LET US MAKE MORE SPACE FOR OUR DEFENCE

STRATEGIC GUIDELINES FOR A SPACE DEFENCE POLICY IN FRANCE AND EUROPE

Foreword

ECPAD

Let us make more Space for our Defence

To ensure its security as well as its autonomy in decision-making and assessment, France needs to have crisis awareness and analysis capabilities together with the means required to carry out coalition operations.

In this respect, space assets play a critical role, as demonstrated during recent conflicts. Such assets enable the countries that possess them to assert their strategic influence on the international scene and to significantly enhance their efficiency during military operations. Space control has thus become pivotal to power and sovereignty, and now involves stakes comparable in nature to those of deterrence during the 1960's.

Today, France possesses real and significant space assets. The 2003-2008 Military Programme Law provides for ambitious programmes and through the development of demonstrators, contributes to preparing our future capabilities and developing our technological and industrial base.

Yet, we now need to go further down this road and prepare the guidelines for our Defence Space policy during the next decade.

Therefore, I entrusted French Ambassador Bujon de l'Estang with the chairmanship of a working group on the strategic directions of Defence Space Policy (GOSPS). The aim was to draw from the analysis of the developments in the strategic context, to anticipate which security and defence space capabilities will enable our country to guarantee its strategic autonomy and meet its key requirements.

The work of the GOSPS has confirmed the increasing significance of Space at both the military and political levels, whilst demonstrating its role as a catalyst likely to promote the emergence of a European Defence. To meet the whole range of Space requirements, the GOSPS deemed it necessary to double the French economic effort alongside similar efforts at the European level.

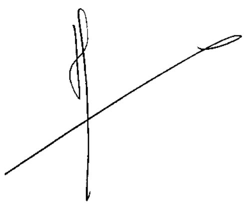
I have asked the MoD staff to present the key issues of the detailed and partly classified report that the GOSPS completed at the end of 2004 in the attached public document. This document is intended to be used to promote a dialogue and strategic analysis between the civilian, military, industrial and institutional partners in both France and Europe.

Increasing our national effort by 50% - in order to reach an annual budget of M€ 650 – and undertaking similar efforts at the European level, while resorting to European cooperation and dual-use as much as possible, will enable us to complete a first milestone within the framework of an ambitious European Space policy.

A new impetus in Defence Space policy, in both France and Europe, is thus within our reach within the scope of the next Military Programme Law.

Space control stands as a stake pivotal to the future. Therefore, it should be fully included in the drawing up of our future Defence strategy. Let us now make more space for our Defence.

Michèle Alliot-Marie
Minister of Defence



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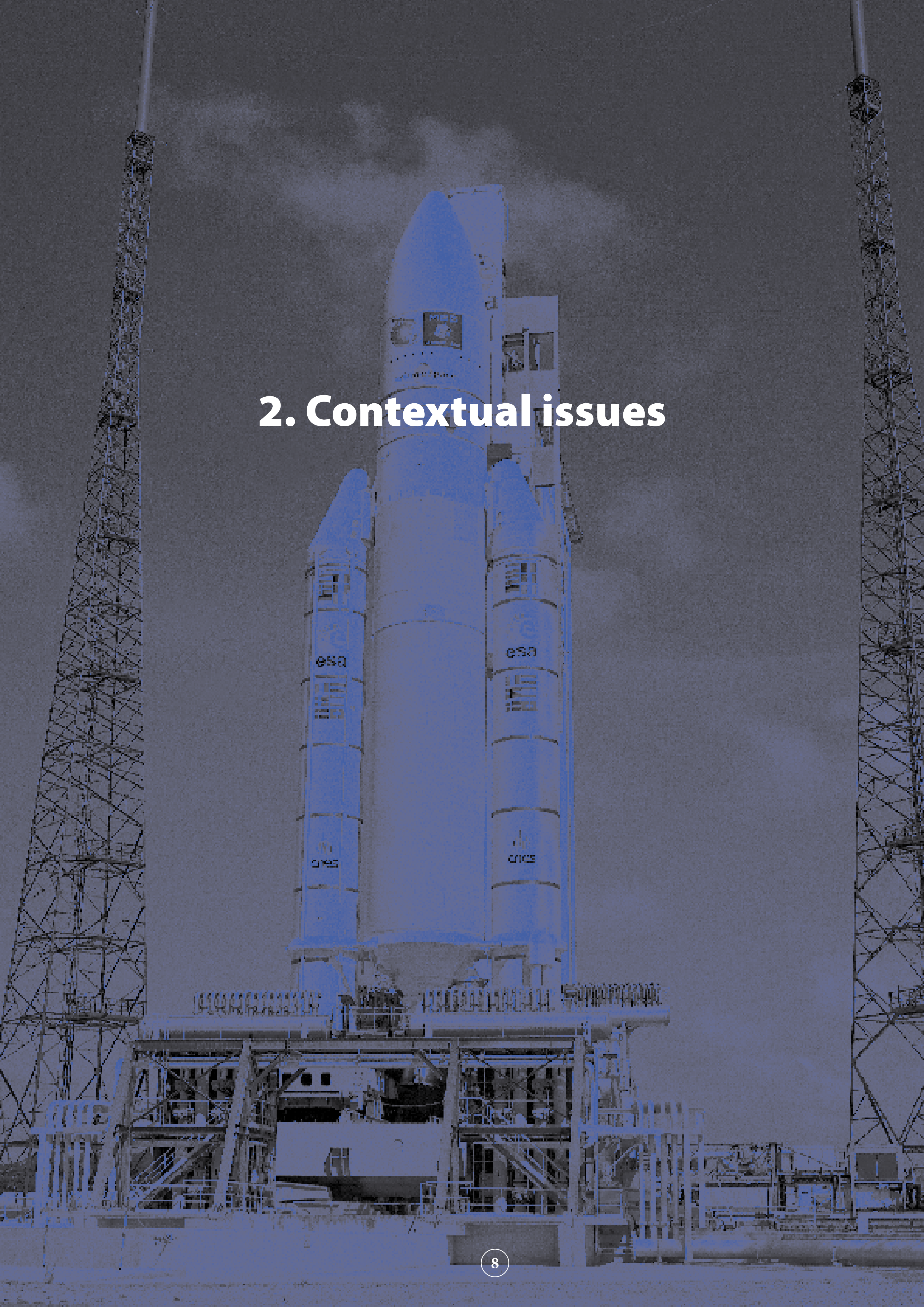
1. Introduction

At the Minister of Defence's request, a working group to examine the Strategic Directions of Space Defence Policies (GOSPS), chaired by French Ambassador François Bujon de L'Estang was created in October 2003. This group was entrusted with the task of conducting an analysis of key defence and security space capabilities in today's and tomorrow's strategic contexts. The conclusions of the GOSPS were presented to the Minister of Defence at the end of 2004. They present a comprehensive range of proposals aimed at strengthening French military space capabilities.

The GOSPS compiled its report following extensive discussions with senior civilian and military officials. The document demonstrates the growing significance of space, at both the military and political levels for both France and Europe. It places emphasis on the role that space should play, as a catalyst in enhancing the effectiveness of Defence resources and as a unifier in the emergence of a European Defence.

The whole range of detailed proposals drawn up by the GOSPS are included in a classified document that stands as a reference for forthcoming programming work. The present document is neither a programming exercise, nor a league table. It aims to update and make available the key issues of the directions presented in the GOSPS report, in order to contribute to a dialogue among all civilian, military, industrial and institutional partners, in both France and Europe.



2. Contextual issues

2.1. DEFENCE MISSIONS AND MODES OF ACTION

In a world in which threats (terrorism, trafficking in sensitive materials and technologies, weapons of mass destruction, organized crime) are increasingly dispersed, the missions of the armed forces consist of preserving the fundamental interests of the Nation, contributing to defending and securing the European and Mediterranean[1] airspaces, and promoting peace and the respect of international laws.
To achieve these missions, the armed forces:

- must have capabilities of situational awareness, planning and action, so as to preserve France's strategic independence, while being able to intervene, if necessary, at all levels (including that of "framework-nation"), whether in NATO Coalitions, EU Coalitions or autonomously;
- must have projection capabilities (deployment and support) enabling them to intervene far from the national territory and sometimes at very short notice;
- act within the scope of a dialogue among the national Ministries, in order to ensure the protection of the population, national institutions and territory;
- arrange for implementing the overall concept of network operations, aimed at providing a real-time sharing of all relevant, useful information among all operators.

The intelligence services fulfil missions that fall within the scope of two major areas:

- on the one hand, they carry out continuous strategic surveillance, aimed at providing the civil and military authorities with relevant information for anticipating crisis situations and implementing actions in the economic or diplomatic areas, or in terms of military deployment;
- on the other hand, in support of action strategies, they contribute to assessing crisis situations, as well as to planning and conducting operations.

The reliability of the information collected implies a control of the whole process of intelligence gathering, collection, fusion and processing, although the information involved may not always be the same, in essence or because of the level of details required.
The armed forces and intelligence services now use space assets to carry out all these missions. However, they must be able to work without such assets.

2.2. THE PLACE OF SPACE IN TODAY'S DEFENCE ARENA

Satellites enable us to see, listen, communicate, locate and synchronize information at the global level and with a permanent availability. Therefore, they have become a major asset in information control and in the phases of situation awareness, preparation and action. They also enable us to make the best use of resources to gain optimal military efficiency.
Space permits rapid action globally and independently of third parties. Space assets have the advantage of being non-intrusive, non-coercive and non-oppressive: they have the peculiarity of operating within an open and free environment, where there are no sovereignty constraints. These assets allow autonomous access to any location around the world, quickly, in secrecy and repeatedly.
Apart from the traditional Space powers – especially the United States, who are involved in a genuine revolution in the art of warfare in which space plays a critical part – there are more and more countries (more than thirty nations including China, India, Japan, Brazil, Algeria, Egypt, Thailand etc…) that have committed significant efforts to obtaining space assets for security purposes.
In Europe, an increasing number of nations (in particular France, Germany, Italy, Great Britain, Spain, Belgium and Greece) are well aware of the stakes and have launched real initiatives. Today, there is a consensus in Europe[2]: the usefulness of Space for defence purposes is no longer questioned.

Over the years, the use of space assets – initially considered as a way of meeting strategic requirements – has developed to become increasingly integrated into operations, from the highest level of command to the operational theatres. Indeed, the new concepts of operation demand real-time control of a variety of information and a swift analysis of the desired effects.

[1] See "The EU Security Strategy Implication for Europe's Role in a Changing World", 12 November 2003: the EU must contribute to stability and adequate governance in its immediate neighbourhood. To this end, the EU must promote a circle of well-governed countries in Eastern Europe and near the Mediterranean Basin, with which we should have close relations.

[2] • «White Paper on Space», European Commission (27 November 2003)
• «ESDP and Space» (16 November. 2004)
• «Generic Space System Needs for Military Operations» (endorsed by the EU Military Committee on 7 February 2006)

EXAMPLES OF OPERATIONAL USES OF SPACE ASSETS

Today, military operations are designed in accordance with four phases. These phases follow one another in a circular-process (known as the OODA[1] loop). Initially, the theatre and its players are Observed; following that, the information enables the command to Orient the action, a Decision to act is then issued and finally, the Action takes place. The result of the Action is then observed, and the whole process is repeated.

The aim is to complete each of our loops more rapidly than a potential enemy. There are many types of loops, different in nature and with different durations, from the strategic to the tactical level.

Speeding up the whole process involves two prerequisites:

- **First and foremost, the provision of broadband connections is necessary for information exchange. During the 1st Gulf War, the Coalition Forces had access to a total of 100 Mb/s. In Afghanistan, broadband capabilities increased by a factor of eight, and in Iraq, by a factor of eighty.**
- **It is essential to be able to Spot locations, static or moving objects, troops and threats, within a reference space to an accuracy of a metre or less, to perform data fusion, to provide three dimensional sub-metric resolution and eventually to conduct real-time continuous surveillance.**

Between the two Gulf wars, the Art of Warfare has rapidly evolved . The aerospace sector has now become a critical-factor in assuring success.

[1] Observe, Orient, Decide, Act.

2.3. AN INCREASINGLY ACCESSIBLE AND AFFORDABLE SPACE

A trend is now emerging towards a significant improvement in the cost effectiveness of space assets. The acquisition of satellites has become affordable for many countries.

The lessons learnt from the processing of the first in-orbit systems, as well as the improvements in the technologies employed, have led to significant enhancements in the performance of the services provided in the fields of communications (where within ten years, capabilities have increased by a factor of ten for the same cost) and in Earth observation (multiplication by a factor of five of the in-theatre imaging capabilities, the ability to provide identification capabilities due to a very high resolution, and reduction of revisit times with halved costs thanks to smaller and more flexible satellites).

A number of missions that hitherto were performed on large platforms, are being or will be pursued using significantly smaller satellites – that might be part of new architectures (e.g.: swarm flights or formation flights).

Moreover, both technologically and performance-wise the first-generation satellites were often designed with growth potential. For example, as a risk reduction measure, the first space oceanography Topex-Poseidon satellite (2.5 tonnes) had the capability to simultaneously carry two reference systems and two altimeters operating at different frequencies and based on different technologies. The next generation (Jason satellite) has a mass of 500-kg, whilst offering similar performance to the previous satellite, but with a more-than-halved development cost.

In the field of optical imagery, Pleiades satellites (1 tonne) will replace the Spot 5 satellite (3 tonnes).

In the field of earth radar observation, the Canadian satellite Radarsat 2 (2.5 tonnes) was developed eleven years after the first satellite in the series. The current satellite is modelled on the initial satellite (similar mass and cost), but has enhanced performance in terms of its resolution and imagery thanks to its polarimetric mode and its improved revisit rate thanks to the increased agility of its onboard sensor.

2.4. THE DUAL USE OF A LARGE NUMBER OF SPACE APPLICATIONS

The technical ability to place and maintain in orbit satellites the main assemblies of the satellite structures (platform, on board fuel, solar panels, propulsion etc…) and the bulk of satellite-borne payloads dedicated to communications or observation duties tend to be identical for both military and commercial requirements. Space techniques and technologies are thus often dual by nature. However, certain configurations in terms of security or the observation of targets of military interest are specific to defence applications.

There are dual-use programmes in a number of areas, such as launching (Ariane), meteorology (Meteosat), oceanography (Topex-Poseidon, Jason), geography (Spot 5 HRS), telecommunications (Inmarsat) or Earth observation (Spot and in the short term, Pleiades). In the future, European governments will also use the PRS[3] services offered by the Galileo European navigation system.

However, not all military requirements and demands can be addressed using commercial systems. There may be several reasons behind this situation: there may be no commercial demand for the required services (e.g.: intercept of electromagnetic signals, telecommunications jamming), the cost of the required services could be too high for the commercial market (e.g.: very high-resolution space imagery), or there could be confidentiality or availability requirements that demand the procurement of specific assets.

Dual-use programmes – provided that they are technically, economically and operationally feasible – should systematically be utilised whilst securing Defence's access to ser-

[3] Public Regulated Service.

vices and data protected by the use of outsourcing and/or redundancy. As regards the services that are not available in the civilian market, there are several alternatives, ranging from a cooperation among civil and military bodies to develop dual-use systems (e.g.: Pleiades or Cosmo-Skymed) to the acquisition of an exclusively military system (Helios, SAR-Lupe, Syracuse or Sicral).
To make the best use of the strong relationship between the commercial and military space environments, commercial and military agencies should collaborate closely on both projects and programmes and during both the phases of research and development. To achieve this end, in France, a partnership has been established between the DGA[4] and the CNES[5].

2.5. A GENUINE EUROPEAN COOPERATIVE IMPETUS

2.5.1. Space becomes a unifying mechanism

After a learning period and evolution marked by a strong desire for national independence, the European landscape exhibits a diverse array of assets that are the fruit of national efforts that have been marked in their diversity by a lack of international coordination (Syracuse, Sicral, Spainsat, Satcom BW, Skynet in the field of telecommunications; Spot, Helios, Topsat, Cosmo Skymed, SAR-Lupe, Tandem X, Pleiades in the field of Earth observation).
The construction of a concerted architecture on the European scale represents a real challenge, one which we will have to address during the coming years.
The signature of a document on common earth observation operational requirements (COR) by six European Chiefs of the Defence Staff[6], has been an initial tangible step at the European level towards the promotion of an enhanced interoperability – or even, to a certain extent, of a "mutual reliance". This document draws up a future European global system of Earth observation satellites dedicated to defence and security. Moreover, it presents complementary technical solutions in both the short and medium terms. In line with this pragmatic approach, discussions on future space-based Earth observation systems are in progress (i.e. the successors to the Helios, SAR-Lupe and Cosmo-Skymed systems)[7], within the framework of the Musis[8] Programme.
The European security Strategy establishes another framework within which the space area may be exploited. To tackle the major threats, such as terrorism, organized crime or the proliferation of weapons of mass destruction, that threaten our common security, the European strategy recommends the use of intelligence and a combination of all civil and military means of action, while also placing emphasis on crisis prevention. Regarding organization, this strategy focuses on the necessity to reduce duplication and overheads through the use of increased pooling and sharing of assets.
In line with the EC White Paper on Space and the new Headline Goal 2010, the EU Council has endorsed a space policy aimed at focusing the coordination of the use of space assets on ESDP[9] goals.
Separately, the requirements for space systems for military operations were updated and endorsed by the EU Military Committee on 7 February 2006[10].
All these initiatives demonstrate that space is a unifying mechanism for the emergence of a European identity in terms of defence and security.


ALCATEL-ALENIA SPACE

Syracuse III

Among its other objectives, the European Defence Agency may eventually further develop this impetus, especially via ad hoc programmes or projects[11]. The aim is to reduce the development costs of similar projects addressing crucial requirements, which would enable the launch of additional projects likely to complete the overall capabilities.

[4] DGA: Defence Procurement Agency (Délégation Générale pour l'Armement).
[5] CNRS: National Centre for Space Studies (Centre Nationale d'Études Spatiales)
[6] From Belgium, France, Germany, Greece, Italy and Spain.
[7] This is an encouraging step towards an enhanced cooperation, since all of the players concerned have reconciled operational stakes with industrial stakes, within the scope of a sharing of liabilities that is well in line with their respective national industrial skills and know-how.
[8] MUltinational Space based Imaging System for Surveillance, reconnaissance and observation.
[9] Document: European Space Policy: ESPD and Space.
[10] Document 6091/06.
[11] Project or programme ad hoc (categories A and B) : Common Action 2004/551/ESDP, EC, 12 July 2004, regarding the establishment of the European Defence Agency.


D. DUCROS/CNES

Helios 2 is placed in orbit

2.5.2. The major European cooperative models

It is crucial to begin building strong foundations here and now in order to meet the challenge of establishing an architecture of space defence assets consistent with the European scale. It may thus be relevant to consider quick and tangible solutions to meet the requirements of European forces (Headline Goal 2010[12]), while at the same time examining other solutions aimed at preparing the long term future.

Two levels of capabilities may be considered. The first is aimed at giving potential framework-nations the capabilities to carry out high-intensity operations. The second consists in having the capabilities to perform low-intensity operations or civil defence missions for all european partners.

In the short and the medium terms:

- we must develop a common European concept aimed at making the next-generation of space assets complementary and interoperable,
- also, we must further develop space assets dedicated to the conduct of operations, in support of other air-land or air-naval capabilities such as UAVs or manned air capabilities,
- finally, we must aim to optimise interoperability by way of participation within European or via international programmes in geography, meteorology or oceanography and also space surveillance.

In the longer term, the most rational pathway will unquestionably consist of generating a European partnership capable of preparing the technological building blocks that will be necessary for tomorrow's space assets, which implies that convincing cooperative research and technology programmes should be devised.

Our capability requirements should also be established cooperatively, since the only way to address the extent of our common requirements entails a common European approach (whilst exploiting dual solutions[13]). Resorting to exclusively national solutions should be limited to the situations where national sovereignty takes priority.

There may be several cooperative models depending on the type of programme and the level of autonomy demanded by any of the participating States. It is important to select carefully, for each capability, the best cooperative pattern according to the strategic interests that are at stake and to the willingness and the financial capacities of the partner-States.

Several cooperative models have emerged in Europe:

- The first one has historically been based on inter-government arrangements underlying industrial cooperation. In the civil field, this pattern has been marked by major achievements such as Airbus, but also by failures (e.g. TrimilSatcomand Horus). This type of cooperation should be used provided the conditions for success can be guaranteed (convergence of the requirements and the schedules, shared understanding of the goals, and non-divergent industrial interests).
- The second model consists of developing common assets via a common agency such as Eumetsat (meteorology) or Eutelsat (telecommunication), the ESA (European Space Agency) or the EDA[14] and OCCAR[15]. The leadership and the ownership of resources were transferred to these agencies, such that they are now able to represent all parties. Their success or their failure probably stems from the existence or the absence of specific, dedicated budgets.
- The third model has more limited ambitions, but has actually produced good results for Helios I and Helios II. It hinges on partnerships of opportunity addressing common interests, which often emerge from a single country (or industry). A country, for instance France, launches a programme and invites potential partners to join, while keeping a leading role in the project. This kind of partnership is used for the Helios I (with Italy and Spain) and Helios II (with Belgium, Greece, Italy and Spain) projects.
- The fourth model is of the kind implemented by France and Italy with Helios, Pleiades and Cosmo-Skymed, and by France and Germany with Helios and SAR-Lupe. The

[12] Headline Goal 2010: intervention synopses under the EU with relevant capability analyses.

[13] See paragraph 2.6.

[14] EDA: European Defence Agency.

[15] OCCAR: Organization for Joint Armament Cooperation.

model consists of sharing services rather than an industrial sharing, which significantly facilitates the finalisation of an agreement. Success of this model hinges on a well-balanced mutual partnership and thus relies on a strengthened level of confidence in the partner.

The third and fourth models may represent intermediate, useful steps towards the implementation of the two first models, which are more structural.

2.6. THE BENEFITS OF AN AUTONOMOUS AND COMPETITIVE EUROPEAN SPACE INDUSTRY

The Space industry is already heavily exploiting the synergy that naturally exists between civil and military programmes. This mechanism provides advantages for Europe, since it maintains a dual space industry that is both skilled and well-structured.

Certain space applications are based on purely military requirements. Such applications rely on specific means of development and production that cannot be applied in the civil sector. It thus falls to the Defence R&D supply chain network to undertake the relevant development for these specific applications (which represent approximately 10 to 20% of the corresponding technologies: active antennae, anti-jamming etc…).

In Europe, the growth and continuity of the Defence Space Industry has been directly proportional to the investments by the governments concerned. Therefore, it is crucial that European governments, via their dedicated agencies, define technical and programme requirements that match only the investments that can be feasibly achieved. Indeed, it is now critical to define targets for the expected capabilities and programmes, in order to provide Industry with a medium and long-term visibility.

In the field of Space, Europe already has a number of advantages (e.g.: programmes, technological demonstrators, dual systems that have been developed over time within the scope of a planned cycle), as well as a competitive technological and industrial base. Nonetheless, Industry still is quite reliant on institutional programmes.

The preparation and development of future Defence systems and their space components requires that the necessary technological and industrial capabilities are developed and their availability assured in a timely manner. This objective is achieved via two essential activities: R&D effort that enables the development of the capabilities critical to the Defence industrial and technological base; together with the monitoring of the whole industrial network concerned.

European governments have a significant role to play in retaining skills and developing a strong, competitive industrial base.

EADS

A satellite being integrated by Matra Marconi technicians EADS-Astrium

3. Capability challenges in the timeframe to 2020

In the context of the above-mentioned global environment, the GOSPS has carried out a thematic analysis aimed at identifying the requirements of the armed forces to enable them to accomplish the missions with which they have been entrusted.

3.1. PROVIDE THE POLITICAL AUTHORITIES WITH THE MEANS TO HAVE A GLOBAL UNDERSTANDING OF THE EXTENT OF REGIONAL CRISES AND THE EVOLUTION OF THREATS. AT THE SAME TIME, PROVIDE THE ARMED FORCES WITH OPERATIONAL AND TACTICAL CAPABILITIES THAT ENABLE RAPID AND EFFECTIVE ACTION UNDER RESPONSIVE POLITICAL CONTROL.

Given their great overflight flexibility, space monitoring and interception assets are the only non-intrusive data collection tools. They significantly contribute to collecting information aimed at assessing the threats posed by some States (e.g.: the development of non-conventional and ballistic capabilities in particular), at identifying terrorist networks and their activities, and at combating trafficking in sensitive technologies or against economic and financial activities carried out overseas by mafia-type criminal organizations.
Thus, we should now focus on achieving information supremacy in order to create decisional supremacy and enhanced operational effectiveness. This approach has already been widely implemented at both the European and the national levels, but the design of technical systems needed to support network operations is still currently under review.
Separately, undertaking the role of framework-nation during Coalition operations requires command tools at the operational and strategic levels, forces able to intervene without delay and also a willingness to share information with other Coalition members, while having sufficient information collection capabilities to perform independent situation assessments. Hence, it is crucial that we maintain an appropriate level of interoperability with our major allies, on doctrinal, conceptual and technical issues (harmonization of standards and interfaces).

3.1.1. Space communication assets

The sizing of satellite communication capabilities should match the needs for force projection, rapid deployment and the need for increasing bandwidth. These needs stem from reduced OODA loops and network operations that require maintaining interfaces with a number of land, naval and airborne sensors and also with weapon systems and deployed troops.

Given their wide coverage and their flexibility, satellite telecommunication systems will be at the very heart of all technical architectures used in support of network operations, especially to broadcast adequate information flows between the decisional centres in Metropolitan France and all forces deployed in theatres.

3.1.2. Earth observation assets

Observation capabilities play a pivotal role in the national capability to assess and decide autonomously. Ever since the Helios programme was launched (1995), such capabilities have proved to be most useful and relevant. However, there are limits to our capabilities. In particular, they depend on the cloud cover – hence the importance of access to radar observation capabilities developed by France's partners.
A resolution of about 50 cm is sufficient for surveillance and warning requirements at the political/strategic level, and revisit rates ranging from a few days to a few weeks are acceptable. Conversely, it is crucial for the surveillance of sporadic sites that there should be several views of the same Spot within 24 hours (i.e. night and day) and that the intervals between the viewings are reduced, especially for sovereignty monitoring systems, which implies that satellites be required to exhibit great flexibility.
Having autonomous, extremely high resolution (EHR) optical monitoring capabilities in the visible band is the only way to accurately characterize sensitive infrastructures and targets of defence interest, in order to assess their purpose and to precisely identify sensitive areas within the scope of a targeting plan. Broadly speaking, such capabilities will also enable reconnaissance missions to provide identification of 80% of intelligence targets and thus a real analysis capability of human activities.
Within the timeframe we are considering it would be appropriate to have digitized images available within four hours, together with a four-day revisit interval as an acceptable compromise solution.
By the next decade, the space-based observation capabilities devoted to planning and operations should benefit from well-managed optical and radar collection assets which enable a regular identification and reconnaissance process.


CNES

Artistic illustration of Pleiades

At the level of a given theatre, space sensors should thus be designed with accelerated revisit times in mind, as a way to supplement airborne assets, or even, in some cases, as a way to collect data that otherwise might be impossible, dangerous or too expensive to obtain using other existing means.

3.1.3. Interception of electromagnetic signals assets

A / In the field of COMINT (the interception of electromagnetic communications traffic):

Any electromagnetic signal broadcast on Hertzian channels is capable of being intercepted by satellite interception assets.
The implementation of a satellite interception system may partly address the requirements of our intelligence services. However, the technical feasibility of almost permanent interception of targeted communications would involve significant technological developments and massive acquisition costs for the European nations.
For example, the interception of multi-beam (or narrow Spot beams) transmission technologies in use in new-generation telecommunication satellites involves major technical and organizational difficulties.
With these satellites, a number of elements targeted by our services (terrorist groups, weapons proliferation, illegal immigration, organized crime) are increasingly able to communicate over very large areas, away from the control of competent authorities.

B / in the ELINT field (technical characterisation and localisation of radars and transmitters):

Electromagnetic intelligence (ELINT) is mainly useful in support of two major requirements:
- Updating digital warfare databases required for programming digital warfare systems and the reconstruction of digital battle orders (i.e.: telecommunication, radio, surveillance and fire control radars), ahead of the deployment of forces.
- Detecting and following-up military activities and force dispositions during operations (activation of radar and anti-air sites, monitoring the evolution and distribution of information flows).

It is worth noting that in France there are already several technological demonstrators devoted to the implementation of space-based electromagnetic signal interception systems.
Over a restricted area and provided air supremacy can be guaranteed, interception using airborne assets increases the likelihood of interception of electromagnetic phenomena.
Conversely, airborne assets are not able to provide global coverage, which can only be ensured by ELINT satellite capabilities.

3.1.4. Satellite positioning and synchronization assets

Satellite radio-navigation now occupies a strategic position in both the civil and military fields. It is now in general use in all kinds of weapon systems (aircraft, ships, land vehicles, precision guided weapons) for positioning and troop location on the ground (so as to limit friendly fire) and also for synchronization systems (including encrypted communication systems) and the broadcasting of common time references.
The international nature of radio-navigation satellite constellations implies that security responsibilities are shared. Satellite radio-navigation provides very accurate positioning and timing information, that must be controlled, whilst also:
- denying ill-intentioned users the ability to carry out actions against national or allied interests as a result of access to information;
- ensuring continuity of service for government users, without relying on the goodwill of third party countries.

Consequently, a non-secure or even partially secure satellite positioning system (whether civil or military) would deprive the programme of any strategic interest.
Space-based positioning and timing systems provide information, the consistency and accuracy of which are unrivalled. In this respect, they have become essential for the armed forces. However, given their vulnerability to jamming and decoying, it is crucial to manage the extent of the dependence of military assets on such systems.

3.1.5. A ground segment for European users

The accuracy, the precision and the diversity of information obtained from analysis carried out using space-based earth observation sensors are proportional to the potential for interdependence between complementary sensors that monitor the same area or the same feature. Moreover, in the majority of cases, raw data is not intended to be directly passed on to operational theatres, but should be collected, checked and then duly analysed by the relevant services.
The whole data collection, fusion, comparison and dissemination cycle should be accelerated. To do so, it would be appropriate to have a "generic" ground segment, that would enable communications with future information gathering systems in the fields of tasking and data processing.
A comparative analysis could also be carried out in the field of telecommunications, where the adoption of harmonized, interoperable user ground segments able to work with various satellites (or even with various ground networks) would prove invaluable for the units deployed.
Eventually, it is worth mentioning that this search for interoperability also addresses requirements in the field of satellite positioning and timing. The use of sensors able to

simultaneously process information collected by the GPS and Galileo satellite constellations will probably guarantee enhanced performance (availability, resistance to jamming and decoying attempts, and confirmation of the accuracy of the information) and thus improved operational effectiveness.

3.2. CONTRIBUTING TO MISSILE DEFENCE VIA EARLY WARNING CAPABILITIES

Should Europe decide to contribute to developing a common ballistic missile defence system, the development of space-based infrared sensors[16] would be necessary to guarantee strategic independence in the areas of detection, identification and tracking.

Such a missile defence system would require space-based global surveillance and tracking capabilities. The characteristics of the European territory (geographic proximity to threats, close proximity of many small or medium national territories) implies that hostile missiles should ideally be destroyed during their boost phase so that they fall back on the territory from which they were launched. Should this initial interception fail, we should also plan, as far as is feasible, to provide continuous re-engagement capabilities, which implies early detection and tracking of the threat. Permanent space-based early warning assets would provide an appropriate answer to such demands for responsiveness.
Besides contributing to a missile defence system, such capabilities would also enable us to identify potential aggressors and provide a valuable tool in the fight against weapons proliferation.

3.3. MEETING THE REQUIREMENTS FOR ACCESS AND SECURITY IN SPACE

The availability of Space-based assets relies upon our ability to successfully launch and maintain them securely in orbit.

3.3.1. Autonomous access to Space

With the Ariane V heavy launcher, Europe will be able to ensure sovereign space access capabilities. Ariane V is especially well-suited to the launch of satellites into geo-stationary transfer orbit. Medium or even small launchers would probably be sufficient for Earth observation satellites (4 tonnes in the short term, but probably 1 to 2 tonnes in sun-synchronous orbit in the medium term, or even mini or micro-satellites).
The commercial availability in Europe will soon diversify, with Soyouz and Vega launchers that will be launched from Kourou.

[16] Like the four US geo-stationary DSP satellites, which have been providing early warning capabilities to NORAD since the beginning of the 1970s, and are to be gradually supplemented with the introduction of the SBIRS (Space Based Infrared System) programme.

In this respect, the principle of using only European launchers as the preferred solution for the launch of national government satellites was agreed during the ESA Council of Ministers held in Berlin in 2005.

3.3.2. A Space-based surveillance system

Near the Earth, Space is strewn with debris of all sizes. Furthermore the increasing number of Space-based military assets could encourage the emergence of in-orbit offensive assets such as standby mini or micro-satellites that may be activated, on demand, to intercept, damage or even destroy other space-based systems.
All countries that operate satellites know how to maintain their own satellites in orbit. Other satellites are able to access coarse and sporadic orbital information using proven techniques. However, the reliable, accurate knowledge of the orbital paths of the approximately 10,000 main objects orbiting the Earth is currently only known by the United States and to a lesser extent to Russia. Europe actually relies on the information provided by these two powers for the global and operational surveillance of Space.
Given the proliferation of Space debris, there are proven dangers of losing satellites in accidental collisions, and the surveillance of the Space environment is indispensable for the planning of collision avoidance manoeuvres. Hence the deployment of ground based space surveillance capabilities (ranging from an altitude of 200 to 36,000 kilometres) for all sub-metric objects is becoming a requirement for all civil and military space operators.
However, it is crucial to provide comprehensive protection for the command & control ground facilities of our space assets, since those facilities already are and will remain the weakest link of our space systems. Indeed, any nation, or even any terrorist group, can easily destroy such facilities, whereas attacking in-orbit assets requires technical resources that are more difficult to obtain.

CNES/D.DUCROS

Launch of an Ariane 5 Rocket

4. Defence priorities in terms of Space assets

4.1. THE 2003 - 2008 MILITARY PROGRAMME LAW

The 2003 – 2008 Military Programme Law (LPM) sets the framework of the programme and budget for the French armies during the five year period. In terms of defence space assets, the LPM recommends the funding of:

- an increase in satellite telecommunications capabilities, with the deployment of Syracuse IIIA and IIIB (600 ground stations in 2014);
- the completion of Helios 2 second-generation optical earth observation satellites, whose very high-resolution images in the visible, plus infrared images, will provide France with a satisfactory level of situational awareness capabilities;
- access – via capability exchanges – to the tasking and exploitation of images obtained from the high-resolution German SAR-Lupe (2007) and Italian Cosmo-Skymed (2009) space radar systems, which will enable an expansion in the spectrum of intelligence gathering thanks to their all-weather observation capabilities.

During the period covered by the LPM 2003-2008, it is planned to devote 2.6 G€ to space systems. It should nonetheless be recalled that this funding level comprises satellites, launch costs, associated ground elements and their maintenance, as well as upstream space research work. In particular it covers the funding of the first surveys on the replacement of Helios 2 and the funding of research into possible future capabilities in the field of electromagnetic interception and early warning, thanks to the development of technology demonstrators.

4.2. CONDUCTING THE NECESSARY RESEARCH IN ORDER TO ACQUIRE THE TECHNOLOGIES AND TO REDUCE DEPENDENCIES IN THE MOST CRITICAL AREAS

In order to establish the necessary minimal inventory of space assets at an acceptable cost, the possibility of implementing a European cooperation and resorting to dual solutions has to be considered. Indeed the security of European States relies on a collection of skills and technical assets that are essentially pooled and implemented within governments, in industrial networks and research sectors. This European technological and industrial base must guarantee the security of supplies and the independence of public defence and security players. In that regard, France's strategic stance in the field of defence is based on:

- funding the development of technologies specific to defence requirements (cryptography, anti-jamming, etc) and, if need be, building technology demonstrators in that field;


THALES

Spartacus, the Syracuse portable terminal

- adjusting dual technologies to defence requirements and seeking to promote defence requirements in civil R&T programmes;
- ensuring that certain civil programmes comply with defence requirements;
- maintaining technical skills in France and Europe, in certain key defence fields such as the major optical sensor devices, or communications security – encryption – etc.
- promote, within the EDA, debate on the requirements in terms of future technological development for defence space applications.

These efforts should be conducted between defence sectors (DGA – procurement agency, DAS[17], EMA[18], EDA) and the civil sectors (CNES and ESA – European Space Agency). In this respect, in France, the activities of the CNES defense team whose aims are to strengthen the bonds between these two sectors, must be sustained and reinforced.

4.3. BEYOND 2008: THE PRIORITY AREAS

4.3.1. Meeting the requirements: striking a balance between autonomy and partnering

The French capability effort must be developed **in cooperation**, since only a European impetus will enable the full extent of the requirements to be met, within the limits of the appropriate space technologies. Even when a strictly national solution seems appropriate, it will have to be justified on the grounds of **acknowledged sovereignty demands,** or as a result of a European decision to acquiesce.

Nonetheless, **a dual solution** will always be preferably: (the requirements of the armed forces will only be military in nature, however every dual solution will be scrutinized).

Within the framework of the sharing of capabilities, which is both our goal and that of our European partners, it will

[17] Delegation for strategic affairs.
[18] Defence staff..

be necessary to ensure that several criteria are respected: data integrity, control of the distribution, programming control, system availability and security, service availability and access delays, confidentiality and security management, defence against attacks, and the ability to undertake those obligations of a framework nation.

Promoting interoperable systems must also be our objective (joint European coalitions, coalitions with US forces, multinational coalitions).

The capabilities that we have, or wish to obtain[19], may be likened to three circles:

- the "Strategic" circle that enables decisions to be taken and autonomous operations
- the "Operational" circle that enables us to project and to protect;
- the "Organic" circle that enables us to prepare and to endure.

Within each of these three circles, target capabilities (that are described in the following paragraphs) may also be subdivided into two categories

- those which must be reinforced or complemented in the short term [A]
- those which must be achieved in the short or medium term [B]

4.3.2. Capabilities: the main mechanisms

A/ In the field of telecommunications

A protected and secure high-bandwidth core for force projection

For this capability, the French Ministry of Defence has acquired the Syracuse system, the third generation of which was recently fielded.

Operationally the contract provides a capability of 18 non jammable and secure transponders until 2018. To comply with this requirement several solutions are currently under investigation.

For the «post-Syracuse III» preparatory phase, cooperation and capability sharing have been primarily and systematically sought, which should enable a significant decrease in costs – thanks, among other things, to redundancy sharing among European countries. Furthermore, innovative funding solutions may also be chosen.

In the field of telecommunications capabilities offered to meet military requirements, one or two private (such as Paradigm) or public (such as a European telecommunications agency) European organizations could emerge, in which case, their applicability will be carefully scrutinized.

[19] Space capabilities must be considered in the broader context of equipment for the armed forces.

A non-secure EHF or Ka band high-bandwidth network, with Astel-S and Inmarsat additions

600 Syracuse stations will be operational by 2014, in order to respond to the French armies' core telecommunications requirements. The French Ministry of Defence also fulfils its capabilities via business services purchased under Astel-S and Inmarsat agreements.

Beyond that capability, Ka band seems adequate for the provision of "asymmetrical-like" communications services, with limited traffic from user to server, but with considerable traffic from server to user. This government-dedicated frequency is well adapted to link many mobile or fixed ground stations to a central, Intranet-like service. Furthermore an interdepartmental service may also be considered.

Using this frequency band could enable several applications[20] to be met and is all the more appealing when when considering that a hundred or more terminals could be deployed in an area of highly varied operations whilst retaining Syracuse terminals for the high intensity theatres of operation[21].

With the aim of building up this capability by 2010, a joint cooperative programme between French and Italian defence agencies and the CNES and ASI space agencies, together with Belgium and the United Kingdom is currently being examined.

Furthermore, the collection of satellite data, which is cheap and has already been used for many years in the civil sector, could also prove useful in the broadcast of covert intelligence information (for instance, automatic transmission of data from "abandoned" remote sensors), the availability of a bi-directional link enabling commands to be transmitted from a base location anywhere in the world to a second location elsewhere on earth.

This capability has to be acquired in the short term, preferably through the exploitation of dual-use solutions and/or by resorting to a service acquisition-type contract.

Multimedia services in support of troops and civilians

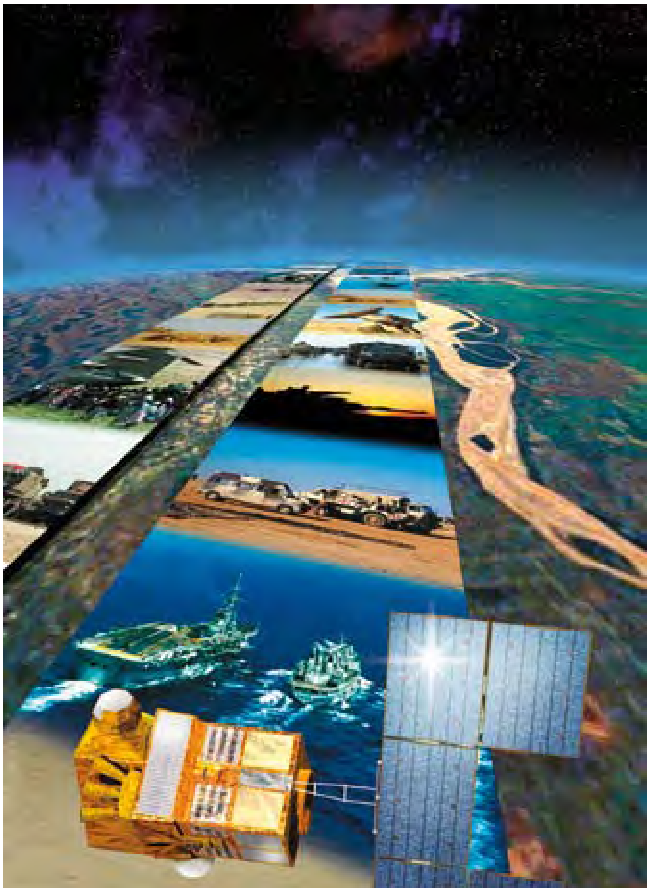
The deployment and support of a force in a theatre of operations requires the implementation of broadband communications systems enabling the exchange of non-sensitive data that requires a low level of protection. This kind of service can readily be satisfied by leasing commercial services.

This capability has to be acquired in the short term, preferably through the exploitation of dual-use solutions and/or by resorting to a service acquisition-type contract.

20 Deployment of Ka band stations:
- To replace Inmarsat stations used for data transmission services.
- In theatres of operation for the transfer of still or video images, or for the administration or support of troops deployed on operations.
- In theatres of operation of low or decreasing intensity, which last some time but without specific defence constraints.
- For overseas countries, for operational use.
- In areas stricken by natural disasters, for civil defence purposes.
- For the broadcast of a major event.

21 Re-enhancing «protected» and «non-protected» ground segments should enable cost reductions.

	STRATEGIC	OPERATIONAL	ORGANIC
TELECOMMUNICATIONS	Anti-jammed and protected SHF for command and control [A]	Anti-jammed and protected SHF [A] EHF or Ka for high information throughput. Non-anti-jammed. [B] Supplements: ASTEL-S and Inmarsat [A] UHF for low-throughput mobility [B] Relay satellites to reduce the delays in accessing information [B]	All frequency bands including SHF (ASTEL/S and Inmarsat) [B]
EARTH OBSERVATION	Reconnaissance capability (THR – panchromatic images) [A] Identification capability (EHR – panchromatic images) [B]	Identification capability in panchromatic and radar with frequent revisit [A] All-weather detection capability (IR images, panchromatic and radar images) [A] 3D Target models for targeting purposes [A] GHOM (geography, hydrography, weather forecast and oceanography) data [A]	Environmental indices (hyperspectral images) [B]
INTERCEPTION OF ELECTRO-MAGNETIC SIGNALS	COMINT – electromagnetic communications traffic interception [B]	ELINT (technical characterisation and mapping of; radars and transmitters) [B]	
RADIONAVIGATION		Secure positioning and synchronisation (GPS and Galileo) [A]	
SPACE MONITORING			European observatory –Space militarization [B]
EARLY WARNI NG	Early warning capability within the framework of an anti-missile defence system [B]		



D. DUCROS /CNES

Artistic illustration of Helios military satellite

B/ Earth Observation

Reconnaissance capabilities are already available but require to be completed in the short term for identification missions

The highly agile Extreme High Resolution (EHR) capability in the visible band, and the ability to provide stereoscopic images must remain a priority area in the development of the Helios programme, within the context of this European cooperative venture. It is essential that the French authorities maintain access to this kind of imagery, as well as the management of the data gathered.

Historically, the principle of a large common platform, incorporating several payloads, designed for various missions has been the preferred option (e.g.: common platform for Helios, Spot & Metop). These programmes stand out as technological achievements, but these multi-mission programmes are not without a cost, and each mission is dependent on the others. To avoid these disadvantages, the new-generation single-mission satellite concept has emerged: the mass of the Pleiades satellite will be of the order of a tonne (compared to 3 to 4 tonnes for the previous generation Spot satellites), and provides improved performance for the mission for which it was designed.

The basic principle underlying new generation satellites is to optimise the platform around the sensor rather than the contrary. The concept of re-using a standard platform for Earth observation missions thus loses its appeal.

In terms of sensors, there is little technological similarity between radar and optical technologies.

In terms of payload use, sharing is a complicated matter due to the uniqueness of each sensor, and image collection requirements by user partners implies compromise.

At the industrial level, a sharing of specialisations has emerged: France in the optical field, with 8 satellite developments (Spot 1 to 5, Helios 1 and 2, Pleiades), Germany with high-precision Radar imagery, and Italy with active antenna radars. Thus the likelihood of achieving industrial cooperation without a costly transfer of established skills appears unlikely.

These factors emphasize just how difficult it is to establish a classic cooperative arrangement in the field of Earth observation from space. Thus collaborative work limited to the exchange of imagery seems minimally beneficial, whereas the strengthening and pooling of mutual competencies appears to be the ideal model:

- **Reciprocal dependence:** the principle consists of transferring operation of an observation satellite to a single country that would then receive all programming requests. That country could propose enhancements in accordance with every users rights – and images could remain the property of the requesting country. Hence, a greater transparency than before would be achieved, together with a mutual dependence.
- **Common user ground segment:** here the idea is to have a common user ground segment for all European countries, with the programming being entrusted to a lead country for each element. This model requires the adoption of common standards.
- **Batch manufacturing of satellites:** the development costs of a new space system are high, and in general the quantity of satellites built is small. It might be economically attractive to create satellite batches, each satellite being exploited by a partner country with an access mechanism to the overall resource as a function of the national financial contribution.

All-weather radar observation

Radar observation from space has not yet reached the level of precision enjoyed with optical imagery. However, optical imagery depends heavily upon weather and light conditions (day/night). Regardless of weather and sunlight conditions, radar observations provide a precious addition to optical observation.

Infrared observation

Infrared imagery enables night time observations to be made, but with a much lower resolution than in the visible band. The main use of this spectral band, for Earth observation from Space, is mainly devoted to the search of evidence of local activity. This domain remains virtually unexploited by the civil sector.

Access to geographic data

Modern operations require the ability to swiftly develop, over a large part of the planet, the geographic data necessary for the functioning of intelligence, information, mission planning and navigation systems. This is mapping data (with the resolution adjusted to allow for population density), digital land models, maps enabling the determination of force mobility, crossing points, and 3D urban models.

Initially consisting of ground measurements by topographers, completed by the the addition of processed air images, sources of military geographic information are now mainly derived from space. This development stems from increasingly high coverage demands (from the "central Europe" theatre to the "worldwide" theatre), associated with constant updating and increasingly effective and affordable space imagery requirements.

Most source data necessary for the development of geographic information are not subject to strong confidentiality, image resolution or revisit requirements. Rather, efforts will focus on the existence of a medium-resolution, wide swath robust space imagery system providing stereoscopic or even multi-stereoscopic imagery. Resources of that kind have a strong dual and European specificity and thus are a strong candidate for a public/private partnership arrangement.
Nonetheless, the European GMES initiative can contribute to supplying useful geographical information on poorly populated areas, as well as determining terrain characteristics – and hence their practicability – for defence and security operations and type of vegetation.

Access to weather forecasting and oceanographic information

The availability of weather forecasting and oceanography data is necessary to plan and conduct military operations. This information derives from digital models that enable us to predict and explain the characteristics of oceans, clouds and temperature gradients. The majority of data that feeds these digital models is derived from space observation systems.
Certain digital models meet specific military requirements, but are fed with source data that is not typically military in origin. This same data is useful to civilian scientists.
There is a double issue for defence: firstly, to guarantee the sustainability of space observation resources (space altimetry, the ocean surface temperature measurement, of water colour, wind speed, etc.) and retrieve this data to inject it into digital models.
It is essential to maintain a close relationship with the Shom[22] and related civilian organizations (Météo France, CNES, Ifremer[23], CNRS[24]...).

Developing 3D target models

Obtaining data necessary to design 3D target models that enable, for example, cruise missiles to carry out their mission precisely and efficiently is a priority. The required data is comprised of high-resolution, multi-stereoscopic imagery.
The time lag between the moment when the images are gathered and their delivery for processing (for instance, there are no clouds in the sky) must be as short as possible so as to enhance the reactivity of any military action.

C/ Electromagnetic intelligence gathering

The field of ELINT

France has designed and is currently developing technological demonstrators aimed at acquiring a capability and experience in the provision of payloads, as well as in the processing and management of data from such sensors.
Currently, no European country has an operational ELINT space system. Technical and industrial cooperation is an option, especially with countries involved in the Musis programme, through which intelligence exchanges are taking place.
Working together on a common space intelligence collection system such as this, will rely upon the ability to readily share all recorded raw data. Each country would remain free to further process this data in respect of the geographic areas under consideration.

This capability is to be acquired in the short term.

The field of COMINT

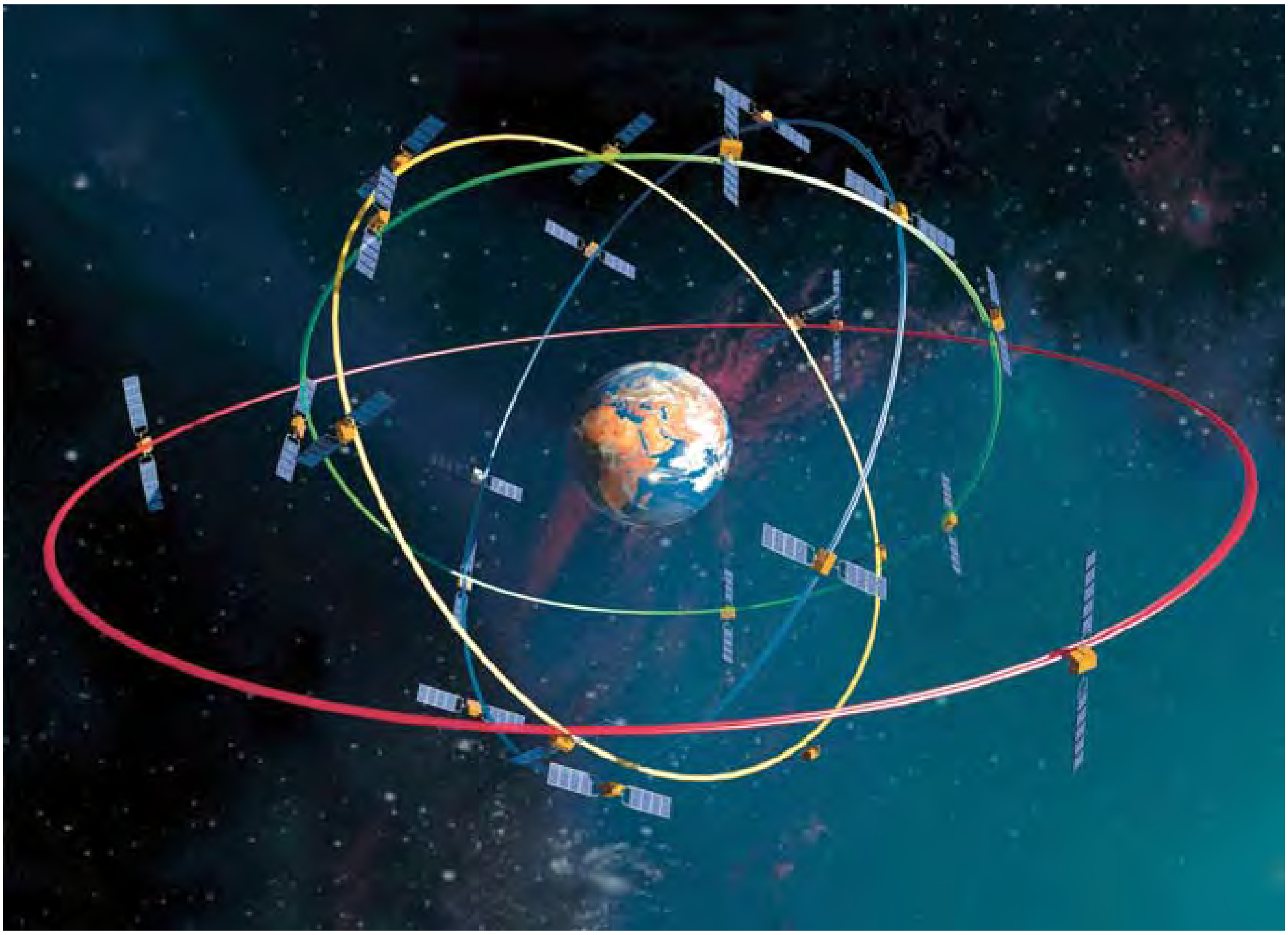
The capability to intercept communications from space and to understand their contents is unquestionably an appealing issue and a real technological challenge. This capability, however, is really only interesting from an operational standpoint, when intercepts can be provided on a continuous basis. Unfortunately, using geostationary satellites does not enable all interesting signals to be intercepted. Therefore provision of a continuous service would require the use of a constellation of a large number of satellites – which would be quite expensive. Furthermore, many earth-based communications may not be intercepted from space.

The acquisition of such a capability is to be obtained in the medium term.

D/ Satellite radio navigation

Using the American GPS system provides the armed forces with a worldwide precise positioning and timing capability.

[22] The Navy's hydrographic and oceanographic service.
[23] French research institute for the exploitation of the sea.
[24] National centre for scientific research.



ESA

Galileo

The emergence of the European Galileo system – and especially its secure government PRS service – enhances this capability. It will allow for a combined use of GPS and Galileo systems and provide more reliable positioning data, increased accuracy, information integrity, and enhanced resistance to jamming and spoofing.

This capability is available and must be completed in the short term via the introduction of a European solution.

E/ Surveillance of Space: to avoid collision with orbital debris and for future space activities

Analysing the requirements of armies and intelligence services emphasises the fact that the increasing strategic dependency by the military on space assets has made it necessary to strengthen space surveillance[25].

This surveillance is aimed at protecting satellites from collision hazards with debris during the launch or orbit injection phase of the mission, as well as managing any possible physical or electronic threats to our civilian or defence space assets. It thus becomes a condition of our ability to guarantee access to space and undertake operations when there.

The aim of space surveillance is basically dual use. Insofar as it participates in revealing and identifying possible attacks against satellites it could, be considered as a multilateral or "good conduct code-like instrument" aimed at limiting the militarization of space.

Rather than create a purely national capability we would prefer a European cooperation project, which could lead to the creation of a system for the use by the international community.

In order to achieve this goal, we must simultaneously:

- Introduce a credible national surveillance capability for low earth orbit satellites, thus opening the door to a cooperative venture among European nations (GRAVES system: from a technology demonstrator to an operational system);
- Contribute effectively to the definition of a dual requirement aimed at identifying objects liable to cause damage to launchers or satellites. In this respect, the Ministry of Defence takes a keen interest in the initiative launched by ESA in December 2005 to develop a "Space Situational Awareness" (SSA) programme prototype to be submitted to the member States' for a decision at the next ESA ministerial council meeting.

[25] To various objects (debris, rocket stages, etc.) can be added satellites in orbit (low Earth orbit 50%, medium Earth orbit 10%, geostationary orbit 40%).

This capability has to be acquired in the medium term, preferably through the exploitation of dual-use solutions and/or by resorting to a service acquisition-type contract.

F/ Early warning

A space-based infrared early warning system must be able to perform the detection and tracking of ballistic missiles during powered flight, in accordance with three objectives:

- the main objective of the system is target identification in order to define the various components of a ballistic missile defence system (early warning radar, fire control...). Such identification is only possible for missiles with a powered flight of sufficient duration;
- prediction of the launch site enables the aggressor to be identified and thus an appropriate retaliation strategy to be implemented;
- the monitoring of ballistic proliferation; tests carried out by proliferating countries are an accurate way to determine their technological and industrial maturity. Surveillance of their activities enhances our analysis of the ballistic threats.

In view of the technical complexity of such a system, France has initiated the design of a candidate system. Within this framework, the SPIRALE technology demonstrator – currently undergoing development – will provide Earth background infrared signature measurements, as well as experience in launch detection analysis and trajectory processing.

This capability must be acquired in the medium term.

A SUMMARY OF SHORT TERM ACTIONS:

- In the field of telecommunications, the aim is to maintain a core of well protected military capabilities. An initial structuring and cost reduction step that should be considered as part of a European process aimed at pooling resources to avoid the perpetuation of duplicate programmes. Separately, national assets should be supplemented with new non-secure broadband telecommunications services cooperatively developed in Europe on a dual-use technology basis. The cooperative models for the next generation of dedicated military assets should also be more interlinked.
- In the field of earth observation, the next generation of space assets should be developed using common architectures and user ground segments, whilst engendering European confidence-building in the field of image gathering planning.
- In the field of electromagnetic interception, a dedicated programme should be undertaken to provide French armed forces with operational ELINT assets. Using a cooperative approach, efforts should be undertaken in Europe, for the benefit of Musis partners.
- In the field of space surveillance, the aim is to favor a European sharing programme for those satellites in low earth orbit and to promote the generation of a dual use requirements statement for the identification of objects capable of domaging space launchers and satellites. This should ensure a safer space environement.
- Besides the above-mentioned points and within the other Space fields, the emergence of dual-use programmes should be encouraged. To do so, military/civil joint funding of the definition, design and development phases of programmes should become widespread.
- Separately, significant upstream research efforts should be sustained.

5. Let’s make space for our Defence

The work of the GOSPS has re-asserted the strategic and operational nature of space assets for Defence purposes. The use of space is pivotal to our decisional autonomy, one which France intends to maintain at the very heart of its Defence policy. Space represents a catalyst likely to promote the emergence of a European Defence and Security identity.

Such assets provide optimum responses in a number of fields central to forces action (long-distance telecommunications, Earth observation, availability of global of positioning information and of extremely precise time standards).

The developments in technologies and the emergence of a commercial market have significantly improved the cost effectiveness of space services. As a result, an increasing number of countries are now acquiring space assets.

It is important to pool resources without jeopardising national data processing independence and safeguarding access to the ever-increasing quantity of information required for operations. More to the point, having privileged access to identical sources is likely to lead to joint analyses with our partners within Europe.

Drawing on the analyses carried out by the GOSPS, the present document considers requirements and implementation options.

To meet these requirements, we must systematically and increasingly seek a well-structured European cooperative approach (globally or multinationally), while at the same time pursuing possible synergies with the commercial world. There are several possible cooperative models, depending on the technology involved and the related restrictions.

This approach can only be implemented if it engenders European confidence-building, one which helps to share capabilities while guaranteeing confidentiality. The aim is to design and develop common architectures and ground user segments, while preserving national capabilities in data processing.

Such an approach is not only likely to sustain and enhance the capabilities that are already available to the French armed forces in Europe, but also to supplement these capabilities to provide Europe and France with the means to achieve a policy that matches the strategic challenges of the 21st century.

ARIANE ESPACE

Kourou Spaceport Control Centre, Guiana

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