role of aircraft's manufacturer, is now planning to enter in the satellite services business through its **Connexion** venture. With the $3.75 billion purchase of Hughes Space and Communications, the Boeing Space and Communication Group will expand to about $10 billion and 43,000 employees.

The consolidation of **Lockheed Martin Group** took seven years, from 1993 to 1999. Today Lockheed Martin Group is the result of several mergers and acquisitions in the aerospace industrial world, leading to the creation of the second worldwide player in Space after Boeing. At least the following companies have been merged: Lockheed, Martin Marietta, GE Aerospace, Ford Aerospace, IBM Federal Systems, and RCA Space and Defence.

Lockheed Martin Space Systems Company is providing integrated products (Space Transportation Systems, Satellites, and Ground Systems) and serving diversified space markets. With the establishment of Lockheed Martin Global Telecommunications, Inc. (LMGT) in 1998 and the acquisition of Comsat, the Group is also going to play the role of

satellite operator and service provider. The 1999 turnover for the LM Space System Company is $5.8 billion (over $25.53 billion for the Group).

	Company	$ million 1999 space sales	Employees (space)
1	Boeing Co. (USA)	6,800	37,100
2	Lockheed Martin Co. (USA)	5,814	NA
3	TRW Inc. (USA)	4,739	NA
4	Raytheon Co. (USA)	2,639	12,600
5	EADS (EU)	2,500	8,000
6	Hughes Electronic Co. (USA)[5]	2,241	7,000
7	Loral Space & Communications (USA)	1,860	4,000
8	United Space Alliance (USA)	1,461	10,275
9	Alcatel Space (EU)	1,344	5,600
10	Orbital Science Co. (USA)	875	4,950
Total USA (over top ten)		**28,428**	**75,925**
Total EU (over top ten)		**3,844**	**13,600**

Source: Space News and companies

Last, **Loral Space & Communications**, with a 1999 turnover of $1.9 billion, is active in satellite manufacturing and technology (Space Systems Loral – SS/L), and satellite services, through several spin-off companies (Loral Skynet and Loral CyberStar, Globalstar).

2.5.2 Europe

Also in Europe, the space industry restructuring is intrinsically connected to the evolution of large aerospace groups, and also to the privatisation of state-owned or controlled companies.

Early in the nineties, five prime contractors were present in Europe:

- MMS – Matra Marconi Space, the result of merging between French Matra Espace, British Aerospace and GEC Marconi;
- DASA, the result of several merging in Germany, between MBB, Erno, and Dornier;
- Aerospatiale, French state-owned;
- Alenia Spazio, result of merging between Italian Selenia Spazio and Aeritalia Space Division;
- Alcatel Espace, the space branch of French Alcatel.

Following privatisation of Aerospatiale and the reorganisation of the French aerospace sector, the Matra Aerospatiale Group and Alcatel Space emerged in 1998.

The Matra Aerospatiale Group, born from the merging of Aerospatiale and Lagardere Group, had two branches operating in space, MMS, and Matra Aerospatiale Lanceurs, who included launcher division of Aerospatiale.

The satellite division of Aerospatiale was included in **Alcatel Space Industries**, the result of merging between Alcatel Espace (51%) and the space activities of Thomson-CFS (49%), in

[5] Only Hughes Space & Communications activities.

the frame of Thomson CFS restructuring. Alcatel Space had a turnover of $1.3 billion in 1999, with about 5,600 employees.

Early this year, following the merging between aerospace activities of Lagardere, CASA, and DaimlerChrysler Aerospace (result of merging between Daimler and Chrysler), EADS (European Aeronautic, Defence and Space Company) was formed, with the subsequent creation of **Astrium** (DASA and MMS – 75% EADS, 25% BAE Systems) and **EADS Lanceurs** (former AM Lanceurs – 100% EADS). The EADS Space division, with about 8,000 employees and cumulative sales for $2.5 billion in 1999, is the first European space industry.

2.6 Private investments

2.6.1 Telecommunications

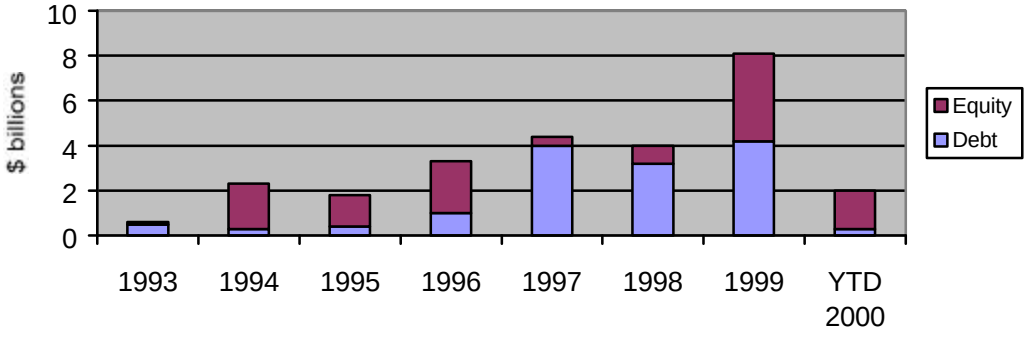
From early the nineties, mobile telephony pushed the creation of several US ventures aimed at financing, building, and operating satellite systems for mobile communications. Main project benefited from large DoD (public) investments made possible thanks to military projects.

Despite problems encountered by those projects (Iridium failure, Globalstar slow launch), significant capital has been raised in the US during the last year. Looking at the figures provided by Banc of America Securities, **debt and equity capitals raised $8.1 billion in US during 1999**, so almost doubling those obtained in 1998, before Iridium bankruptcy.

It is otherwise clear that investors require today substantially more equity beneath them than in the past. So, looking at the new ventures in the DARS (Digital Audio Radio Services) sector, like CD Radio or XM Satellite Radio, the ratio between debt and contributed equity is very close if not equal to one.

As far as Europe is concerned, we can count only one satellite initiative aimed at raising private investments, i.e., SkyBridge backed by Alcatel Space, who is prime contractor for the system. While in the past mobile communication ventures, European operators have invested in US-led ventures, Skybridge is the only initiative, backed by Europeans, that is trying to raise non-European funds.

Public Capital Raised for satellite Cos.



Source: Banc of America Securities

2.6.2 Earth observation

The situation looks very different in the remote sensing field. The majority of the market is coming from publicly financed satellite manufacturing, while remote sensing services, i.e.,

selling remote sensing data, still represent a small part of the remote sensing business. The major players are still governments and state-owned agencies.

While satellites are still totally publicly funded (Eumetsat, Landsat, ERS, Spot, Radarsat), some interest by public entities in raising private funds in exchange of the right of utilise data has been shown, for instance in the Radarsat-2 and Landsat-7 procurement. Companies in charge of commercialising remote sensing data (Spotimage, Radarsat International, EOSAT, etc.) are usually publicly participated, even if, starting with Orbimage, private ventures have entered the remote sensing imagery market.

Nevertheless, in the remote sensing field it is very difficult to identify really private investments, due to large re-use of military technologies and strong presence of Governments' commitment in using planned systems. A typical example is the recent acquisition of US EOSAT by Space Imaging, owned by Lockheed Martin, Raytheon and Kodak. The launch of private initiative in the remote-sensing field, IKONOS (first satellite in orbit since September 1999) is not yet valuable, due to the lack of figures on actual or projected sales.

2.6.3 Navigation

Even if current estimates of the revenues generated by global navigation services over the world raise $40 billion in 2005, it is today unlikely that future navigation systems could be developed under private investments.

Facing the GPS Block II, built by US DoD, whose signal in space is provided for free, the planned European Galileo is likely to start under largely publicly funding. Private investments will come at a later stage of the development, and in the Value Added Services stream.

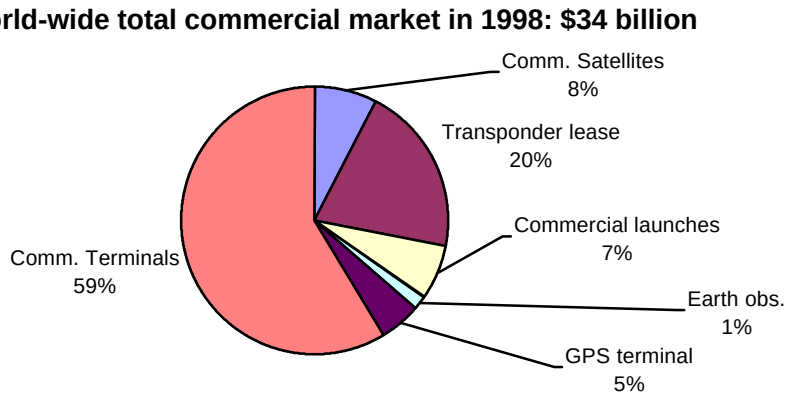
2.7 Share of the world-wide commercial market

Concerning the commercial space products market, telecommunications satellites and their launch mainly drive it. Basically all TV signals go through a geostationary satellite, and broadcasters are really depending on satellite systems. While mobile telephony is to be considered as less than a niche market, multimedia services promise to be the main markets of the future.

The receivers and services associated with space-based navigation systems (GPS – USA, GLONASS – Russia and Galileo – EU) could also be a fast growing space related commercial market.

It can be estimated that sales of commercial communication satellites amounted to about $2.6 billion in 1997, while transponder leases on such satellites probably added another $7 billion, sales of ground terminals generated about $20 billion, and commercial launches about $2.3 billion. Sales of satellite navigation terminals contribute another $1.8 billion. The Earth observation market contributes on the order of $0.7 billion.

The total commercial space markets amount to around $34 billions, i.e. of the same order as the public investments.

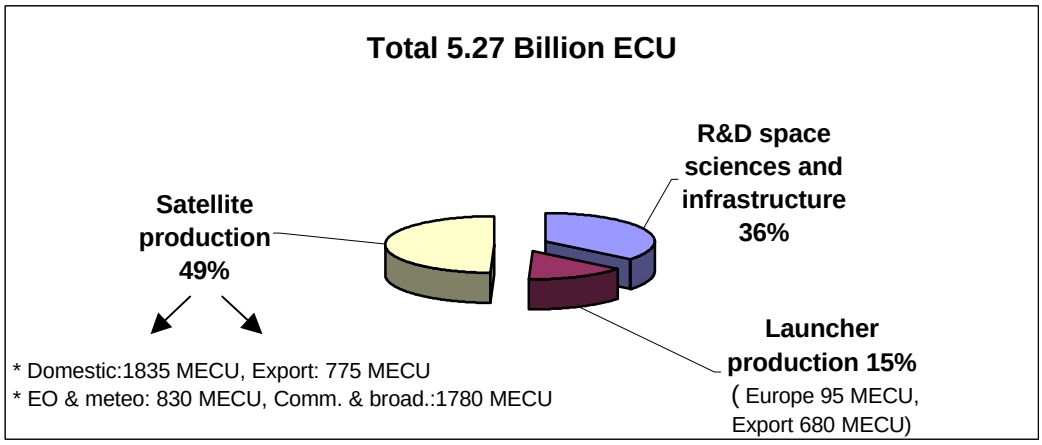


Source: Euroconsult

2.8 European industry share in the world-wide commercial markets

In 1997 consolidated sales of the European Space industry amounted to 5,27 billion of Euro. 49.5% of them were coming from satellite production, 35.8% from R&D, space science and infrastructure, and 14.7% from launcher production. About launchers, over 775 million Euro, only 95 million were coming from European customers, while 680 million were coming from Export contracts.

Satellite production was on the contrary mainly for the domestic markets (1835 million) than for export (775 million).



Source: Euroconsult

2.8.1 Telecommunications

	N. satellites	world-wide Market for the decade, BUS$[6]	**European share**
1970-1979	37	2,8	0%
1980-1989	96	6,6	25%
1990-1999	169	17,4	28%

Table 1: Civil GEO communication satellites contracted over 1970-1999(Euroconsult)

2.8.2 Earth Observation

The Earth observation marketplace is very different from the telecommunication one. During the last twenty years, due to the fact that almost no commercial satellites have been launched, the market has been extremely captive, i.e., the European share is limited to European publicly funded systems.

	N. Satellites	**European Share**
1980-1989	40	12.5%
1990-1999	74	14.9%

Table 2: Civil GEO/LEO satellites launched over 1970-1999 (Euroconsult)

2.8.3 Launchers

Over the period 1988-1997, Arianespace captured about 53.5% of the total $11,740 billion commercial launch market. This was largely due to the big success of the heavy Ariane IV rocket, which largely anticipated the market demand for big satellites launch services.

	N. Launches	World Wide Market for the decade, BUS$[6]	**European Share**
1970-1979	29	0,35	0%
1980-1989	68	2,5	32%
1990-1999	276	17,4	42%

Table 3: Launch Market for commercial satellites over 1970-1999 (Euroconsult)

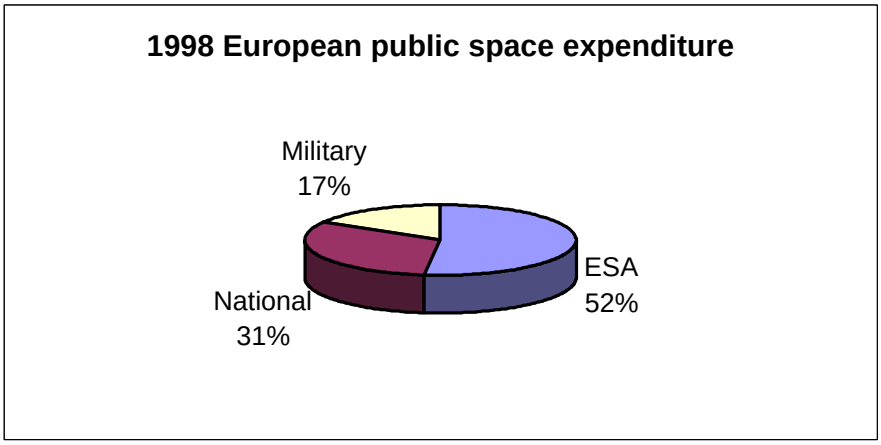
[6] 1996 economic conditions.

3 ANALYSIS OF THE EUROPEAN SPACE SECTOR

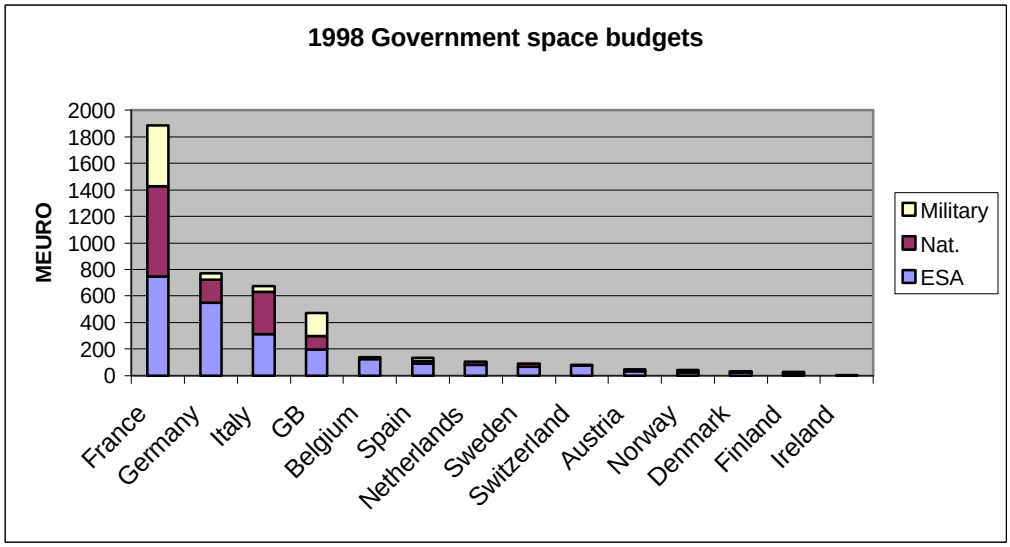
Public European space expenditure is divided into civil and military activities.

Over the 15 ESA member states, only few fund military space activities and there are no European military programmes, at all. Only few activities have been carried out as co-operation between single European countries.

As far as the nature of funds is concerned, it should be noted that about 75% of the European actual expenditure are coming from Research Ministries, against about 15% from Defence and 10% from others.



Source: ESA



Source: ESA

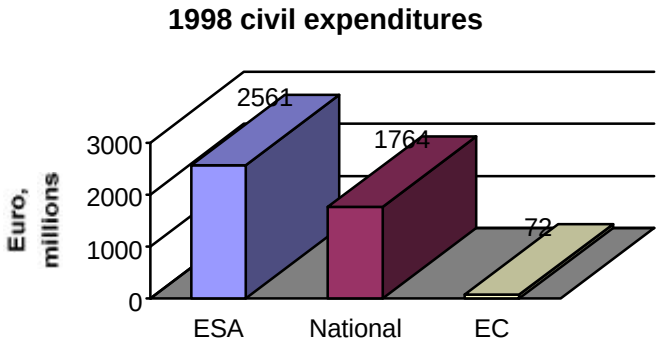
3.1 Public civilian budgets in Europe

In Europe, public civil expenditure can be divided into three different categories.

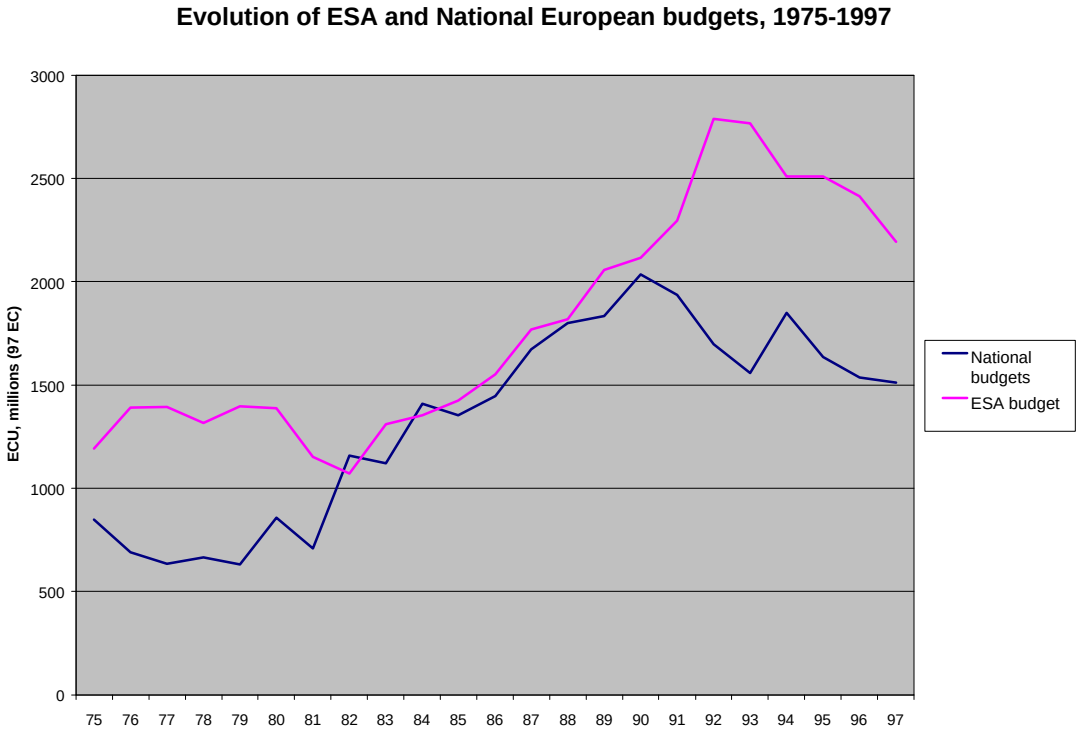
1. The ESA budget, coming from its 15 Member States,
2. National budgets,

3. European Commission R&D Framework programmes budget, devoted to space-related activities.

The latter is planned over a five-year period. The 4th Framework Programme activities were planned for 1994 to 1998, with a total budget for space-related projects of 360 million of Euro. The budget 1998 is assumed to be the average per year of the 5-years budget. Projects are above all in the application domains, i.e., Earth Observation, Telecommunications and satellite Navigation.

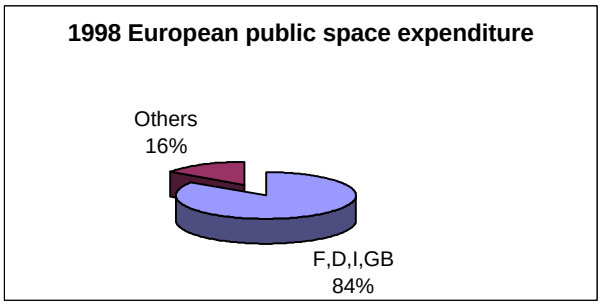


NOTE
EC 4th Framework Programme's funding of space-related projects amounts 370 Meuro over 1994-1998 period (source: ESA)

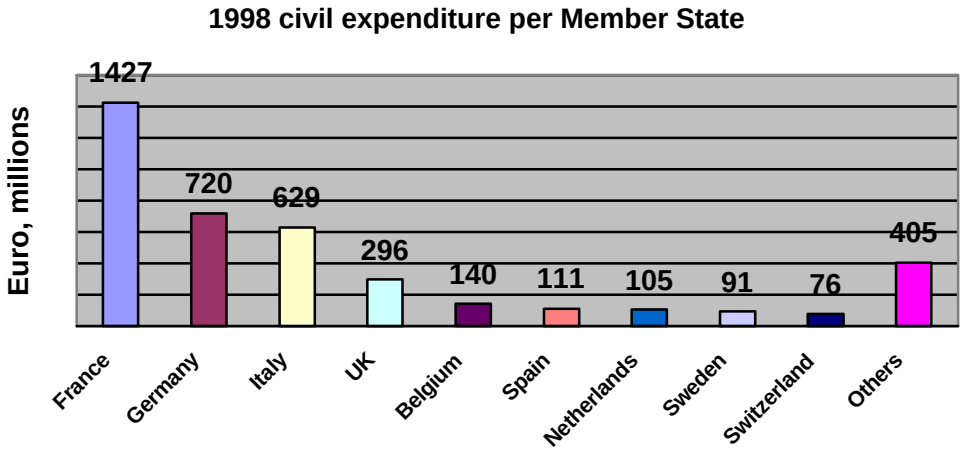


Source: ESA

In 1998, ESA accounted for about 65 % of its member states' combined civil space budgets. The main contributors to ESA are France, Germany, Italy and Great Britain, which fund about 80% of the total ESA activities. Most of the space activity of other European countries concerns their participation in the ESA programmes.

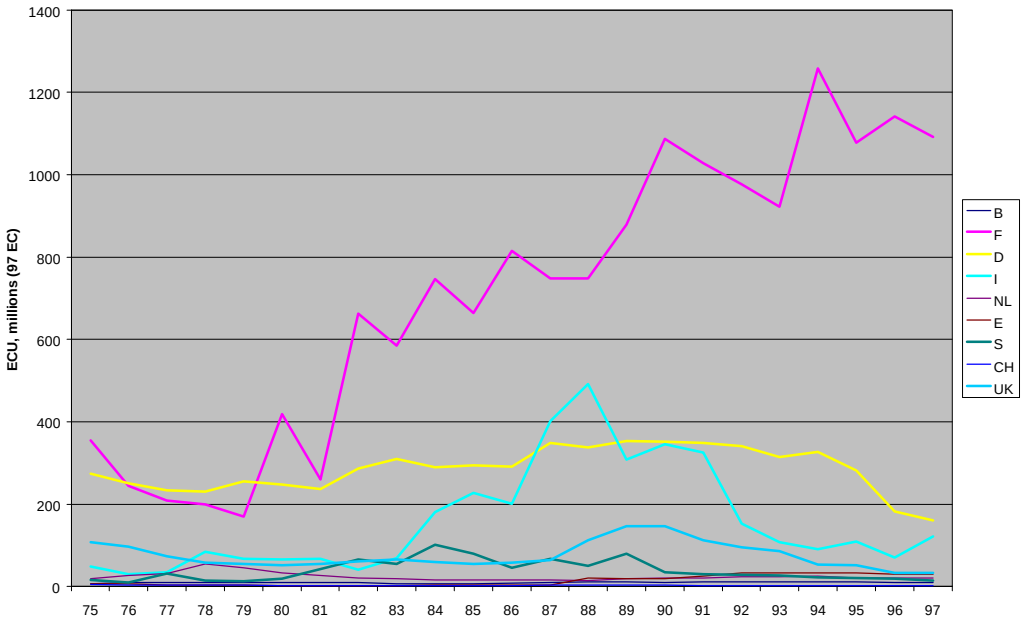


Source: ESA



NOTE
Including contributions to ESA (source: ESA)

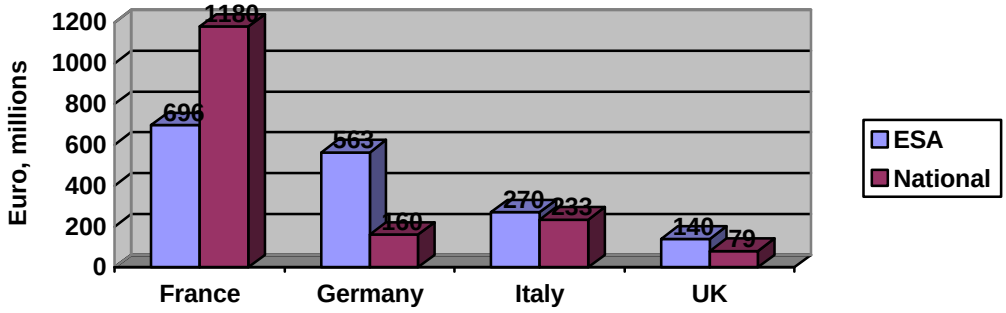
Evolution of National budgets, 1975-1997



Source: ESA

Hereinafter a comparison between ESA contribution and specifically national space activities expenditure is given for the four major contributors to ESA.

1998 ESA/National budgets share



NOTE
ESA four major contributors (source: ESA)

3.2 Public defence budgets in Europe

Europe is building-up a Common European Security and Defence Policy and does not yet have a military space programme. The Western European Union (WEU), which is currently in the process of being absorbed by the EU, attempted to define a European system, but did not develop into a procurement programme.

In Europe, military space programmes are only developed at national level or through limited multilateral co-operation (e.g.: France develops the optical observation systems Helios, with participation from Italy and Spain).

French military space budget is $457 million in 1998, about 60% of the total European military expenditure. Two main fields of applications share this budget: observation (Helios), and telecommunications (Syracuse). Both activities have significant support from civilian projects.

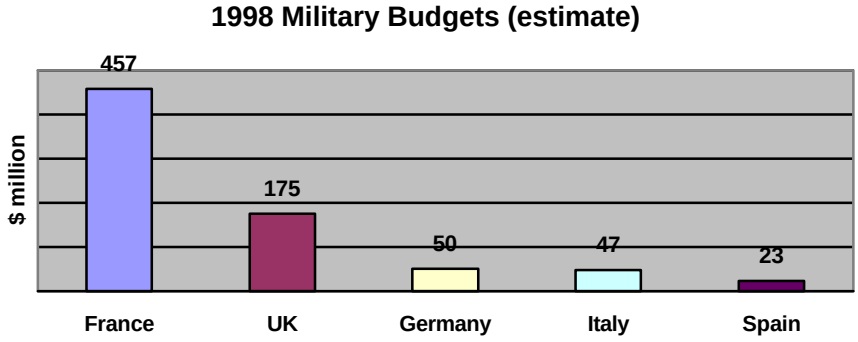
With about $175 million of expenditure in 1998 for military space programmes, the United Kingdom is, after USA, France, and Russia (estimated in $200 million in 1998) the fourth worldwide player, active above all in telecommunications. Britain operates its own dedicated military communication system, composed of three operational Skynet satellites.

Germany's $50 million in 1998 were allocated above all to observation programmes. This engagement will continue with the SAR-Lupe project.

The $47 million that Italy has allocated for space military activities in 1998 were essentially allocated to the Sicral telecommunication satellite. Some engagement in observation could be envisaged through the participation to the COSMO/SkyMed funding by Ministry of Defence.

Last, Spain spent $23 million in 1998, essentially to observation activities in the frame of Helios programme.

Hereinafter estimates of national space military budgets are given for each Country.



Source: Euroconsult

3.3 Employment within Europe

According to AECMA, the European association of aerospace industries, space employment increased at an average annual growth rate of 4.3% between 1987 and 1997. After a continuous growth in the eighties, employment in the European Space industry declined from 24,450 in 1991 to 21,350 in 1995 due to stagnant space sales and decrease in the industry's workload. However, as space sales resumed their growth in 1995, space employment increased again to reach 28,900 employees in 1997.

Space employment is mainly concentrated in France and Germany. Employment in these two countries (67%) plus Italy and Great Britain accounts for 90% of space employment in Europe.

3.4 Main programmes of ESA

A complete list of the ESA completed and on-going programmes is given in the annexed table. They are in chronological order and divided into the following categories:

- Scientific missions
- Telecommunication satellites
- Earth Observation satellites
- Launchers
- Manned infrastructures

Where applicable, for each programme the number of procurements made by ESA and financed partially or totally by the operator such as Eumetsat, Eutelsat and Arianespace have been also reported.

3.4.1 Scientific Satellites

	Programme[7]	Development costs[8]	Launch date	N. of procurements	Operators
Scientific Satellites	EXOSAT	503	1983	1	NA
	GIOTTO	242	1985	1	NA
	HIPPARCOS	596	1989	1	NA
	ULYSSES	334	1990	1	NA
	HUBBLE	409	1990	1	NA
	ISO	806	1995	1	NA
	Huygens/Cassini	290	1997	1	NA
	XMM	1170	1999	1	NA
	CLUSTER II	246	2000	4	NA
	SMART-1	80	2001	1	
	INTEGRAL	359	2002	1	
	MARS EXPRESS	165	2003	1	
	ROSETTA	745	2003	1	
	FIRST-PLANK[9]	360	2005	1	

Total scientific satellites	**21[6]**

[7] Major ESA programmes from 1983 plus Ariane. Four more scientific missions were launched between 1977 and 1978, coming from developments started by ESRO.
[8] Cost at completion in millions of Euro at 2000 EC.
[9] Partial.

3.4.2 Application Satellites

	Programme[6]	Development costs[7]	Launch date	N. of procurements	Operators
Telecommunications	OTS	933	1977-1991	2	Eutelsat
	MARECS	787	1981-1984	3	Inmarsat
	TELECOM ECS	660	1983-1984-1985-1987-1988	5	Eutelsat
	OLYMPUS	1179	1989	1	
	ARTEMIS	959	2001	1	
Earth Observation	METEOSAT	723	1977-1981-1988	3	Eumetsat
	MOP METEOSAT	827	1988-1989-1991-1993	4	
	ERS 1	1171	1991	1	
	ERS 2	592	1995	1	
	MTP METEOSAT 7	128	1997	1	Eumetsat
	MSG	561	2000-2002-2007	3	Eumetsat
	ENVISAT - PPF	2551	2001	1	
	METOP	739	2003-2008	3	Eumetsat

Total application satellites	**29**

TOTAL SATELLITES	**50**

3.4.3 Launchers

	Programme[6]	Development costs[7]	Launch date	N. of procurements	Operators
Launchers	ARIANE 1	3000	1979-1985	10	Arianespace
	ARIANE 4	1500	1988	1	
	ARIANE 5	8000	1996-1998	3	

3.4.4 Manned Infrastructures

	Programme[6]	Development costs[7]	Launch date	N. of procurements	Operators
Manned Inf.	SPACELAB	2282	1983	NA	
	EURECA	577	1992	NA	
	ISS	2964	2004		

LEGENDA:

Programmes completed

Programmes yet to be completed

Source: ESA

4 FUTURE TRENDS

Space has changed from a niche, high-tech market to one that shares common concerns with other sectors: R&D, innovation, marketing, government regulations, changes in the global financial markets, international competition, and a need to attract and service clients.

The leading market in such a transformation is, as often already reported in the document, telecommunications.

The **direct broadcast satellite television** marketplace has emerged as a serious competitor to cable providers as they continue to add more than 150,000 new subscribers per month while new additions for cable services remain flat. With more than 12 million customers in the US and 35 million worldwide, DBS providers are beginning to offer Internet services directly to consumers.

Digital audio radio systems, planned to enter the US market in late 2000, are being called a "killer application" for attracting consumers and have signed up partners at all the major automotive companies.

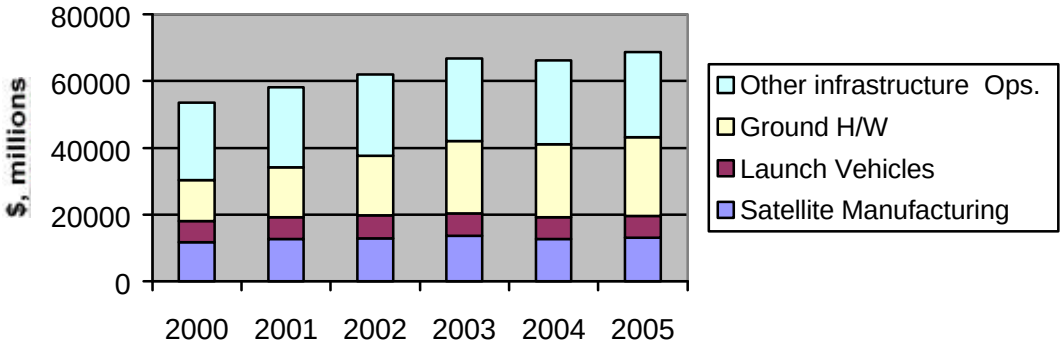
VSAT services have become widely accepted by business clients, offering a wide variety of services. Their ability to multicast across diverse geographic areas provides firms with broadband capabilities unmatched by terrestrial systems.

The launch of the IKONOS satellite and the sale of commercial high-resolution imagery are opening several opportunities in different industries and operators.

Space Products

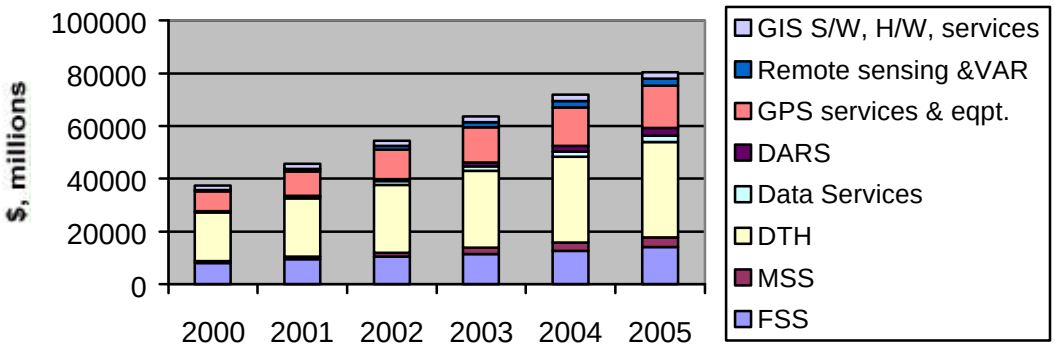
- **Infrastructures:** space (satellites, ISS)
- **Infrastructures:** ground
- **Infrastructures:** transportation
- **Applications**: telecom (FSS, MSS, DARS, Internet, VSAT, etc.)
- **Applications**: utilisation of data derived from Space-based assets (remote sensing, GIS, GPS, etc.)
- **Applications**: use of Space assets (i.e., Microgravity)

Infrastructure manufacturing revenue forecast



Source: International Space Business Council

Application revenue forecast



Source: International Space Business Council

5 ACRONYMS

AECMA	*European Association of Aerospace Industries*
DARS	*Digital Audio Radio Systems*
DBS	*Direct Broadcast Satellites*
DoD	*Department of Defence*
DoE	*Department of Energy*
DTH	*Direct To Home*
EC	*European Commission*
ESA	*European Space Agency*
FCC	*Federal Communication Committee*
FSS	*Fixed Satellite Services*
GEO	*Geostationary Earth Orbit*
GIS	*Geographic Information Services*
GLONASS	*GLObal NAvigation Satellite System*
GNSS	*Global Navigation Satellite Services*
GPS	*Global Positioning System*
ISS	*International Space Station*
LEO	*Low Earth Orbit*
MSS	*Mobile Satellite Services*
NASA	*National Aeronautics and Space Administration*
NOAA	*National Oceanic and atmospheric Administration*
R&D	*Research and Development*
VSAT	*Very Small Aperture Terminal*
WEU	*Western European Union*

6 REFERENCES

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[3] State of the Space Industry 2000 – International Space Business Council, 2000

[4] Satellite Communications & Broadcasting Markets Survey – 2000 Edition – Euroconsult, 2000

[5] Government Space Programs Worldwide Survey – The Age of Cooperation – Euroconsult, 1999

[6] U.S. Space Programs: Civilian, Military, and Commercial – Marcia S. Smith – CRS – The Library of Congress, August 2000