

EUROPEAN PARLIAMENT

Working Documents

1981-1982

29 June 1981

DOCUMENT 1-326/81

Report

drawn up on behalf of the Committee on Energy and Research

on/European space policy

Rapporteur: Mr A. TURCAT

121

On 19 December 1980 Mr Calvez submitted to the European Parliament, pursuant to Rule 25 of the Rules of Procedure, a motion for a resolution on European space policy (Doc. 1-764/80).

On 19 December 1980 the European Parliament referred this motion to the Committee on Energy and Research as the committee responsible and on 15 June 1981 referred it to the Committee on Youth, Culture, Education, Information and Sport for its opinion.

On 19 March 1981 the Committee on Energy and Research appointed Mr André Turcat rapporteur.

It considered this motion at its meetings of 27 March 1981, 14 May 1981 and 18 June 1981.

At its meeting of 18 June 1981 it unanimously adopted the motion for a resolution and the explanatory statement.

Present : Mrs Walz, chairman; Mr Gallagher, vice-chairman; Mr Normanton, vice-chairman; Mr Turcat, rapporteur; Mr Adam, Mr Beazley, Mr Calvez (deputizing for Mr Pintat), Mr Estgen (deputizing for Mr Sälzer), Mr Frdh (deputizing for Mr Sassano), Mr Fuchs, Mr Galland, Mr Ghergo, Mr Herman (deputizing for Mr Croux), Mr Linkohr, Mrs Lizin, Mr Moreland, Mr Price, Mr Purvis, Mr Rinsche, Mr Seligman, Mr Vandemeulbroucke (deputizing for Mr Capanna), Mr Vandewiele, Mr Veronesi and Mr Wedekind (deputizing for Mr Müller-Hermann).

The opinion of the Committee on Youth, Culture, Education, Information and Sport will be presented orally.

CONTENTS

	<u>Page</u>
A MOTION FOR A RESOLUTION	5
B EXPLANATORY STATEMENT	8
CHAPTER I - EUROPE AND SPACE	
1 - SPACE IN INDUSTRY AND COMMERCE	8
2 - HISTORICAL BACKGROUND	9
3 - DEVELOPMENTS	10
CHAPTER II - THE USES OF SPACE	
4 - SCIENCE	11
5 - SPACE APPLICATIONS	12
6 - TELECOMMUNICATIONS BY SATELLITE	12
7 - EARTH OBSERVATION	13
8 - SPACE METEOROLOGY	15
9 - NAVIGATION AND LOCATION	15
10 - THE MANUFACTURE OF MATERIALS IN SPACE	16
11 - BIO-ENGINEERING	18
12 - SOLAR ENERGY COLLECTORS	18
13 - MARKETS AND SPACE	18
CHAPTER III - THE WORLD AND SPACE	
14 - SPACE TODAY	20
15 - JAPAN ON THE STARTING BLOCKS	20
16 - RUSSIA IN CLOSED SPACE	21
17 - AMERICA AND THE SPACE SHUTTLE	22
18 - A PROFOUND CHANGE	24
19 - A CHANGED WORLD	26
CHAPTER IV - EUROPE TODAY	
20 - RESOURCES	27
21 - PROGRAMMES	28
22 - THE INDUSTRIAL STRUCTURE	30
23 - ACHIEVEMENTS	30
CHAPTER V - A NEW VISION OF SPACE	
24 - FUTURE PROSPECTS	32
25 - WHY A LONG-TERM POLICY IS REQUIRED	32
26 - STRATEGIC OBJECTIVES	34
27 - THE KEY TECHNOLOGIES	35
28 - A HEAVY LAUNCHER	37
.../...	

CONTENTS contd.

	<u>Page</u>
29 - ADAPTATION OF STRUCTURES	38
30 - THE EUROPEAN SPACE AGENCY	38
31 - NEW INDUSTRIAL AND COMMERCIAL COHESION	39
32 - THE ROLE OF THE EEC	40
CHAPTER VI - CONCLUSION	
33 - THE GREAT DESIGN	41
ANNEX I : TABLES I - IX	42
ANNEX II : MOTION FOR A RESOLUTION (Doc. 1-764/80)	55

The Committee on Energy and Research hereby submits to the European Parliament the following motion for a resolution together with explanatory statement:

MOTION FOR A RESOLUTION

on European space policy

The European Parliament,

- having regard to the motion for a resolution tabled pursuant to Rule 25 of the Rules of Procedure (Doc. 1-764/80),
- having regard to the report of the Committee on Energy and Research (Doc.1-326/81),
- having regard to its resolution of 25 April 1979 on Community participation in space research¹,
- having regard to the scientific, material and human structures and resources which the Member States of the Community and the European Space Agency have developed in the field of space activities,
- having regard to the proposals submitted by the Agency and by Eurospace respectively,
- having regard to the limited scope of current and projected programmes within the Agency, in the individual Member States and in the framework of agreements between them,
- having regard also to the low level of European financial commitment in the field of space activities compared to the considerably higher amounts allocated by the USA, by the USSR and also, proportionately, by Japan,
- whereas a new space era has been initiated by the launching of the American Space Shuttle and there are now definite prospects for the placing in orbit of heavy loads and the construction of multi-purpose space stations, which offer prospects far beyond Europe's present plans for the future,
- aware of the importance of space activities for the people of the Community in terms of employment, prosperity, independence, health, science, communication, culture and international cooperation with the industrial powers as well as the developing countries,

¹ OJ No. C 127, 21.5.1979, p.42 (Ripamonti report - Doc. 2/79)

1. Applauds Europe's achievements in space;
2. Considers nevertheless that the individual nations and the Community should devote still greater efforts than in the past to space activities;
3. Declares that the presence and the role of Europe in space can be maintained and developed in the last decade of the century only by means of the immediate formulation of a powerful and coherent long-term policy on space applications, and only if the necessary material and intellectual resources are made available; this policy and the necessary early decisions must also obey the fundamental objectives of peaceful activity, which, therefore, implies separation from the military industry, the improvement of possible applications in the fields of telecommunications and television, navigation and position-finding, earth observation and meteorology and the manufacture of materials in space; the needs of the developing countries must also be taken into account.
4. Considers that the main aim of such a policy should be to take early decisions with a view to :
 - (a) beginning the ARIANE IV programme,
 - (b) acquiring the key technologies for performing rendezvous and docking in space, controlled and unmanned space flights, re-entry into the atmosphere and recovery operations,
 - (c) developing a European heavy launcher, as a sequel to the Ariane programme, and heavy satellite stations in geostationary or low orbit before 1990;
5. Urges the Council to discuss these problems at the earliest possible moment by calling a European Space Conference at ministerial level, and to call on the European Space Agency (ESA) and the research centres of the Member States to formulate and implement projects capable of achieving these ambitions;
6. Calls on the Commission to submit within six months proposals for a more ambitious space policy to be formulated by the Agency, for more effective cooperation between the organs of the Community and for all the necessary financial instruments to be placed at the disposal of European space projects;
7. Calls upon the Commission to report to Parliament, if possible within a year, on the action which might be undertaken by the European Community in the fields of space research and exploitation including :
 - (a) an analysis of the scope for Community action and, in particular, a summary of the advantages, disadvantages and cost ranges of each option;

- (b) the range of possible applications of satellites, with an assessment of potential benefits to Europe as a whole, to the Community in the fulfilment of its sectoral policies and to the Third World and an indication of priorities within this range;
 - (c) a review of the consequences of such a Community programme on technological innovation within European industries and the possible economic benefits which might be gained; and
 - (d) the time scale when the funding might be required, whether this should be met entirely through the Community budget and what financial contribution or return might be expected from the users or beneficiaries;
8. Is convinced that only major projects of this nature can stimulate industry to greater efforts, improve its structure and persuade men of the need for a peaceful and civilizing presence in space;
9. Instructs its President to forward this resolution and the report of its committee to the Council and Commission.

EXPLANATORY STATEMENT

CHAPTER I - EUROPE AND SPACE - SURVEY OF THE PRESENT SITUATION1. - Space in industry and commerce

- In 1981 space is more than a field of scientific adventure; the extraordinary photographs of Saturn's rings or Jupiter's satellites transmitted to earth by the American interplanetary space probes should not distract our attention from the wider applications of satellites. Satellite photographs are used for weather-forecasting, satellites are used for long-distance telephone links, for giving the position of ships at sea, for cartography and mining prospection; the developing countries are setting up educational TV systems using satellites. Space has become a prime target for industry and commerce, with opportunities created by satellites, launchings and by the sheer range of services space activities can provide.
- In 1981 space is no longer the monopoly of the two superpowers, the United States and the Soviet Union. For twenty years Europe has made forceful and determined efforts which are now bearing fruit. With the Ariane launcher and the KOURO test range, with an aerospace industry capable of producing competitive satellites, with the European Space Agency and the various national research centres, Europe at present stands as a space power in its own right. The orders placed by the Intelsat organization for satellite launches by the Ariane launcher and the decisions taken by Europe in 1979 on telecommunications and earth observation satellites are ample evidence of this.
- In 1981, however, following the launch of the American Space Shuttle and in the face of competition from other countries such as Japan, Europe must consolidate its position. As far as space applications are concerned, Europe now has the means to be independent and it must seek to maintain this independence, particularly in the field of new applications. It must also strive to increase its competitiveness on the major international markets, where fierce battles will be fought.
- As a starting point, it is worth remembering how Europe reached its present status.

2. - Historical background

Four main periods can be distinguished:

- 1962-1966 - Sensitive to the prestige attached to the scientific knowledge of space and to the spectacular moon race between the Americans and the Russians, the European nations began to create space organizations of their own, ESRO and ELDO, to develop scientific satellites and launchers respectively. At the same time France set up a national body of its own, the CNES.
- 1967-1973 - By now America was turning its attention to the application of the techniques already acquired. This move towards utility was viewed unfavourably on this side of the Atlantic. With the exception of meteorological offices, European administrations had no faith in the practical use of space for their own needs. While France was embarking on a national programme to develop the Diamant launcher and Germany and France were cooperating on a bilateral telecommunications programme, Symphonie, only the METEOSAT, and later the OTS satellites were being developed at European level. The scientific programme, on the other hand, remained of the highest standard at both national and European level, with projects like the British Ariel series.
- 1973-1976 - European governments gradually came to recognize the possibilities afforded by space systems, though not yet to the point of taking action. The key development was the setting up between 1973 and 1975 of the European Space Agency, which included science, applications and launching systems in its programme. The ARIANE, SPACELAB and MARECS programmes were all part of this new framework; certain national programmes were abandoned (Diamant) and some national resources were transferred to the Agency, which was still expanding at this time.
- from 1977 onwards - European governments began to take an interest in operational space applications, while at the same time doubts began to appear as to the role of the ESA.

With national and commercial constraints proving an obstacle to the integration of all European space activities, the more powerful Member States decided to pursue national space applications programmes or to cooperate in bilateral or multilateral programmes outside the Agency framework. The failure to Europeanize the SPOT programme

(earth observation), for example, led France to pursue the project at national level alone; similarly, the market outlook led Germany to abandon the Agency's complex H-SAT programme (television) in favour of a bilateral programme with France. This then left Great Britain to take the leading role in the rival L-SAT programme within the Agency.

Applications programmes like ECS (communications), MAROTS/MARECS (maritime navigation) and METEOSAT, however, remained within the Agency.

The industrialization and commercialization of the Ariane launcher, also developed as part of the Agency programme, was undertaken on a flexible basis by ARIANESPACE, an industrial company grouping together thirty-three European firms.

3. From this historical development - which was straightforward technically, though rather problematic at institutional level - a number of facts relevant to the present situation emerge:
 - a) In terms of launchers and satellites, Europe possesses the necessary means for the study and exploitation of space; more will be said of this in Chapter IV;
 - b) The European governments who dispose of these resources are aware of their potential;
 - c) Space activities remain divided between, on the one hand, the ESA, whose role is mainly in the field of research and development, and, on the other, the national industries who have now come of age and are operating on the markets.

The most important question, however, is the utility of space activities and of the markets to which they give rise.

CHAPTER II - THE USES OF SPACE

4. - Science

The most striking aspect of space activities is the role played by science. Indeed, scientific reality loses nothing by comparison with the world of science-fiction.

Even before the launching of the first artificial satellites, space sciences had begun to advance with the development of space probes, modelled on German war rockets - AEROBEE in America, VERONIQUE and CENTAURE in France and SKYLARK in Great Britain. But these investigations only touched on a restricted sphere of geophysics, the study of the earth's immediate environment, that is the neutral or ionized upper atmosphere. The instruments used were relatively primitive - in 1958, for example, a single Geiger counter had enabled VAN ALLEN to discover the high energy charged particles which constitute the magnetosphere of our planet.

The remarkably rapid development of space techniques, with the initial emphasis being placed mainly on an increasingly ambitious programme of scientific missions, made this an exceptionally dynamic sector of research and completely transformed the traditional perspectives of astronomy and the environmental sciences. Today space observatories are an essential instrument in stellar and extra-galactic astronomy. Satellites and planetary space probes are responsible for almost all our knowledge of the solar system and have given a new impetus to solar astrophysics.

Today Europe is developing a satellite (EXOSAT) for the study of cosmic X-rays and another (GIOTTO) for the close-range photography and study of the composition of Halley's Comet when it next passes in 1986. It is also planning to take part in the exploration of the neighbouring planet of Venus as well as the more distant one of Jupiter, using modules which will land on the actual surface of these planets.

In the same way scientific space missions have proved a powerful stimulus to technological progress. New techniques which began as scientific projects have also found, or will find, economic space applications in conjunction with operational space vehicles. These include hyper-frequency low-noise amplifiers (radioastronomy), space telescopes (astronomy), photon and high energy particle detectors (geophysics and astronomy), on-board computers and attitude control and precision direction-finding systems (astronomy), and robot sciences and telemanipulation (planetary exploration), not to mention the corresponding developments which have taken place in the field of electronic components.

From this point of view, scientific and technological developments can genuinely be said to be progressing hand in hand in the field of research, where technical constraints are costly but results are abundant.

5. But on the planet earth, inhabited - it has been said - by four thousand million cosmonauts, the stage has now been reached where space activities have direct applications in four main sectors:

Telecommunications
Navigation and location
Earth observation and meteorology
Manufacture of materials.

6. - Telecommunications by satellite

Telecommunications by satellite were the first area of space applications in terms of chronology as well as social and economic impact. They can be divided into three categories: fixed network, mobile network and direct broadcasting - the same headings used for drawing up regulations.

The fixed network is made up of links between fixed points on earth - telephones, telex, telematics and also includes the transmission of television programmes from one network to another. These links stretch right across the world (international air-traffic is controlled by the Intelsat organization). Their efficiency has been increased and their cost reduced to such good effect that the actual space link-up accounts for less than 15% of the cost of a transatlantic communication.

The mobile network is designed to provide similar links between fixed stations on earth and ships, planes and even road transport when it is equipped for the purpose. For ships the Inmarsat organization is to put into operation Intelsat V satellites and European MARECS satellites. Initially the service will be provided for owners and operators of mainline commercial shipping, but will subsequently be extended to include ships of more modest size.

Direct broadcasting concerns radio and television programmes intended for direct reception by users (individual or collective aerials). Radio broadcasting, as a forerunner to television, is an important educational instrument for the developing countries. In Europe the first television satellites will be in operation in 1983, each broadcasting on two or three channels. Eventually, by virtue of international conventions, operational satellites will be able to broadcast on up to five channels.

The next ten years will also see the creation of new space telecommunications services, in many cases supplementing existing terrestrial facilities. These will include the transmission or diffusion of information or professional data, tele-informatics, video-conferences, video-broadcasting, electronic mail and tele-medicine. In future decades the rapid progress of telematics should lead to the substantial development of high-volume inter-establishment digital links using satellites.

7. - Earth observation

Earth observation is a new activity mainly concerned with photography and does not yet have comparable economic importance. By virtue of the services it can offer, however, rather than through potential satellite sales, earth observation is becoming of vital importance for the nations of the world.

Earth observation draws together all the space techniques which enable us to increase our knowledge and understanding of the natural phenomena which occur in the neighbourhood of the earth's surface and it provides us with the capacity for the continuous monitoring both of these phenomena and of those which have a human origin.

It embraces such varied disciplines as meteorology (which will be dealt with separately), oceanography, glaciology, climatology, geology, cartography, plant ecology, agronomy, hydrology and regional development.

The satellite photographs are intended to provide the user with synoptic and usually successive views of the phenomena which interest him.

- The high-precision observation of land masses is intended for use in cartography (in the broadest sense) and in the study of geological formations and ecological phenomena (vegetation, water, the effects of human activities on the natural environment).

Its use will make it possible to improve the management of arable lands and to monitor the state of crops and vegetation on a world scale. This, together with climatological studies (also using satellites), ought eventually to enable effective action to be taken on crops and vegetation and so progressively help to resolve the problem of hunger.

High-precision observation will also make it possible, of course, to monitor for peaceful purposes the distribution of strategic weapons and installations over the globe; indeed, it is possible that serious armed conflicts may already have been avoided recently as a result of satellite observation, which removes the element of secrecy from military preparations and makes it easier for a supervisory body to operate.

- The systematic observation of the surface of the ocean contributes to our scientific knowledge (ocean currents, interaction between sea and atmosphere) and has practical applications (location of plankton-rich zones, particularly suitable for fishing).

8.- Space meteorology is no longer in its infancy

Operational meteorological observation, which has been a model of international cooperation for several years within the framework of the World Meteorological Organization, consists of a network of satellites in low orbit and observation satellites in geostationary orbit providing half-hourly pictures of the earth's surface in several wave-lengths, particularly in the visible and in the infra-red zone. Europe's contribution to this network is the METEOSAT satellite, the first model of which was operational from November 1977 to November 1979; the second is due to be launched at the third Ariane test launching.

Thanks to geostationary satellites, space meteorology has also distinguished itself through its ability to detect and monitor great natural disasters. Progress is expected to be made in the continuity of surveillance and the detail of observation attainable (from tropical cyclones to hailstorms!).

9.- Navigation and location

Satellite systems for navigation, location and data acquisition are noted for their ability to cover the whole globe as well as for the great diversity (ships, buoys, balloons, terrestrial vehicles) and the large number (up to hundreds of thousands) of mobile elements able to participate.

Those navigation systems which are operational, or about to become so, were originally intended for military purposes, although access is now granted to civilian users for less sophisticated operations (ships, oil prospection on continental shelves).

Location and data acquisition systems have mainly civilian and humanitarian applications, for example the SARSAT programme designed to aid the location and rescue of ships in distress, which has been a model of cooperation between America, Canada, the USSR and France, and the ARGOS system, which is now operational.

10. The manufacture of materials in space is likely to remain at the experimental stage for some time to come.

The absence of gravity in orbital conditions means that it is feasible to contemplate the production of samples of materials of a different quality and composition to those produced on earth. In fact, the first spectacular results obtained during successive missions by American astronauts on the SKYLAB orbital space station (the manufacture of giant monocrystals), the imminent completion of the Space Shuttle and SPACELAB programmes and the crystalline synthesis being performed on a regular basis on board the Soviet orbital station SALYUT are all indications that the capacity for conducting experiments under conditions of microgravity acquired by the two space superpowers is going to be fully exploited to explore this new field which, although still at the scientific stage, has every likelihood of becoming industrial. It would be dangerous to neglect this sector as it also includes the fields of electronics and magnetism.

Crystalline synthesis

The forces of gravity exert an important influence on the formation of crystals, particularly around the critical moments when atomic structures change their physical form and several phases - solid, liquid or gaseous - can coexist, with the associated phenomena of convection. Outstanding results are expected in these transitions from the liquid or gaseous phase, and with a high degree of purity. One example is the development of mercury iodide (HgI₂) from the gaseous phase to give crystals of a 'strategic' material (used to make high energy particle detectors), which is produced on earth in small quantities and at very great expense; the current cost of a mercury iodide crystal is about 250 EUA per gramme.

Given that the cost of manufacturing such materials in space is equivalent to the cost of the space transport involved, it is clear that the space production of crystals like mercury iodide could easily become viable, once the quality of crystals produced in space became superior to that of those produced on earth. However, the world market for products of this type is very limited (a few dozen or a few hundred kilogrammes per year) and on its own it would hardly justify the massive investments involved.

New alloys

There is a wide variety of alloys for which a certain degree of concentration cannot be achieved under terrestrial conditions, because the constituents when melted form two non-miscible liquids of different densities which separate like water and oil under the action of gravity. It is perfectly feasible to use conditions of microgravity to stabilize an 'emulsion' of the two liquid phases and produce after crystallization an intimate mixture with original mechanical or electronic properties. Encouraging results have already been obtained in this area during short ballistic flights, though using very small samples. Conditions of microgravity should also produce significant effects on the phenomena of surface tension.

Fusion without a crucible

Microgravity also opens up the possibility of the remote stabilizing and manipulation of samples of matter in levitation, through the action of acoustic or electromagnetic forces, without physical contact with a support of any kind and, for liquids in fusion, without a crucible. We know that the manufacture of a great many refractory materials - glass, ceramics, special alloys - often comes up against the impossibility of achieving fusion without simultaneously producing unwanted chemical reactions, whatever type of crucible is used. Processes where the material itself is used as a support are employed successfully on earth, particularly when purification (recrystallization of silicon by zone fusion) rather than synthesis is involved. But the cost of these processes can be as high as that of space flights - monocrystalline silicon, for which there is a world market of thousands of tons, can cost anything up to 20,000 EUA/Kg.

It is clear that the production of each product must be shown to be profitable. Profitability depends to a very large extent on the cost of space transport and could only be achieved if the ratio of price to weight of materials were very high and if the 'space quality' made for much greater efficiency.

However, among the extensive range of new products and projected space experiments on board SPACELAB and SALYUT, there cannot fail to be some materials with potential applications, particularly in the field of semiconductors, supraconductors and magnetic and optical materials.

11. - It is possible that there will be similar developments in bio-engineering, an area in which the Russians in particular have conducted experiments. However, your rapporteur had no reliable information available on this subject.
12. - This chapter on space applications would not be complete without some mention of the idea, put forward in various quarters, that solar energy could be collected by means of orbital stations of photovoltaic cells and retransmitted to earth in the form of microwaves. Leaving aside the difficult problem of retransmission, the prospect of solar energy orbital stations ever becoming viable seems less and less likely. To achieve a station with the equivalent output of a conventional four-reactor nuclear power station would require a load of at least 30,000 tons in geostationary orbit, that is almost 10,000 launchings of the Space Shuttle. Nevertheless, this area of research has made possible the study of a number of general purpose technological developments. Furthermore, the fact remains that, even twenty years hence, the future cannot be predicted with any certainty.
13. - Markets and space

Space, then, is closely bound up with science, defence and commerce.

As far as science is concerned, a spirit of generosity prevails, frontiers are open and aggression does not prevent good relations from existing between the different world agencies. In the military sphere, however, secrecy and autonomy are the order of the day, of course.

As regards commerce, there are markets available and suppliers prepared to fight over them.

Two markets are already protected:

- the Socialist bloc countries,
- the American authorities.

But there is a vast free market stretching across the rest of the world: Europe, South America, Africa, the Arab countries, the Far East, Australia and the Pacific.

Your rapporteur was unable to find an in-depth assessment of how the world space market is likely to develop, even over the next ten years. Indeed, in a sector such as the manufacture of materials, it is difficult to gauge what is likely to happen. On the other hand, it can be predicted with some certainty that by 1990/1995 there will be between one and two hundred telecommunications satellites and approximate turnovers can be calculated on that basis.

The best forecast for the European space industry over the next decade would be in the region of at least ten thousand million EUA.

Rough estimates of the possible development of some markets will be found attached.

Three or four suppliers of space resources will share these markets between them, with America in the forefront, Russia operating in the confines of its own closed market, Europe attempting to challenge American supremacy and Japan entering the field.

CHAPTER III - THE WORLD AND SPACE

14. - Around the earth and in the solar system space is dominated by the USA and the USSR.

It was Russia who put the first satellite into orbit, America the first man on the moon. Venus is a Russian speciality, Mars an American one. Of more immediate interest to us, Russia dominates space applications in the Soviet bloc while American industry dominates the satellite market in the rest of the world. In addition both superpowers possess military space resources which correspond to their ambitions.

Away from the two superpowers and outside Europe,

- Japan has recognized the commercial possibilities of space and is currently equipping itself with the facilities which will eventually enable it to break into the market;
- China, India and Canada have made considerable progress towards self-sufficiency in their military or civilian needs;
- many countries in South America, Asia, Australia and among the Arab nations have recognized the potential benefits of space.

It is essential to look more closely at the activities of the main suppliers.

15.- JAPAN ON THE STARTING BLOCKS

After making extensive use of foreign techniques, particularly in the field of launchers, Japan now has an ambitious programme of its own. Its annual budget, in the region of 300 m EUA, will enable it to achieve long-term independence. The emphasis being given to space applications, earth observation and above all telecommunications, is evidence that the Japanese Government and Japanese industrialists are aware of the economic importance of space. The pattern followed by Japan has become a familiar one - it opens its doors willingly to technological cooperation and, once the relevant techniques have been acquired, withdraws to launch its own attack on world markets.

In addition to conventional activities like launchers, science and applications, the Japanese space programme also contains more adventurous projects such as space factories, manned space vessels, geostationary platforms and power stations.

To a great extent, these objectives depend on Japan's ability to develop launchers. It will soon be apparent, therefore, whether Japan is to become, like Europe with Ariane, a space power in its own right.

The current Japanese programme includes:

- in the field of science, the launching of three small astronomic satellites and a space probe 'Planet-A' which will study Venus and Halley's Comet;
- in the field of applications, the launching between now and 1990 of two technological satellites (ETS 4-3), a meteorological satellite, a geodesic satellite, three marine observation satellites (MOS 1-2-3) in cooperation with MBB (Germany) and two earth observation satellites LOS 1-2.

As for telecommunications, the programme already embarked upon (Mitsubishi is participating in Intelsat V) will continue with the launching of two satellites CS 2a and CS 2b, each with eight repeaters, and of two direct television satellites.

Finally, Japan is developing its own range of launchers, notably the H launcher, which by the end of the decade should be capable of putting loads of about 800 Kg in geostationary orbit - a relatively modest performance, of course. However, in the long-term, there is no reason why Japan should not aim to develop a mini-Space Shuttle.

The future Japanese programme seems fairly comprehensive and if their launcher is a success - and there is no reason to doubt that it will be - the Japanese will play an important role in space activities, probably specializing in miniaturization.

16.- RUSSIA IN CLOSED SPACE

Russia launches a satellite every five days. Having sent their hundredth man into space, the Russians are maintaining and - until the US Space Shuttle has proved itself - consolidating their position as leaders of the field in world space activities.

Although our information is incomplete, there is no doubt that Russia is involved in all aspects of space activity:

- Telecommunications, with a network of satellites providing links between the socialist countries;
- Earth observation, from manned space stations, and data acquisition;
- Science, with planetary missions to study Venus, Mars and shortly Halley's Comet, and with astronomic or geographical satellites;
- Space manufacture of materials, with the SOYUZ-SALYUT-Progress complex, a veritable 'space train' enabling long-term experiments to be conducted in the manned SALYUT station;
- Military and civilian space manoeuvres, a recent example being the guided destruction of a target satellite.

The USSR cooperates freely with the socialist bloc countries and some developing countries, particularly on satellite launchings, and also collaborates with the US, France and Sweden at scientific level. Recently it offered the opportunity for foreign astronauts, from India, France, Spain and Greece, to be sent into space. Nevertheless, for the moment the Russian market remains confined to the socialist bloc with no indication that it intends to enlarge this protected market by adopting a trade policy which would place it in direct competition with American, European or Japanese suppliers.

17. - America and the space shuttle

Despite the recent budgetary restrictions imposed by the Reagan Administration, the coming decade is seen as the beginning of a new era in America.

The era of the Space Shuttle

The distinguishing features of this new era are:

- space launches have become commonplace as a result of their increasing frequency and the simplification of 'integrations', a term which in space vocabulary refers to the assembly and linking-up of complex systems consisting of a satellite and a launcher;

- utilization of space vehicles has become flexible with the possibility of performing inspections and recovery and repair operations during orbit;
- the construction of large orbital space stations will open up possibilities for new applications.

The development of the Space Shuttle programme will soon be complete. But successive delays, increasing costs and the support given to the programme by the Defence Department and the Carter and Reagan Administrations has led to the neglect of other space projects. The 1981 and 1982 budgets make little provision for new programmes; the emphasis is being placed on the use of the Shuttle and every effort will be made to ensure that this programme is a commercial success.

The overall civilian and military annual space budget is in the order of ten billion dollars.

Scientific programme

Redefined with the advent of the new Administration, the American programme provides for a balance between the different research sectors: astronomy, the ionosphere, the magnetosphere, the study of the sun and planets, biology and space medicine. Nevertheless, the programme remains the most ambitious in the world and places its main emphasis on the use of the Shuttle and the manned SPACELAB station, and on automatic satellites such as the small 'Explorers' or the larger planetary space probes.

The priority areas of the wide-ranging programme are:

- planetary exploration;
- astronomy (space telescope, gamma ray observatory);
- solar study (SOT solar telescope).

Applications programmes are designed with the same regard for thoroughness:

- earth observation, including the study of renewable and finite resources on a global scale (oil, ores, water, land, crops) and the study of the environment (meteorology, oceans);

- telecommunications - this sector has been left to private enterprise since 1972, but in the light of the progress made by Europe, the US Government is now embarking on a research and development programme designed to maintain American superiority in this field, which is where the great majority of space markets are; a study of the possibility of launching satellites from the Shuttle at reduced cost is in progress;
- space manufacture of materials - if the processes being researched on board the Shuttle and SPACELAB prove practical and economically viable, the aim of the project's leaders is to achieve the automation of these processes and the remote control of the equipment.

The priorities of the American programme, then, are:

- to maintain an extensive programme of scientific research;
- to re-establish supremacy in the field of telecommunications;
- to maintain an aggressive technical and commercial policy based on the use of the Shuttle, with a view to eliminating or out-pacing competition from abroad, particularly Europe.

Despite the fact that the needs which users have expressed would require only a gradual development of the space programme, NASA's projects are aimed at providing new space services and a new type of astronautics, justifying and making worthwhile the use of the Space Shuttle.

18. A profound change is in prospect.

The most advanced area of research concerns the future of space telecommunications, which will continue for a long time to account for the major share of a market that America would like to manoeuvre to its own advantage. Telephone traffic is still the largest area of demand and will continue to occupy 75% of satellite capacity until the end of the century. But the present generation Intelsat V satellite, with its 24,000 circuits, could be succeeded by an Intelsat VII model with 320,000 circuits and of double the weight. There will of course be parallel technological improvements aimed at reducing the overcrowding of geostationary orbit in terms of both satellites and frequencies and at increasing the flexibility and performance of space systems.

The availability of new services, made possible by the size and power of satellites, could alter the situation considerably and the number of clients could provide an economic justification for the use of space stations rather than ground antennae. It is expected that by the year 2000 individual microreceivers will have been developed, fitted for direct telephony, alarm and surveillance systems and location.

But with the Shuttle NASA has the still more ambitious goal of establishing a genuine system of space operations, of which the essential elements would be:

- the SPACELAB orbital laboratory;
- RMS manipulator arm to remove or pick up loads from the Shuttle, to be supplemented by a work platform;
- on-board non-reusable motors enabling secondary satellites to be fired into the required orbit;
- the PSP module, a power-supplying solar panel service station, able to accommodate, for example, experimental units for the manufacture of materials, which could subsequently be recovered by the Shuttle;
- TDRS auxiliary liaison satellites, to replace the network of monitoring stations.

With the development of this 'orbital service', consisting of a service module operating in close proximity to the Shuttle, NASA plans to be able to maintain, recover - or possibly destroy - satellites in close orbit.

It is clear that this service module would only need to be harnessed to a transfer module to enable it to operate in any orbit, even geostationary.

Even more spectacular is the long-term project to construct giant orbital space stations with the help of 'space mechanics' (like those working at MBB in Germany or BADG in Great Britain). The possible use of such stations is undecided at present, though it could be industrial, and their sub-units would be assembled, supplied and unloaded by the Shuttle. There is no reason, of course, why further possible developments to the Shuttle itself should not be contemplated.

19. - All this, however, belongs to a still distant future.

Nevertheless, our world has been changed utterly - our horizons and our points of view have literally been transformed.

- One branch of astronomy has turned its glance away from the troubled surface of our planet;
- Aerial cartography will be supplanted by space cartography;
- Surface meteorological observation and conventional large-scale weather-forecasting are losing most of their significance;
- Maritime navigation now consists of putting questions to a satellite;
- The forecasting of harvests and, before long, the fixing of world commodity prices, will be performed from space;
- Antennae turned towards the sky can gather the data required to compile an inventory of the resources available to humanity from the earth, the atmosphere or the sun, and to make predictions about its material future.

Only the choices made by men and nations remain at ground level.

The value of space can no longer be doubted; the question is: does Europe have the means to meet the challenge it faces?

CHAPTER IV - EUROPE TODAY

20. - Resources

To implement its space programme Europe has at its disposal:

- the infrastructure and resources required to perform launchings (launchers, test ranges, tracking network) and orbital operations (earth station);
- the industrial capacity to produce launchers and satellites for scientific projects and space applications;
- the capacity to plan, prepare, design and test the different types of space equipment.

In addition to hundreds of probe rockets, Europe has placed 30 satellites in orbit since 1960, several of which are still in operation.

Within the framework of the ESA, Europe has both Community and national resources at its disposal, mainly in France and Germany, but also in Great Britain and several other countries.

- The launcher

Europe is on the point of using the Ariane launcher for its satellites and the American Space Shuttle to exploit the SPACELAB station, which it developed for NASA. It is also pursuing projects involving probe rockets and stratospheric balloons.

- Launching centres

The launching centre for the Ariane rocket at KOUROU is currently being extended to include a second test range and is, of course, the most important European installation.

Scout rockets are still launched at the Italian San Marco centre (Kenya) and there are launching centres for probe rockets in Norway (Andoya), Sweden (Esrange) and Spain (Huelva) and for balloons in the south of France (Aire-sur-Adour) and in Sicily (Trapani).

- Testing facilities

These are concentrated in Toulouse (CST), Nordwijk (ESTEC) and Ottobrun (IABG) and, for engines, at Vernon (SEP) and Lampolshausen (DFVLR).

The satellite control network consists of operations centres at Darmstadt (ESOC) and Toulouse (CNES).

Stations specializing in the perfection of individual programmes are spread over several different countries: the ESOC network at Redu (Belgium), Malindi (Kenya), Villafranca (Spain), Fucino (Italy) and Odenwald (Germany) and the CNES network at Kourou (Guyana), Pretoria and Toulouse.

Three large technical centres, ESTEC, CST and DFVLR, are responsible for implementing technical research programmes, drawing up programmes and, in the case of the CST, processing the data collected.

These various centres employ directly approximately 6,000 people in Europe (excluding industries, sub-contractors and associated laboratories).

21.- Programmes

The ESA's scientific programme is of a very high level.

- Four ESA satellites are in orbit:

Cos B	(gamma-ray astronomy)
ISEE	(sun-earth relationship)
IUE	(ultra-violet ray astronomy)
GEOS 2	(magnetosphere)

- Six programmes are in progress:

EXOSAT	(X-ray astronomy)
ST	(participation in the US space telescope)
ISPM	(participation in an international programme)
GIOTTO	(study of Halley's Comet)
HIPPARCOS	(Astrometry)

The ESA supplies the SPACELAB laboratory and participates in its use, conducting experiments in:

- medicine (the 'space sledge')
- manufacture of materials
- atmosphere physics.

This Community programme will be supplemented by the ROSAT X-ray satellite (Germany) and the bilateral German and American GALILEO programme (exploration of Jupiter). France is cooperating with Russia on an extensive programme including the exploration of Venus, a space probe to study Halley's Comet and medicine and materials physics programmes in SALYUT stations. The United Kingdom is cooperating with America in the field of X-ray astronomy.

As for earth observation, the ESA's two major achievements are the European METEOSAT programme and the Earthnet network. France (in collaboration with Belgium and Sweden) is constructing the SPOT satellite, due to be launched in 1984.

Germany has embarked on projects designed to use microwave technology to make it possible to see through clouds. France has become particularly skilled in the field of location and data acquisition with the ARGOS and SARGOS (search and rescue) programmes and the SARSAT project, which is the subject of multilateral cooperation.

In the field of telecommunications, the proposed L-SAT satellite, being developed under British supervision, is the continuation of the Agency series which has already seen the development of the OTS, ECS and MARECS programmes. France, meanwhile, is working on TELECOM 1 and by 1984 Germany and France will have direct television satellites, TDF and TV/SAT.

It should be said in passing that the rivalry between the TDF-TV/SAT and the L-SAT projects is to be deplored. Extensive duplication by the two programmes is placing resources which still could be used jointly, in needless competition.

A table summarizing the space activities of the principal members of the ESA will be found attached. The table also provides an analysis of the Agency's resources by member state and a breakdown of expenditure by programme.

It must be said at this point that there is no reason why the same industries who are involved in European projects should be excluded from participation in civilian or military national programmes.

France, for example, entrusted the construction of the TELECOM 1 satellite to Matra, which is associated with British Aerospace, a powerful company, all the more qualified to work on the project in view of its experience of supervising the European ECS and MARECS telecommunications satellite programmes.

22. . The industrial structure of Europe's space activities has evolved in the main from its early initiatives, which were fraught with difficulties.

Once the Agency had been set up, with its initial role of harmonizing space programmes, it was seen as necessary to re-balance industrial groupings. To this end, and in order to safeguard both the principle of competition and the individual interests of the states taking part, three consortiums were formed. Both their names and their development have been diverse. Today they are called COSMOS, MESH and STAR. Although their existence and their composition are still official as far as the Agency is concerned, they no longer correspond to any rigid structures.

On the one hand, two of the three only have a hard core, around which alliances vary, and, on the other, national restructuring in Germany and Great Britain has led to a single group belonging to two different consortiums, thereby causing realignments.

In reality, expediency, shared points of view, the complementary nature of their resources or an affinity between individuals have, without undermining official plans, resulted in more flexible, but probably more stable groupings such as EUROSATELLITE GMBH (German registered), SATCOM, GIE and ARIANESPACE S.A. (all French registered).

In addition, official bodies like the CNES or DFVLR may be granted 'integration' or even supervisory responsibilities for a satellite or a launcher.

23.- Achievements

After twenty years of space activities and without ever relying - unlike the superpowers - on military programmes, Europe has clearly achieved its first objective: it has acquired its own independent capacity to produce, launch into space and utilize space machines for the various types of applications already mentioned (telecommunications, earth observation, etc.).

The completion of the development phase of the Ariane launcher, the current European and national telecommunications satellite programmes, the success of the first European meteorological satellite METEOSAT and the promising progress of the SPOT earth observation satellite programmes are all evidence of this capacity as far as the present generation of applications and materials is concerned.

Today, of course, Europe must seek to reap the benefits of these achievements, to gain as large a share as possible of the extensive external markets discussed above, and to satisfy all of its own domestic needs.

There is widespread agreement on the three lines of action which must now be pursued. Efforts must be made to:

- improve by means of technological progress the efficiency of payloads placed in orbit;
- reduce the cost per kilogram of placing satellites in orbit, particularly geostationary orbit which is the main source of markets;
- increase the weight and volume of satellites that can be placed in orbit by Ariane launchers.

Reasonably favourable conditions exist for the European space industry to pursue these three lines of action.

The question remains whether such steps constitute an adequate response to the new technological challenge and whether they are capable of ensuring Europe's continual presence in space in the future.

CHAPTER V - A NEW VISION OF SPACE

24. - As Chapters II and III have demonstrated, the future prospects for operational space activities are changing.

Naturally, conventional launchers, of which Ariane is the latest model, and specialized telecommunications and earth observation satellites have a great and apparently unlimited future before them, and they require the kind of advance technology programmes that Europe is pursuing with a determination which must not be relaxed and a success which must be extended into the field of commerce, as Chapter IV indicated.

Yet already, unless we are careful, two limited natural resources are in danger of running out:

- the single geostationary orbit will soon be full to capacity;
- in space, radio wave bands will be in very close proximity to each other.

The management of these two resources will require not only international agreements and the organization of space networks, but also, in all probability, the placing of multi-purpose stations, several times heavier than present-day ones, into the equatorial orbit at an altitude of 36,000 Km.

Then, above all, there is the American Space Shuttle, ringing in a new technological era in space, with its capacity to place 30 ton payloads in low orbit and the prospects it offers for space construction, servicing in orbit and recovery operations, already demonstrated by the Soviet space trains and the Apollo-Soyuz experiment.

A new vision of space is needed, one capable of looking to the farthest horizons, which stretch far beyond the confines of our own millenary.

25. - Why a long-term policy is required

Your rapporteur believes that the present document should concentrate on the need for long-term planning for several reasons.

- Firstly, because Europe and the ESA, as we have just seen, have already given full consideration to their present and medium-term requirements, which are of an essentially technical and industrial nature, and there is no need for a resolution by Parliament to promote action which is already under way.

- Secondly, because this long-term vision is absolutely vital to the progress, the independence and the economy of Europe. The preceding chapters have elaborated this theme of progress in space activities because, as in any advance technology industry, properly-managed innovation is of paramount importance for prosperity, employment and civilization.

- It is worth remembering that, if Europe does not have its own capacities and its own programmes in vital areas, then its independence could be threatened.

Because of the lack of a European launcher, the Franco-German telecommunications satellite Symphonie, launched in 1974 by an American THOR-DELTA rocket, which is today enjoying a further lease of active life thanks to the remarkable stability it has shown, was not available for commercial use. The loss of the first operational communication satellite OTS 1, when the THOR rocket exploded on launching, has not been compensated. The AEROSAT navigation satellite programme, undertaken in cooperation with America, was developed along the wrong lines and finally abandoned unilaterally. Future scientific or industrial experiments on board the Salyut or the Shuttle, which are dependent on American or Russian hospitality, and joint applications programmes could be simply cancelled or postponed at any time either by a political decision by a new US Administration - the joint ISPM programme has recently suffered this fate - or by the barriers the Pentagon might raise to bilateral or multilateral industrial cooperation, or similarly as a result of an adverse political circumstance in the Soviet Union.

We must remember, therefore, that the value of this highly profitable technological bridge to the two Superpowers depends on the stability of its supports at either end and it must not be allowed to become the sole road to progress if Europe is to retain its independence in decision-making.

- There is no reason, moreover, why proposals for long-term commitments should not be made, for, as we have already seen, Europe has the necessary resources in terms of research, industry, manpower and basic cooperation structures.

It also has the financial resources, because it could easily double its space budget at a stroke, as EUROSPACE has pointed out¹:

- each European contributes no more to the space budget every year than the price of a cinema seat to see a science-fiction film, that is, half the amount contributed by a Japanese, and a tenth of that paid by an American, although it is true that half of that goes on defence programmes;
- it is less a question of whether Europe can mount a new space effort than whether it can survive on the inadequacy of its present investments in the face of competition which could soon become overwhelming.

But above all it is Parliament's duty to draw attention to the need for a long-term programme, because no-one else is in a position to do so.

- not the ESA, because even if its Director General proposes only a ten-year plan to the Council of the eleven Member States, he is liable to be reminded of a more immediate reality by several of the delegations. And, in any case, the most apt description of the Agency's policy is 'what can be done with 450 m EUA';
- not industrialists, who cannot be expected to embark on their own initiative on onerous long-term enterprises, when their main role is to manage current short-term projects successfully and to win markets;
- not governments - the European Space Conference has not met at ministerial level since 1977 and they appear reluctant to countenance long-term projects.

26. - Strategic objectives

- Given the long-term economic and strategic significance of space activities and in the light of the American programme, it is impossible to ignore the new technological and industrial challenge.

¹ EUROSPACE Association - long-term policy proposal, May 1980.

Three areas in particular must be looked at:

- the use of low-level space stations (at an altitude of 200-500 Km) to explore and develop new processes, particularly in the fields of metallurgy and bio-engineering;
- other applications, not yet clearly defined, using large space stations and techniques of assembly, maintenance and service in space, with or without direct human intervention;
- the exploitation of heavy earth observation and telecommunications satellites in geostationary orbit.

- The extent of European resources. Even if these were increased, a programme as extensive as NASA's would be out of the question. Although we cannot hope to cover everything, it is valuable to remain associated, however modestly, with programmes and ambitions such as those for the exploration of the solar system of the 'closer' reaches of the galaxy.

Equally, we must not allow ourselves to be side-tracked along roads with no foreseeable outlet.

The only sensible strategy for Europe is to continue developing current programmes which have a clear purpose and to strive in particular:

- to keep abreast of the key technologies of the future by a policy of constant review;
- to draw up immediately as complete a model programme as possible with a view to developing these technologies (which will be discussed below) and defining their potential use in space;
- to give Europe the capacity, by means of an adequate heavy launching system, firstly to implement the above-mentioned programmes and secondly to place reasonably heavy loads in geostationary or low orbit.

27. - The key technologies¹, whatever the precise technical objectives of tomorrow may be, are those which are compulsory stages of any development towards new space perspectives. Experts agree that the following technologies fall into this category:

¹ Some of the technical details given here are taken from a document drawn up for the CNES.

- Space rendez-vous

Space rendez-vous and docking with or without the involvement of a human pilot, are manoeuvres which the United States and the Soviet Union have thoroughly mastered. Automatic docking, demonstrated to good effect by the Russian 'PROGRESS' project, and the interconnection of electric and fluid circuits are techniques essential for the replenishment and eventual maintenance of a permanent space station.

- Electricity supply

Prospective applications in the fields of high-power telecommunications or the treatment of materials would require an electricity supply in the order of 10 KW, which is appreciably greater than that of present-day space vehicles (1 KW). We are not concerned with solar cell technology here, but the establishment of large-scale solar generators would pose new mechanical problems (positioning) and dynamic problems (rigidity) which must be overcome.

- Telemanipulation and robotics

The performance of space operations without direct human involvement presupposes the development of universal tools or of robots capable of performing the required actions in accordance with a pre-established programme or under the direct control of a ground operator. Europe has already made extensive developments in robotics for a variety of ground applications where direct human access is costly or impossible. The development of telemanipulation, remote control and intelligent robots is vital for the establishment of space systems which can be repaired, re-equipped, maintained and even modified during orbit, so as to give them an extended operational life comparable to that of industrial installations on earth.

It seems wiser, moreover, to exploit Europe's own skill in robotics rather than imitate the manned space flights already performed by others a long time ago. Nevertheless, it is possible that direct human presence, despite its heavy weight (1 man in space for 1 month = 1 ton in orbit), may prove advisable during the initial installation stage. Strictly speaking, Europe ought to be capable of this should it prove necessary if it does not wish to be dependent on one of the Superpowers for this facility.

Re-entry into the atmosphere and recovery

Most space applications missions (except those which are purely scientific) are carried out by non-recoverable space vehicles which are eventually destroyed in controlled manner after use in order to free their orbital position. But in the case of the manufacture of materials under weightless conditions, for example, the products have to be recovered from the space station. The recovery of space capsules, by means of the simplest technique of the aerodynamic braking of an unpiloted re-entry body, is one of the key technologies for this type of programme. A further reason for developing recovery techniques is the economic advantages of a re-usable stage, which need not necessarily be the last one. It is the role of technicians to suggest the most suitable compromises.

28. - A heavy launcher

The Ariane series of launchers, which are equipped for launches into geostationary orbit, can send up satellites of the following approximate respective weights:

- 1,000 Kg for Ariane I
- 1,200 Kg for Ariane II (1983)
- 1,400 Kg for Ariane III (1983).

This is already a considerable performance and it covers the requirements of the INTELSAT V international telecommunications programme, which is a client of Ariane and the Shuttle (and meanwhile of the revived conventional ATLAS-CENTAUR programme).

Yet already the INTELSAT VI satellite planned for 1985 exceeds these capacities in terms of weight and also of diameter, which conditions the dimensions of Ariane's cap.

The Ariane IV project, the latest in the series and capable of placing 3,800 Kg in 'transfer orbit' and 2,100 Kg in geostationary orbit, exists and could be ready in time. A decision on Ariane IV can no longer wait. The Ariane IV project is included here in this 'long-term' report because its development would make it possible to conduct experiments relating to all the techniques described in the previous section (27).

Essentially, however, the aim of the present report is to look further into the future and so beyond the Ariane series, strictly speaking.

It is not feasible to confront a new technological challenge, even if only competitive aims on a European scale are chosen, without being able to more or less double the capacity of Ariane IV, that is to place

10,000 Kg in low orbit

6,000 Kg in transfer orbit

3,000 Kg in geostationary orbit.

This last figure is only slightly lower than the potential of the Space Shuttle, which, despite its capacity to place 30 ton loads in low orbit, is less adapted proportionally for geostationary orbit, which, as we have seen, is an important source of markets.

Projects for heavy launchers also exist, but they are less clearly defined. Although they go under the names of ARIANE V or FEL, in reality they are the beginning of a new series.

Obviously, it is not the task of a rapporteur to draw up new programmes, but it is clear that a vehicle of this type requires the immediate development of a cryogenic motor (liquid hydrogen and oxygen) of superior power and pressure to the third stage of Ariane. What is also clear is that it is vital to embark on this study with the utmost urgency if the launcher is to be available by the beginning of the next decade.

This, then, with one or two possible variants, is the foundation of the vast programme required if Europe is to maintain the world status it has fought so hard to acquire.

29. → Adaptation of structures

There is no doubt that the development of a new and large-scale project requires the rearrangement of existing structures and an initial examination of their capacities.

30. The European Space Agency comprises eleven Member States, of whom three (Switzerland, Spain and Sweden) do not belong to the EEC, while two members of the Community (Luxembourg and Greece) do not belong to the Agency. The Agency also has associate members (Austria and Canada) and an observer member (Norway).

The Agency provides:

- on the one hand, its general budget (13%) and its compulsory programmes (mainly scientific), from a basic budget provided by the Member States as a percentage of their GNP and decided by the Council on the principle of 'one country - one vote'; contracts are distributed on the basis of the 'fair return' rule, with a minimum of 80%;

- on the other hand, the development of optional programmes, for which Member States decide their own contributions; the ARIANE and SPACELAB programmes are in this category.

Overall in 1980, 51% of expenditure went on these two programmes while 51% of revenues came from France and Germany and 20% from Great Britain and Italy.

With its own installations, its receiving stations, the Kourou launching range and the cooperation between the national centres, the Agency has all the necessary technical resources for developing the most advanced programmes.

By virtue of its structure its most suitable role is:

- as a European forum for planning, recording of new technologies and designing of large-scale joint projects;
- as a technical body responsible for a large number of scientific programmes and for the development phase of application programmes.

Because of its limitations it is ill-suited to effective industrialization and commercialization.

It is well within the province of the Agency, therefore, to establish the technical basis of a vast project, of which this report proposes the main outline. In addition to its own ideas, it can gather and stimulate proposals from research centres and industries. Its budget and its mode of operation, however, do not permit it to take the initiative and to obtain the agreement of its Council unless a firm political decision has already been taken by the protagonists in space and finance.

But it is also necessary to consider whether the industrial structure is capable of dealing with this new European dimension.

31. - In fact, in the successive forms in which they have evolved through a process of natural selection, the Agency, the official national bodies and the European industries have demonstrated their capacity to devise and carry through advanced programmes as far as the pre-operational stage, particularly in the field of science.

But now that it is a question of facing up to international competition, so far mainly American (Hughes, RCA, Ford, TRW) but likely to be also Japanese in future, the fragmentation and dispersion of European capacities and decisions can only lead to it losing on the markets what it has achieved in the workshops.

The time has clearly come to extend our industrial and commercial cohesion. The example of Airbus-Industrie in the aeronautics sector shows what can be done.

In short, it is the role of industrialists to form a union amongst themselves, more extensive in terms of members but more concerted in its action, along the same lines as the Economic Interest Group (GIE) formed by Airbus-Industrie.

It is the role of the Agency, by means of its contracts which still account for a large share of the turnover in space activities, to promote a more advanced structure.

Sub-contracts should be distributed as effectively as possible to this kind of body, as the smaller members have greater opportunities, at the industrialization and commercialization stages, in competitive specialization than in the pursuit of a fair return, which imposes constraints on the research and development phase.

But the Airbus is a product with a vast programme of its own, whereas space programmes remain to a large extent diverse.

Naturally, no-one doubts that everyone must have the freedom to choose the best available partner, even outside of Europe, for separate programmes or regional projects.

Equally, no-one doubts that coherent industrial strength can only be achieved in the context of a major project, financed by European governments in agreement, above and beyond their normal participation in current Agency programmes.

32. The role of the EEC

Although membership of the Agency and of the EEC does not strictly overlap and the two organizations have separate budgets, it is clear that the Community must remain associated with the major European space projects. That is why the Committee on Energy and Research, on the strength of the motion for a resolution (PE 70.610 Doc. 1-764/80 of 19 December 1980) and the report (PE 56.322/fin. Doc. 2/79 of 30 March 1979) requested and obtained authorization for an own-initiative report on this vital subject. That is why your rapporteur has devoted his attention to those programmes which are essential for the long term.

Of course, the Commission must also lend its support by drawing up proposals designed to stimulate political decisions by the Member States and to obtain financial support from outside the Community's budget, from the European Investment Bank, the new Community instrument.

CHAPTER VI - CONCLUSION

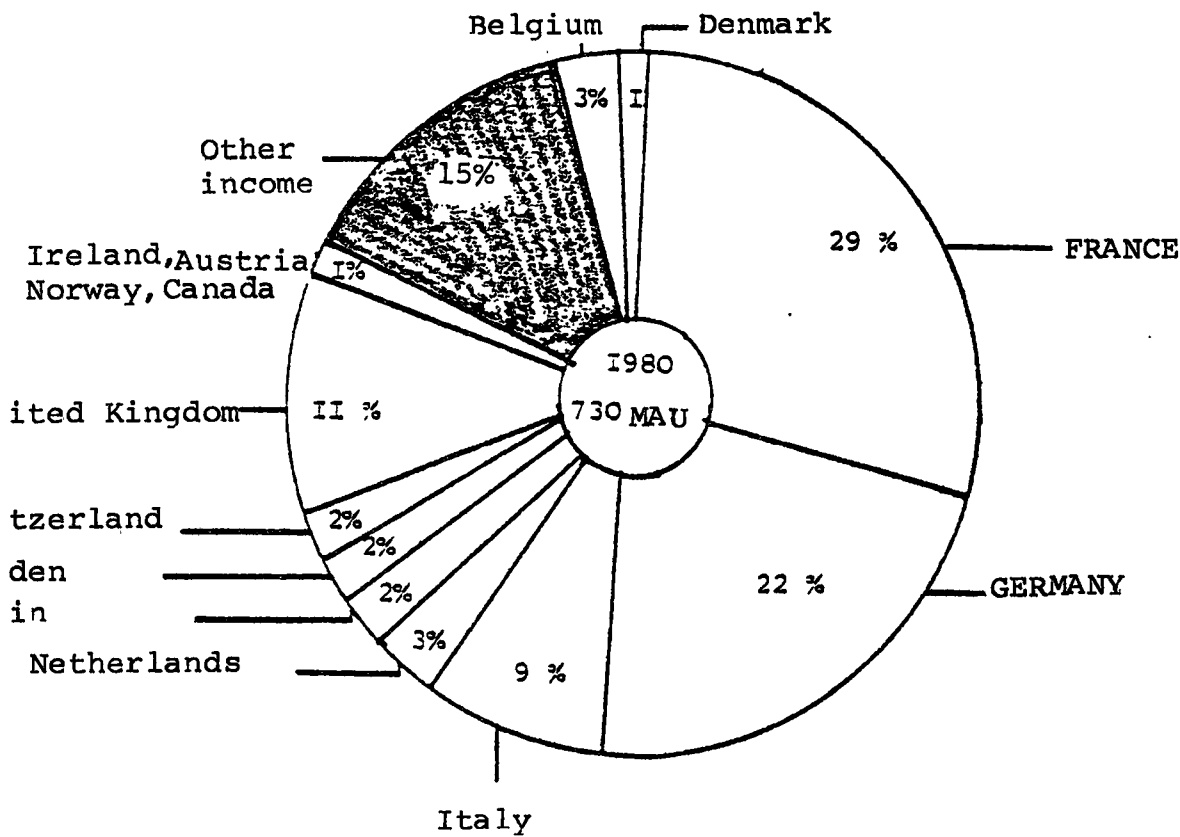
33. — Leaving precise objectives to technicians and ways of achieving them to administrators and industrialists, the scope of the present report is to call for the development of the great design outlined in Chapter V which will enable Europe to maintain its future presence in space and to consolidate its competitiveness on world markets.

It is now the task of those governments who possess the vision and the depth of resources to take the initiative in deciding the future.

TABLE I

EUROPEAN SPACE AGENCY :

CONTRIBUTIONS OF MEMBER STATES
1980

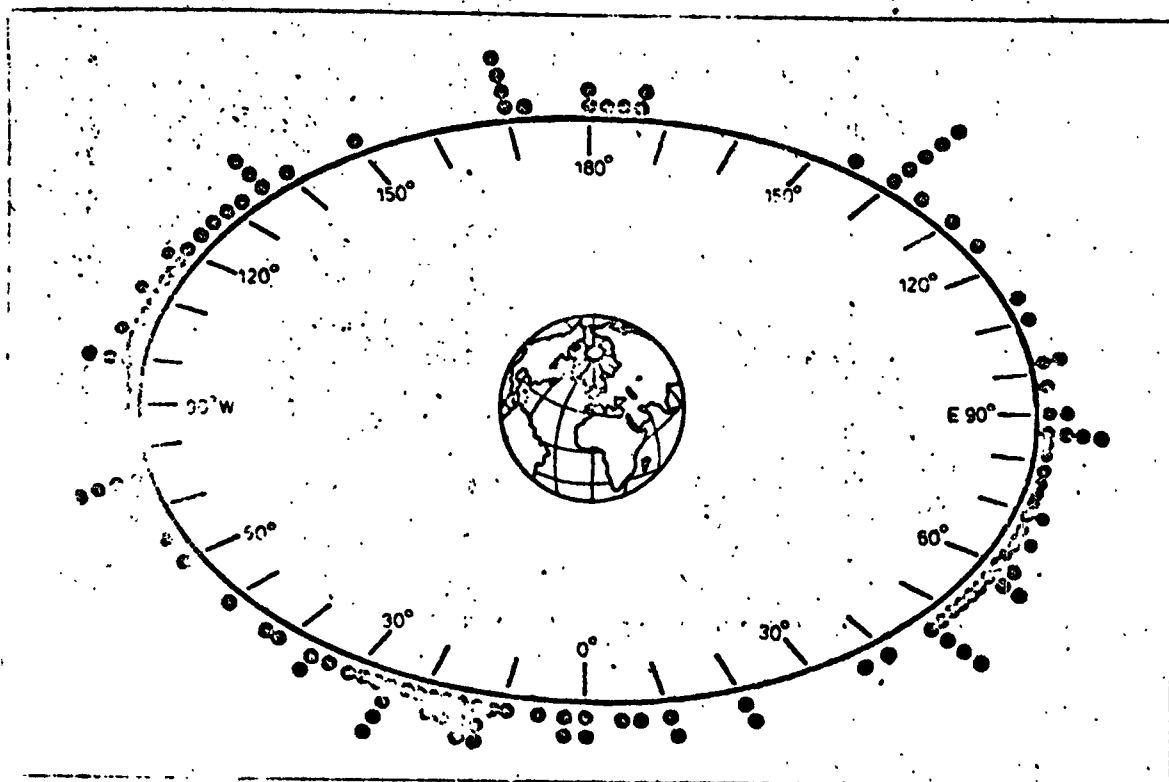


MOTION FOR A RESOLUTION (Doc. 1-764/80) tabled by Mr CALVEZ
pursuant to Rule 25 of the Rules of Procedure on European
space policy

The European Parliament,

- having regard to its resolution of 25 April 1979, and in particular paragraphs 2, 5, 6 and 7 thereof,
 - whereas only cooperation between the Member States will allow Europe to have a comprehensive space policy, either in the form of bilateral or multilateral agreements or within the framework of the European Space Agency,
 - whereas the introduction of an independent space policy represents for Europe one of the options for an independent industrial policy,
 - trusting in the competence of the organizations and undertakings involved in the 'Ariane' programme,
 - having regard to the industrial, economic and commercial benefits which the Community could derive from cooperation in the field of space extending beyond existing programmes,
 - having regard to the exemplary success of European cooperation in the field of aircraft construction,
1. Calls on the Council, the Commission and the governments of the Member States to draw up and implement a programme for a comprehensive space policy;
 2. Instructs its appropriate committee to study the bases thereof, with particular reference to:
 - (a) the development of the 'Ariane' group of rockets to increase the payload, by effective industrial decisions,
 - (b) the commercial development of the same 'Ariane' group,
 - (c) commissioning studies on a large-scale space station with a view to industrial exploitation of space,
 - (d) commissioning studies on a powerful European launcher for use in the 1990s, possibly, though not necessarily, as a continuation of the present launcher programme,
 - (e) immediate consultation on the abovementioned topics with the European Space Agency and, through that intermediary, the European industrial consortia;
 3. Instructs its President to forward this resolution to the Commission, the Council and the governments of the Member States.

DISTRIBUTION OF RECOGNIZED POSITIONS IN GEOSTATIONARY ORBIT



SOURCE ESA
BULLETIN No. 25
FEBRUARY 1981

OTS 2	Pre-operational Telecommunications	ESA	MESH Consortium	BADG (ex-HSD)		THOR-DELTA 1978 (OTS 1 destroyed in 1977)
ROSAT/SPAS	X-ray astronomy with SPAS platform	GERMANY		MBB		SHUTTLE SPAS- ROSAT 1982
SIRIO 2	Meteorological Telecommunications	ITALY/ ASC		CNA		ARIANE 1982
SPOT	Earth Observation	FRANCE	Sweden + Belgium	MATRA	1979	ARIANE 1984
SYMPHONIE	Experimental Telecommunications	FRANCE/ GERMANY	Aerospatiale/ MBB	CNES/ DFVLR		THOR-DELTA 1975
ST (Space Telescope)	Astronomy - small objects	NASA/ASE (15%)	DORNIER - MATRA - ETCA	BADG	1978	SHUTTLE 1984 ?
TDF 1/TV	Direct television	GERMANY/ FRANCE	MBB - AEROSPATIALE THOMSON	EUROSATEL-1979 LITE		ARIANE 1984
TELECOM 1	Telecommunications (6 satellites)	FRANCE	BADG - AEG - SEP- SNIA VISCOSA	MATRA	1979	1985 sq
VENUS/HALLEY	Exploration of the solar system	USSR/ FRANCE	CNES/CNRS	INTER- COSMOS	1980	1984
VIKING		SWEDEN/ ESA		SAAB- SCANIA	1980	ARIANE 1984 (with SPOT)

IRAS	Infra-red Astronomy (3 satellites)	NASA/ Netherlands	FOKKER - PHILIPS SIGNAAL	NASA	1977	THOR-DELTA 1981
IRIS	Infra-red Astronomy	NASA/Italy	CNA-SNIA-VISCOSA	NASA	1979	SHUTTLE ?
ISEE 2	Magnetosphere Sun-Earth Relationship	ESA			1977	
ISPM	Ex-ecliptic solar probe (2 satellites)	NASA/ESA	Star Consortium	DORNIER	1979 ¹	SHUTTLE 1985 ?
ITALSAT	Pre-operational Telecommunications/TV	ITALY	?	?	1981 ?	?
IUE	Ultra-violet ray astronomy	ESA				1978
L-SAT	Telecommunications/TV (3 satellites)	ESA (without France and Germany)		BADG	1980	ARIANE 1985/86
MARECS	Maritime tele- communications (3 satellites in coordination with 3 Intelsat satellites)	ESA	MESH Consortium	BADG	1978	ARIANE 1981 sp
METEOSAT 2	Pre-operational meteorological observation con- tributing to the world weather watch (3 to 5 satellites eventually)	ESA	Cosmos Consortium	AERO- SPATIALE/ MBB	1975	ARIANE 1981

¹ Cancelled by NASA 1981

TABLE VIII

EUROPEAN SATELLITES - PROGRAMMES AND PARTICIPATION

NAME	OBJECTIVE	Initiative	PARTICIPATION	SUPER-VISION	DATE DECIDED	LAUNCH
COS-B	Gamma-ray telescope	ESRO/ESA	Cesar Consortium	MBB		THOR-DELTA 1975
ECS	Operational telecommunications (5 satellites)	ESA/ EUTELSAT	AEG - ERNO - MATRA - SAAB - SELENIA	BADG	1978	ARIANE 1982 (ECS 1 and 2)
ERS	Operational earth observation	ESA	(Use of SPOT platform)	?	1981 ? ERSI Ocean ERS2 earth	ARIANE 1986
EXOSAT	X-ray astronomy (very elliptical orbit)	ESA	Cosmos Consortium	MBB	1978	ARIANE 1981
GALILEO	Jupiter probe	NASA	MBB	NASA	?	SHUTTLE
GEOS 2	Magnetosphere	ESA	Star Consortium	BADG		THOR-DELTA 1978
GIOTTO	Study of Halley's Comet (GEOS vehicle)	ESA	Star Consortium	BADG	1980	ARIANE 1985
HIPPARCOS	Astrometry	ESA	?	?	1980	ARIANE 1986
INTELSAT IV	Telecommunications	INTELSAT	BA-THOMSON-AEG-ETCA CONTRAVES-SELENIA	HUGHES		1971 sq
INTELSAT V	Telecommunications (8 satellites)	INTELSAT	Cosmos Consortium	FORD	1975	ATLAS-CENTAUR- SHUTTLE -ARIANE 1980 sq

TABLE VII

ANALYSIS OF THE WORLD MARKET FOR ALL SATELLITES

	<u>until 1990</u>	<u>1990/1995</u>	<u>Total to be launched</u>
Telecommunications	50	50	100
Television	20	30	50
Earth Observation (including Meteorology)	20	20	40
Scientific Satellites	40	30	70
TOTALS	130	130	260
(not including USSR, China and military satellites)			including: 180 in geostationary orbit 80 in low orbit
Ariane launchings	55		

TABLE VI

ESA Exec. 79 (3)

ANALYSIS OF THE TELECOMMUNICATIONS SATELLITE MARKET UNTIL 1995

I - Number of satellites (Source ESA)

	Forecast for European large satellites		Satellite requirements on the free world market	
	Minimum	Number expected	Large satellites	Small satellites
European service-fixed network	6	9	9	14
European service-Radio-Telecommunications and TV	13	19	26	26
Intelsat	2	8	26	26
Mobile network	2	4	7	10
Non-European regional and domestic	2	10	45	71
Total	25	50	113	147

II - Turnover (Source EEC/Industry) 1984/1994

Average cost of a satellite	50 MAU
Average cost of a launching	25 MAU
Average cost of a system (2 satellites + 1 replacement)	200 MAU
Direct market	10,000 MAU
Indirect market	50 to 100,000 MAU

TABLE V

BREAKDOWN OF THE STATES' SPACE BUDGETS FOR 1980

I.	<u>MEMBER STATES OF THE EUROPEAN SPACE AGENCY</u>					
	COUNTRY	E.S.A.		BILATERAL	NATIONAL	TOTAL
		<u>EUA</u>	<u>NATIONAL CURRENCY</u>			
	FRANCE	226 M	1.295M FF	97.09M FF	682.49M FF	2074.58M FF
	GERMANY	170 M	446M DM	40M DM	210M DM	696M DM
	UNITED KINGDOM	82 M	52M £	£ 1M	£10.50M	£ 63.50M
	ITALY	18.3M	87.964M Lire	-	-	-
2.	<u>NASA AND OTHER AMERICAN GOVERNMENTAL AGENCIES</u> (military and classified expenditure not included)					
	TOTAL	4,327 MILLION \$ US				
3.	<u>JAPAN</u>					
	643 MILLION \$ US					
4.	<u>INDIA</u>					
	45 MILLION \$ US					

TABLE IV

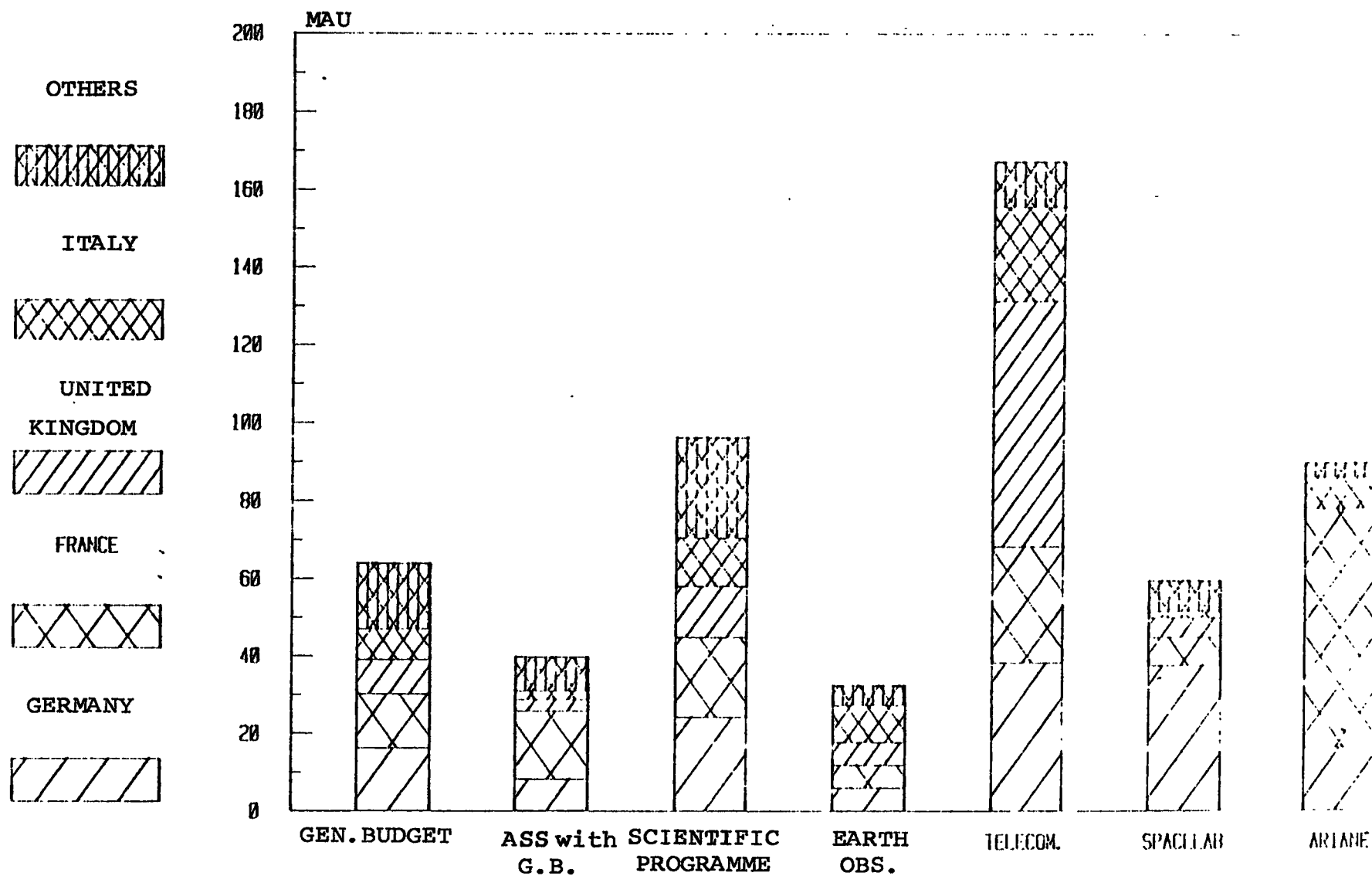
AMOUNTS RECEIVED BY CONTRACTORS OF THE EUROPEAN SPACE
AGENCY IN THOUSAND AU FROM 1 JANUARY 1972 to 30 SEPTEMBER 1980

COUNTRY	COMPANY	AMOUNT RECEIVED
F	SEP	258 205
D	ERNO	231 448
F	SNIAS	166 165
GB	BADG/HSD	139 666
F	MATRA	118 441
D	DORNIER	116 324
D	MBB	83 847
D	AEG-TFK	75 473
I	AERITALIA	59 300
GB	MARCONI	48 061
F	THOMSON-CSF	43 608
B	ETCA	40 261
F	AIR LIQUIDE	38 893
GB	BADG/BAC	35 118
NL	FOKKER	34 127
I	SELENIA	33 305
D	MAN	27 092
F	CNES	26 612
B	BTM	26 092
GB	ICL	21 818
E	SENER	21 625
I	MONTEDEL	19 581
I	FIAR	19 560
B	SABCA	18 315
S	SAAB-SCANIA	18 258
F	SODETEG	16 790
D	SEL	16 408
E	CASA	16 343
CH	CONTRAVES	15 916
D	SIEMENS	15 013
D	DFVLR	14 820
DK	ROVSING	13 717
I	TELESPAZIO	11 428
I	SNIA-VISCOSA	11 130
I	MICROTECHNICA	10 502
D	IABG	9 966
E	INTA	9 795
CH	CIR	9 495
GB	RCA	9 084
S	ERICSSON	9 059
F	SODERN	8 834
I	OFFICINE GALILEO	8 371
DK	KAMPSAX	8 208
F	CII	8 078
F	CIMSA	7 842
F	INTERTECHNIQUE	7 625
D	ELEKLIFT	7 570
F	SGE	6 737
S	VOLVO	6 628
F	SEEEE	6 270

TABLE III

MEMBER STATES' CONTRIBUTIONS BY PROGRAMME

1981 BUDGET



APPROXIMATELY 603 MAU (850 M\$)

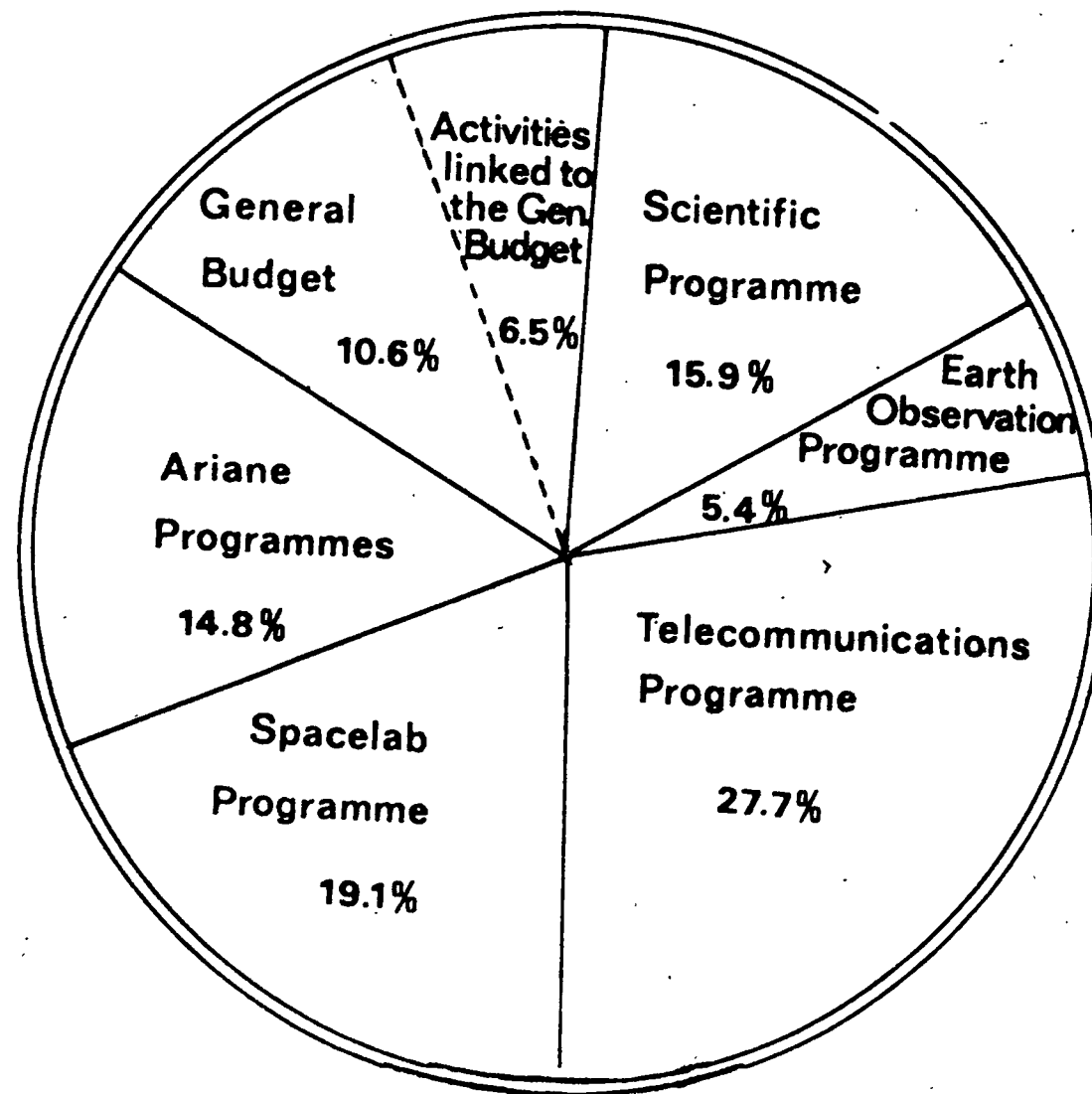
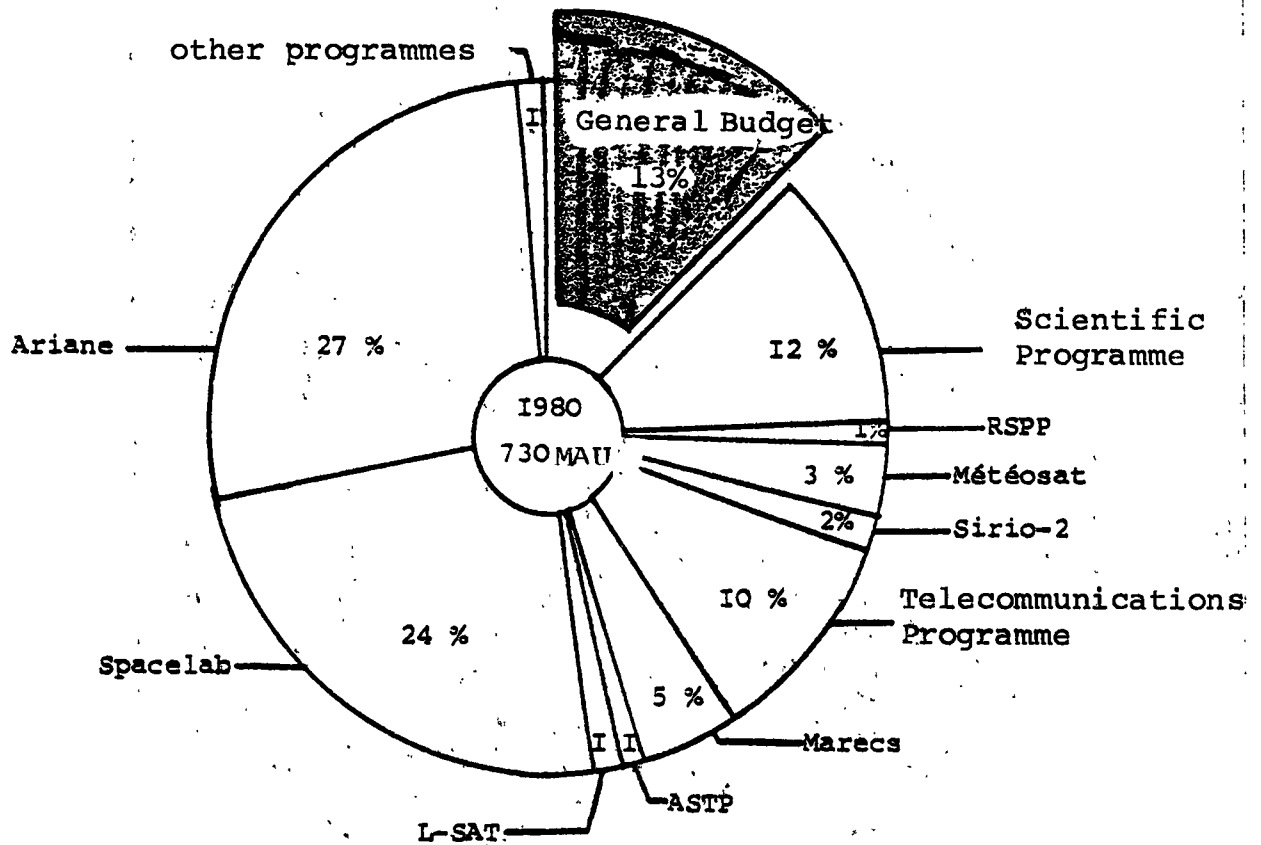


TABLE II

EUROPEAN SPACE AGENCY ::

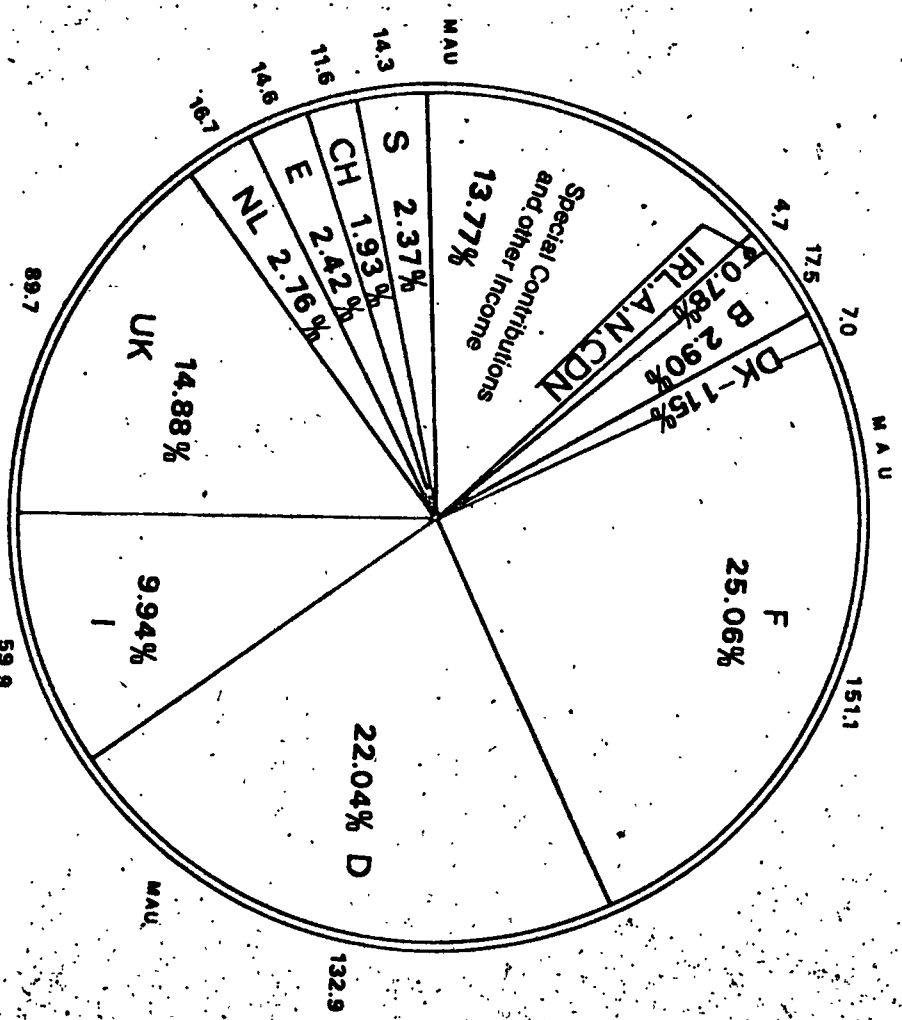
BREAKDOWN OF EXPENDITURE BY PROGRAMME

1980



BUDGET FOR 1981 **INCOME FROM MEMBER STATES AND OTHER SOURCES**

APPROXIMATELY 603 MAU



(FEBR. 1981)