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THE EUROPEAN SPACE POLICY

Evolution and Perspective

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EDITORIAL

Europe's place in space has never been stronger, and more fragile at the same time. We are faced with a potential that, much like space itself, is quasi-limitless. These opportunities are currently being exploited through several major research and development programmes as well as through ambitious operational programmes. Projects such as Galileo and Copernicus are discussed extensively as they provide the best image of the European Union's (EU) ambitions in space. Our interests in space and on Earth are thoroughly explored as this issue of The European Files connects the many states, institutions, firms involved with making space more than just the final frontier.

The European Union and its member states are adamant in developing a common space policy. It is critical for the efficient use of Europe's resources that there is transparency and coordination coherence between the European Space Agency and the numerous other actors at the national and international level. Systems such as Galileo, a global navigation satellite system, can provide great innovative commercial and consumer services. Copernicus, a Global Earth Monitoring system, is a great source of data for environmental and security issues. Now that these systems are being implemented, the European Commission must ensure that their evolution is demand-driven, supported by a strong legal and financial framework and an infrastructure that ensure an easy and fast access to thess data to all European decision-makers and entrepreneurs.

This ambitious space policy must remain competitive and progressive. The EU and member states are responsible for mitigating the risks and costs of the space sector's expansion. This sector is to be considered as an "enabler" and a leverage, as it provides hundreds of millions of Euros in economic activity: it is therefore a European policy priority. Whether the financial model is public, private, or both, the consensus is that it must provide a long-term commitment to the public's needs. Therefore, the future of Europe's space program depends on its functionality. It also depends on the capacity of Europe to maintain the competitiveness of its Industry, in the absence of a global playing field, and with an increasingly harsh competition on the – relatively rare – open markets.

Since the Lisbon Treaty, the European Defense Agency (EDA) has been given greater freedom to take advantage of the monitoring systems in orbit. Furthermore, synergy between civil and military objectives is imperative to achieving the full potential of the Galileo and Copernicus projects. Dual-use functionality and developments are a policy priority as more consumers depend on satellite services for navigation, entertainment, etc. In addition, space satellites are the only option to effectively monitor the climate and environmental variables that are required to effectively commit to the future conclusions of the COP21, the largest climate change conference with the goal of creating a legally binding agreement on this issue.

The challenges in this sector remain complex. This issue is proud to present national and international success stories such as Belgium's industrious space manufacturing sector and Spain's continued domestic innovation and development. However, further coordination and increased transparency is essential to the evolution of Europe's space policy. If Europe is to remain a global leader in space, especially in the face of rising superpowers such as China and Russia, it must continue to export its services. This issue of The European Files opens a discussion for a more European evolution of space policy and provides a collection of perspectives key in understanding the potential of our space programmes

Laurent Ulmann

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GALILEO

The importance of space: An International Priority for the EU

Maroš ŠEFČOVIČ

Vice-President of the European Commission in charge of Energy Union

Space-based applications and services support many economic sectors every day. Few of us get through the day without using at least one satellite based service as for example in-car navigation, electronic trading or mobile phone networks, including effective road, sea and air traffic management. The potential socio-economic benefits are huge, for Europe and, as we face the grand challenges such as climate change, the whole world. Space gives us the tools to tackle today's problems.

All around the world governments are investing to exploit the potential of space. People everywhere see the potential benefits and leaders in services and technological solutions will reap enormous rewards. We in Europe are determined to be in the first rank of space actors. We can only do this if we ensure that we have the science, the research base, the industry and the infrastructure to develop and operate space-based services.

The European Commission is working on the development of infrastructures under the leadership of my Colleague Commissioner Elżbieta Bieńkowska. In March we successfully launched two more Galileo satellites; the Copernicus programme has its first dedicated satellite in orbit and the chain of earth stations needed to link these satellites to their users is being developed. Very soon we will have a European designed, built and operated platform to launch our satellites, giving us true independence in the development of our space programmes and contributing to greater security.

The benefits of a successful space policy are many. Agriculture benefits from improved land use – and the environment benefits as fewer chemicals are used. Satellites give us immediate information when disaster strikes, or even threatens, allowing emergency services to coordinate their efforts or take preventative measures before floodwaters arrive. Heavily loaded transport networks or energy infrastructure can be used more efficiently with a little help from space. As populations grow, as demands on resources increase and as our climate continues to change, space solutions will help society adjust to the pressures.

Our two flagship projects Galileo and Copernicus are very close to offering their first services. Indeed, Galileo satellites are already improving the reliability and accuracy of satellite positioning services, while the EGNOS - the European Geostationary Navigation Overlay Service, another EU activity in place since 2011, saves millions of euro every year by reducing delays at airports. Although Galileo is probably the best known of our programmes, Copernicus will also make a huge impact. Already it has made a big contribution to disaster relief, for example after earthquakes in Haiti and Nepal. With the added capacity of the Sentinel satellites the EU will have the data and earth observation abilities to tackle not just present problems of fire or pollution, but to gather the data we need to truly understand the complex processes of climate change and to design and implement effective policies.

The cost of our space programmes is modest. Every year the European Union invests two or three euro for each citizen into space research or one of the operational programmes Galileo and Copernicus. For this we are building our future, creating tomorrow's jobs and getting ready to solve today's problems.

Today the EU invests in space through its research actions and through the flagship programmes Galileo and Copernicus. But there are other partners in this area; many Member States invest either directly or through their European Space Agency membership. We need to make sure that we get the maximum benefit from our collective efforts. We need to develop the governance structures to coordinate our efforts and focus our resources on our shared priorities. We need to make space work for Europe.

What are the key features of a common European Space policy?

Elżbieta BIEŃKOWSKA
European Commissioner for Internal Market, Industry, Entrepreneurship and SMEs

European space policy is first and foremost about bringing benefits on earth and to the EU in particular. Investment in space brings growth and jobs to the EU. One euro invested in space creates eight euro in GDP growth. With 315 billion euro in the Juncker investment plan, we must seize our opportunities.

Space policy helps make EU industry more competitive. It is a highly strategic industry where cutting-edge technology is the norm. Its scientific and engineering excellence is a magnet for the brightest minds and stimulates the development of research and education institutions that feed a wider range of high-tech industry. And it makes a major contribution to help us cope with some of the biggest challenges we face today, such as environmental management and understanding climate change.

Our policy has three main axes: Galileo, Copernicus and research.

My aim for Galileo is very clear and simple. We must have the Galileo initial services operational next year. This will build confidence among companies which will create the products and services that will boost our economy. We are back on the right track after the successful launch of two satellites in March. With an accelerated deployment of our constellation, made possible in particular by the future use of our European launcher, we can realistically expect to have Galileo fully operational by 2020.

But the Galileo infrastructure is not an end in itself. It is an enabler. It is the launch pad for new business opportunities. That is why we have to make sure that service providers and equipment manufacturers can get better information to plan and provide new innovative services and products. We are setting up an infrastructure to provide developers with that information so that in a few years' time your car, your phone or even your wristwatch will all speak Galileo and make your life easier and safer.

Our other flagship project, Copernicus, is already a success and a truly European success story. Built on cooperation between a very wide range of institutions from all across the EU, it has now moved into its next phase of operation with the launch of the first satellite (Sentinel 1-A), soon to be followed by 2 other Satellites (Sentinels 2-A and 3-A) and more satellites over the next two years. One challenge is to make sure that the data flowing from those satellites can be fully exploited. Copernicus will be the fourth largest source of data in the world. We have to build the infrastructure to store that data and to get it to where it can be used. If we are to use this huge growth potential, we need to set the right legal framework.

Moreover, if we are to create a single market for space applications, space data, including high resolution data, must be able to be exchanged across borders. This is why the Commission proposed a directive on High Resolution Satellite data which will make it possible for this data to flow across the EU in a transparent, non-discriminatory and timely way. This is essential for the creation of a competitive, innovative and dynamic market for space applications. We see the potential for a strong downstream market for data, as a foundation for the creation of new business models and new services. .

For the EU to be a leader in space we have to keep moving forward. Galileo and Copernicus bring benefits from today's technology but they must be backed up by research, to make sure we are leaders tomorrow as well. Cooperation in space science is a European success story and a model for European integration. The EU is investing more than 1.4 billion euro into space research as part of the Horizon 2020 programme. We aim to end our dependence on third parties for critical space technology and establish the EU as a global leader.

For us to achieve our ambitions in space we need to ensure an independent and autonomous access to space. In this perspective it is crucial to develop a true European launchers policy a European launcher. The recent agreement between Member States to develop Ariane 6 is a vital component of our policy. It gives us not just greater independence, but greater capacity as well.

In the same vein, we have to protect our assets in space. That is why we are going ahead with the Space Surveillance and Tracking Support Framework. Working jointly with EU Member States we will pool existing resources to monitor threats to our space infrastructure so that we can act to protect it.

Europe can also count on a very dynamic and high quality space industrial base. But if we are to unleash the potential of the European Space industry, we need to improve the governance of the European space policy to make it more efficient. Strong links between the European Space Agency, the EU and the industry are already established. However, we need to go further to ensure that Europe is able to face the challenges ahead in the space sector.

“The Freedom of Access and Use of Space for Europe”

Najat VALAUD-BELKACEM

French Minister of National Education, Higher Education and Research

Services relying on space equipments are always more numerous, whether for addressing challenges in the area of information society, of defence, or for understanding our planet earth. Europe therefore needs efficient space infrastructures in order to meet the needs of its institutions and companies as well as the needs of its citizens. The significance and the diversity of the challenges involved make this issue a matter of sovereignty.

Given the outstanding reliability showed by Ariane 5, it is easy to forget that access to Space remains itself a challenge, due to the complexity of the technologies involved. That is why all launch systems across the world benefit from significant state financial support. These support mechanisms seek to reconcile two imperatives: ensuring the availability of launch capacity for institutional and commercial missions as well as ensuring the most economically efficient organisation of this access to Space.

Europe has achieved undisputable success in this area. The conditions required in order to maintain our position in the long run are well identified. First and foremost, we need a consistent range of European launchers meeting the diverse launching requirements of institutional and commercial clients, and offering strong synergies within the range. We must then maintain a sufficient level of engineering skills and industrial capacity to produce and ensure the safe and reliable operation of the launchers, and make preparations for the future through regular investment in R&T. And finally, we need a reliable, safe, and efficient Space base on the territory of the European Union.

The economic viability of the European model is based upon a specific balance: half of the European Space industry activity comes from contracts with the private clients and from exports, unlike the United States where the institutional market is much larger. The competitiveness of our industry on the world stage is therefore a key issue. Yet, the competitive landscape has dramatically evolved, particularly with the emergence of new players with a culture of breakthroughs in the areas of technology and economic models, and with massive investment capacities.

In this changing context, maintaining the status quo in Europe would have led our industry to wither away. It was therefore necessary to upgrade the Ariane launcher itself in order to increase its competitive edge and better adapt it to the current and future markets, as well as to enhance the industrial organisation and governance of the sector with the aim of increasing responsiveness and optimising production costs. These points were the central issues discussed at the ESA ministerial meeting that took place in Luxembourg in December 2014.

Considerable work has been done to identify the technical configuration for Ariane 6 best suited for the satellite market and the uncertainties related to its evolution, with a significantly lower production cost compared to Ariane 5. As a result, a flexible concept was selected, supported by our industrial and technological know-how and expertise, in direct synergy with Vega through the use of the same boosters.

However, it would be a mistake to reduce the Ariane 6 project solely to a change of the launcher configuration. This project has a much more global scope for the future of the European launcher sector. Compared to its international competitors, the Ariane programme is characterized by a scattering of its production sites and interlaced responsibilities between all stakeholders. While guaranteeing continuity with the major balances that have made the Ariane programme a success, a dual upgrade of the sector was necessary:

- simplifying the industrial organisation, by creating a 8,000 people-strong joint venture between Airbus and Safran, that will lighten the scheme of contractual interfaces between Ariane’s two main stakeholders.
- adjusting the relationship between public and private partners, with the aim of allowing for maximum responsiveness. The European agency ensures the overall management of the launch system, with the industry as a prime contractor for the launcher, and the CNES as a prime contractor for the ground segment. While the commercial market accounts for more than half of Arianespace’s turnover, the commercial operational risk will now be supported by the industry.

These upgrades, that will allow the sector as a whole to gain in competitiveness, have been validated by all ESA Member States during the ministerial meeting held in Luxembourg on 2 December 2014. They underpin their financial commitments to developing a new launcher and a new launch pad.

Since then, all stakeholders - agencies and industrial partner - have been working at a steady pace to keep up with the scheduled timetable, with a key milestone in 2016. Through this exceptional project, Europe is demonstrating its willingness to stand its ground on the market of access to Space. This momentum, bringing together the whole sector, is extremely positive and conveys a strong message for the future.

Can we expect an ambitious common space policy within a context of reduced public spending?

Stefania GIANNINI
Italian Minister of Education, Universities and Research

The Treaty on the Functioning of the European Union (Lisbon Treaty), which entered into force in December 2009, has for the first time attributed to the European Union (EU) a new specific competence in the area of space policy, providing the political and juridical basis to engage in the full spectrum of space activities without, however, preventing the Member States from exercising their own competence. Indeed, the EU and its Member States have a shared competence in this respect.

Governance of European Space Policy is based on three main actors, namely the EU, the European Space Agency (ESA) and their respective Member States. Needless to say that the Union's enhanced role in European Space Policy goes hand in hand with increased interaction and coordination among these three actors, in the interest of avoiding any unnecessary duplication of activities and enhancing synergies and complementarities.

Furthermore, space research works with long timescales, necessitating a clear, effective and forward-looking roadmap for investment decisions. Therefore, effective cooperation requires the European Commission, ESA and national space agencies to define coherent roadmaps for future research and innovation activities.

It is of paramount importance to use the competencies already developed by all relevant actors for these purposes, as well as to define coordination and resource management mechanisms which would allow the exploitation of space assets and services owned or operated by the EU, other international organisations, commercial providers, or the Member States to fulfil operational needs more effectively i.e. in the areas of crisis management and external action.

Space is a continuously evolving sector, one that is capable of playing a central role in stimulating growth, employment and innovation. European citizens are increasingly aware of the impact that space-based technologies and services can have on their daily lives.

As a matter of fact, space activities have proved to be a reliable tool for reaching multiple policy objectives as well as for supporting various European policies and the interests of citizens, including, but not limited to, research and development, the environment, weather forecasting, transport and traffic management, telecommunications, search and rescue activities, defence and security.

Pursuing the European endeavour for space science and exploration contributes to maintaining the European scientific and technological lead through an adequate level of research and innovation activities.

Moreover, space activities can also be considered as one of the building blocks of European international relations, because they contribute to determining Europe's position as a global actor, and enable it to participate in prestigious international cooperation programmes.

The space sector is a strategic asset for Europe. This implies, inter alia, non-dependence in Europe's capability to conceive, develop, launch, operate and exploit space systems.

Furthermore, by engaging in space activities, Europe will also reduce its technological dependence on other countries by developing economically profitable industries in key sectors and contributing to the development of research on innovative technological solutions. In so doing, Europe will also be working towards protecting high quality employment as well as remaining at the forefront of new discoveries and challenging projects.

Space policy is not only one of the latest additions in the growing EU competences list, it is also an expensive and highly visible one with important political implications for other policy areas that could promote the pooling of resources rather than their duplication.

It is agreed that everyone should contribute to strengthening the European space community, to capitalizing on past investments and to improving the use of funds for the new programming period. Approximately 12 billion euros have been allocated for the 2014-2020 financing period, which represents an unprecedented increase in the EU's support towards space initiatives, such as Galileo-EGNOS, Copernicus, and space research in Horizon 2020. In addition, we should also consider ESA's budget of about 3 billion euros per year, as well as that of individual Member States – all this demonstrates the growth of investments in this sector.

In 2013, the global space economy has generated some €203 billion in revenues, divided between the space upstream supply chain (€67 billion or 33%), satellite operators (€17 billion or 8.4%) and consumer services (€118 billion or 58%). The trend and the outlook are both positive and strongly influenced by the force and momentum of the downstream sector. The European space upstream industry has been able to generate growth with an overall turnover that amounted to €6.8 billion in 2013 (compared to €6.5 billion in 2012) which corresponds to 10,6% of the global space manufacturing chain. The share of the industrial activity with European public customers in 2013 has remained stable at 53% of its global turnover. At the same time, the share of export revenues out of Europe has reached 22%, a level above those of any non-European competitor.

For all these reasons, the still young common space policy needs all the support it can get. Financial and political investment in the space domain cannot be taken for granted. To develop and mature, it needs to become even more attractive to decision-makers and to trigger further reflection on the development of additional EU space initiatives (e.g. Govsatcom, a European policy for access to Space) supporting the policies and actions of the Union, in view of promoting employment and competitiveness.

The Mastery of Space is a Strategic Priority for Europe

Etienne SCHNEIDER
Luxembourgian Deputy Prime Minister - Minister of the Economy

Since the emergence of the "space race" era in the 1950's, the use of space infrastructures has incredibly increased. Most of us ignore that satellite-delivered services are today ubiquitous in our daily lives.

Today, more than 1 billion households worldwide receive TV channels via satellite. This trend is rising until the end of the decade with a strong growth of satellite TV broadcasting services in the emerging countries. With the increasing demand of permanent connectivity, connecting to the Internet via satellite becomes more and more popular, while confirming the trend for increased reliance on satellite-delivered services.

With this growth comes an increased daily use of space-based navigation services, like built-in car navigation systems for instance that became a worldwide standard. Global positioning systems are used in many areas, for example for private applications registering the trajectory of a walk, or for professional use in agriculture or transport.

With the growing need to monitor the earth for environmental or other purposes at local and global levels, geo-information services become a crucial issue driving space-based infrastructure. More than 200 satellites are expected to be launched for Earth observation by 2020. Even if the science community has played an important role as driver for setting up initial infrastructure, today new initiatives are mainly business oriented. Observing the Earth from space is unique and offers unique opportunities and opens new paths for applications and services.

The Grand-Duchy will host the EarthLab center dedicated to industrial and environmental risk monitoring. Telespazio France, e-GEOS, POST Luxembourg and HITEC Luxembourg invest in the setting up of a Joint Venture for the establishment of the first European center for environment monitoring dedicated to industrial and environmental risks. This industrial cooperation is consolidated by the support from the Luxembourg government, in the frame of its commitment to diversify and innovate in advanced technologies.

The EarthLab Luxembourg center is the third center of the international EarthLab Galaxy program initiated by Telespazio France, after the setting up in 2013 of EarthLab Aquitaine and of EarthLab Gabon.

There is no doubt that the European economy depends on space-based systems to create new jobs and opportunities. But space is not only important from an economic point of view. Space-based applications, services and infrastructures also help to build a momentum for much wider societal challenges. The first global challenge where space has definitely a role to play is climate change. Many other challenges can be addressed using space infrastructures, like digital divide.

Satellite communications have also become a very important tool in managing the early phases of emergency situations. In case of natural disasters, the communication infrastructures are not operational anymore and satellite communications are the only mean that can support first responders. There again, mastering space has become an indispensable necessity.

As all satellites and de facto all the applications and services related to them have to be brought into space, the manufacturing of launchers is a mandatory step for the rest of the value chain. Its importance has in particular been emphasized with the anomalies and even entire failures that happened recently, in particular with Russian launchers. And the European Union has been directly affected by the malfunction of a launcher in its Galileo program. This shows that the dependence on international partners may lead to unsustainable situations, even if those partners are spacefaring nations with a worldwide recognized reputation.

Besides the influence of the economic setting of the space industry and its potential to address societal challenges, its inspirational capacity should not be underestimated. The outstanding success of the Rosetta mission showed how much mankind is fascinated by what exists beyond the limits of our atmosphere. For millennia, space has captivated and inspired scientists, engineers and artists. The people and their knowledge are a fundamental aspect of mastering space. Therefore, space should be used as a leverage to promote scientific and technical careers in space industry to the younger generation.

Through the increasing dependence on space-based technologies and infrastructures, this sector has a strategic importance for Europe and its citizens. Therefore, the European Union has significantly increased the budget dedicated to space in order to implement its two flagship programs, Galileo and Copernicus. At the recent Council of the European Space Agency at ministerial level in Luxembourg, the decision to develop the new generation of European launchers has been confirmed. This is a clear message that the development of the space sector is and will remain a strategic priority for Europe.

SES

Cooperation in the Space sector in Europe; the Spanish example

José MANUEL SORIA
Spanish Minister of Industry, Energy and Tourism

50 years ago two organizations that would be the origin of the European Space Agency (ESA), started their operations. It was the European Space Research Organization (ESRO), to carry out activities related to the development of satellites, and the European Space Vehicle Launcher Development Organization (ELDO), that had the objective of developing the project of the big European launcher.

Both organizations gather almost all countries from Western Europe, Spain included. Ever since, our country has been implementing the principle of international collaboration in the field of space.

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In 1973 the two organizations joined to create the ESA, being Spain one of their founder members.

In this half century, the Spanish industry has had an impressive development. Spanish companies have evolved from the provision of devices and subsystems to be able to build satellites by themselves. Nowadays, our national industry participates in all big international projects, such as: satellites, launchers, ground segments and all kind of applications (navigation, earth observation or telecommunications).

This development has been possible thanks to international cooperation, mainly through the participation in programs of the European Space Agency. None of those achievements would have probably been possible without the decision of the Spanish Administration to be an active part in the European Agency.

The industrial sector itself recognizes the key role of the international cooperation through ESA in the development and growth of Spanish enterprises. They claim that, thanks to that, our industry is now capable of managing bigger contracts in the framework of national and international public programs, and also in the commercial market.

As a clear example to check how investment in ESA improves the competitiveness of the Spanish industry, we can see that between 2000 and 2010 the Spanish contribution to ESA increased from 100 million euro to 200 million; meanwhile the turnover of this sector went up from 300 to 700 million.

This positive evolution of the Spanish industry through cooperation led to some key achievements within which are to be mentioned:

- 1989, HISPASAT was created. Now, it is one of the biggest satellite operators in the world. In 1992, HISPASAT launched the first Spanish telecommunication satellite, HISPASAT 1A.
- 1997, MINISAT, the first national satellite designed and produced in Spain, was launched.
- 2001, the ESA mission, ESA INTEGRAL, is launched. In this ESA mission, for the first time in history, the main researcher is Spanish and one of the payloads was designed and produced in Spain.
- 2009, the SMOS mission is launched. Again, the main researcher is Spanish and the payload is designed and produced in Spain.
- Collaboration with NASA has also been important. In 2012, NASA launched a mission to Mars with a crucial participation of Spanish technology.

In 2014, we had up to 11 satellites in the hands of Spanish operators: seven by HISPASAT (Hispasat 1 C; Hispasat 1 D; Hispasat 1 E; Amazonas 1; Amazonas 2; Amazonas 3), two by HISDESAT (Xtar-Eur; Spainsat) and two by Elecnor Deimos (Deimos-1 y Deimos-2).

Furthermore, 2014 was a key year because our national industry got highly relevant contracts under ESA framework:

- Airbus Defence and Space CASA got a 20 million contract to develop the platform of the CHEOPS mission (first small size mission of the Scientific ESA Program, in collaboration with the Swiss Agency).
- SENER got the leadership of PROBA-3 mission, also eithin the framework of ESA. It is a contract of 97 million, 40 of them for Spanish companies.
- Airbus Defence and Space CASA won the contract to develop the ICI Instrument, that will fly in the MetOp-SG B satellite. It is an 88 million contract.
- There will be two BIC (Business Incubation Centre) in Spain. This is an ESA Program to foster the creation of new enterprises based on space technologies.

In 2014 we also saw the meeting of the Rosetta mission with the comet it was trying to reach for 10 years. Another example of how the international collaboration can lead to unbelievable goals. Again the role of the Spanish industry and Universities was really important.

The evolution of the Spanish space sector in the next years looks even more impressive: in 2015, PAZ will be launched and in 2017 it will the time for INGENIO. PAZ and INGENIO are two satellites designed and produced in Spain that will increase our capacities in Earth Observation, in fields so strategic such as security, emergencies and environmental surveillance.

Thus, there is no doubt that cooperation in the space sector has been the key element to achieve the degree of development of the industry we have today: a very dynamic and strategic sector, with more than 30 enterprises and a turnover of more than 700 million. Very competitive, of a high added value and that works in global markets. We are the 5th country in ESA and in the EU in terms of turnover, number of employees (more than 3.000) and investment.

The Spanish Governments, no matter political colours, have always recognized the strategic importance of this sector, knowing its impact in key economic and social fields: navigation, telecommunications, meteorology, emergency, climate change or security,

Therefore, the Government supports the sector, and in doing so is aware of the significance of international cooperation. That is why in the last Ministerial ESA Council in December 2014, Spain reinforced its commitment to ESA increasing our public investments in many of ESA Programs. And that is why the Spanish Administration supports, as much as we can, our industry and participates in the 3 big flagships of the EU for the space sector: Galileo, Copernicus and SST.

In conclusion, Spain has a highly attractive and competitive space industry that has thriven in the last 50 years thanks to the collaboration at international level, especially within the framework of ESA. Knowing the importance of this sector the Spanish Government will keep fostering this collaboration as a mean to support and strengthen our industry and our companies.

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The industrial policy for the space sector in Belgium

Elke SLEURS
Belgian Secretary of State for Science Policy

In the global and European space cooperation, Belgium occupies a decisive place thanks to the continuous support of its public authorities and its impressive scientific and industrial tissue, which is recognised as such abroad.

The Belgian authorities make a significant contribution of EUR 200 M a year in the field of space, thus placing our country in eighth position worldwide in relation to the gross domestic product.

The objectives of Belgium's space policy are various. First of all Belgium wants to reinforce and to stimulate the country's expertise and scientific and technological capacities in the various areas of growth in space activities. Secondly Belgium wants to give the industry the opportunities to sell its products and capture new markets and thus reinforce the space sector's position in the Belgian economy, especially in terms of employment. And last Belgium wants to ensure that the country's various public authorities have the space tools they need to define, implement and control their sectorial policies.

Characteristic of the Belgian industry regarding space

The Belgian industry, active in the space sector, is considerable, and varied as regards the type of activity, the size and the shareholding of the companies, etc.

Some 60 Belgian firms regularly work in the space sector and 80 % of contracts placed annually by the ESA in Belgium, are placed with 20 or so Belgian firms. With the exception of three, all Belgian firms are independent from the three main European primes in Space: ASB, OHB and TAS.

These firms' areas of activity are highly varied and they can be found in nearly all the technological fields of the ESA technology tree such as: materials (solar cell and substrates, telescope mirrors), engineering (aluminium and composite structures), electronics (power distribution), mechatronics (TVC), software (on-board and ground), ground segment, control and operation centres, instruments (optics, etc.) and small systems (small satellite). It should be noted that some of these areas are covered by several firms; this is the case for structures, software, optics, etc.

The majority of firms have specialised in the space sector and the majority of their activities are in this domain. On the other hand, firms active in aeronautics are also active in the space sector: this is the case for structures, valves and for certain developments in mechatronics.

In the value chain, the Belgian players are mainly active as 'suppliers' and several of them are European and even world leaders in their niche (solar cell substrates, CMOS sensors, etc.).

The Belgian industrial policy in the space sector

The goals of the Belgian industrial space policy are manifold. The main goals are the support of innovative technological developments and new ideas as well as the reinforcement of the existing space industry, by supporting the players in their technological development and product strategy. A secondary, yet economically important goal is the promotion of developments that lead to recurring activities, whether in systems or equipment.

Special attention is required for the promotion of space / non-space complementarity and technology transfer. Because space activities are cyclical, it is important, in order to maintain a minimum workload in the small firms, to complete the space activities with activities beyond this field and to allow space / non-space cross-fertilisation and vice versa.

The Belgian industrial policy also promotes complementarity between firms in closely related fields, with the objective of moving the companies up in the industrial chain of responsibilities. The Belgian policy envisages the evolution of a company from a developer of space components, to a prime contractor for space systems, especially in fields like the development of complete instruments, or complete small satellites.

All of these objectives should lead to the creation of new companies and employment, mainly in the field of applications.

Belgium relies essentially on the ESA to implement its space and industrial policy in particular. More than 90 % of the means are made available to the ESA's programmes with considerable support for 'à la carte' technological development programmes. Through these programmes (GSTP - generic technologies, ARTES – telecom technologies, etc.), it is possible to implement the majority of Belgium's technology and industrial policy. This situation was quite satisfactory until recently. Because ESA has to pursue the common objectives of an ever-increasing number of ESA member states, the Belgian objectives tend to be less served. Moreover, since the Lisbon Treaty, the European Commission is playing a more prominent role and is having an increasing impact on ESA. The European and worldwide scene is changing rapidly. The launcher market is in full change. Newcomers like China play an ever more important role. Finally, the space business is more and more focusing on the users and not only on science. Galileo and Copernicus of the European Commission are good examples of this. This means that more and more Belgian regional competences are affected and impacted by space matters. For all these reasons, the Belgian government will establish a Belgian Space Agency that will be more suitable to cope with these future challenges.

Besides ESA, the Belgian space policy also has bilateral cooperation programmes with France (SPOT, Pléiades, Vegetation) and Argentina (SAOCOM), in the field of optical observation and radar. Belgium only has a small national space programme in the field of Earth Observation, to support the research and development of applications, in parallel with the agreed investment in observation programmes carried out bilaterally.

To conclude, the Belgian space policy depends largely on the European context. Means are used to promote a specifically Belgian emphasis. The creation of a Belgian space agency in the near future will allow us to have extra means to implement and reinforce our space policy. The flexibility provided by the Belgian space agency is the answer to a rapidly changing space environment.

Credit line :
ESA - J. Huart
Programme :
Artemis

"What advantages exist in a common European space policy?"

©: Bundesregierung/Bergmann

Brigitte ZYPRIES
German Parliamentary State Secretary at the Federal Ministry for Economic Affairs and Energy

Space technologies form an integral part of everyday life in Europe and have developed key importance for business, science, and government. They have become a central element of research and development and of education and innovation. They raise our quality of life and helping to protect our planet. They also play a key role in security and are a major area of international cooperation.

Today, virtually every company and every person living in Europe uses technology and services built around space-based applications. Satellite television is an everyday commodity, communication satellites are used to connect people worldwide, and satellite navigation systems allow for modern transport planning and logistics. Earth observation satellites open up new dimensions for climate research, town and country planning, and the prevention and management of crises and disasters.

At the same time, space technologies are competing with other technologies. Given their high costs, they must be constantly judged as to whether they provide adequate scientific, social or economic benefits.

This kind of competition is becoming stronger and is already leading to visible changes in the space sector. Indeed what we are seeing is an ever greater focus on the usefulness of the various technologies, as well as on their commercialisation. Europe needs to be able to respond to these changes and to develop the right strategies within its space policy – strategies that take account of the fact that space technologies are a growing global market.

Across the world, there are over 50 countries that pursue space activities. These countries invest a combined total of more than 65 billion euros in the civil sector every year. In the downstream markets (i.e. using data from earth observation, navigation, and communication satellites), conservative estimates for annual turnover are set at at least 250 billion euros.

In the USA in particular, new business models are being explored – many of which are supposed to work without the need for significant assistance from the state. Here, the market for space technologies is increasingly being driven by the private sector. Over the last few years, for example, NASA has been supporting efforts to commercialise space transport for supplying the International Space Station. This initiative has led to the development of competition between a number of different US companies in commercial space transport, such as Space X, Boeing and Orbital Sciences, as well as between companies in a nascent space tourism industry, such as Sierra Nevada Corp., Virgin Galactic, and Bigelow Aerospace.

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Recently, efforts to commercialise space technologies have also been extended to other space-based services. As we can see from the market for satellite communications, space-based applications can be used to earn money. In the USA, private-sector initiatives go beyond the realms of satellite television. In fact, two different consortia – the first made up of Virigin Galactic, US-Qualcomm and OneWeb, and the second of Google and Space X – have announced plans to offer satellite broadband. Of the estimated 7 billion people on Earth, around 3 billion have access to the internet. The activities of the new consortia are designed to target the 4 billion potential internet customers that remain.

The market for satellite-based earth observation is also expected to undergo dynamic development. Two consortia – the first consisting of the start-up Planet Labs and the second of Google and Skybox-Imaging – are currently planning to offer services in realtime images from space.

These developments in the USA offer major opportunities for industry in Europe, thanks to our strong technological and manufacturing capabilities. They also provide further opportunities for the supplier industry. A number of companies are already receiving enquiries from the USA in these areas. Beyond this, some of the new business models are certainly transferable and can be used in a German and European setting.

Europe offers good conditions for tapping this potential. The European space industry has a strong export focus which means that it is not as dependent on the institutional market as the space industry elsewhere. Between 2007 and 2013, European companies exported satellites, launchers, and other space vehicles worth 12.4 billion US dollars – almost four times as much as was exported between 2000 and 2006. By way of comparison, exports by the US space industry grew from just 1 to 1.9 billion US dollars. We want to maintain this lead and to extend it by as much as we can.

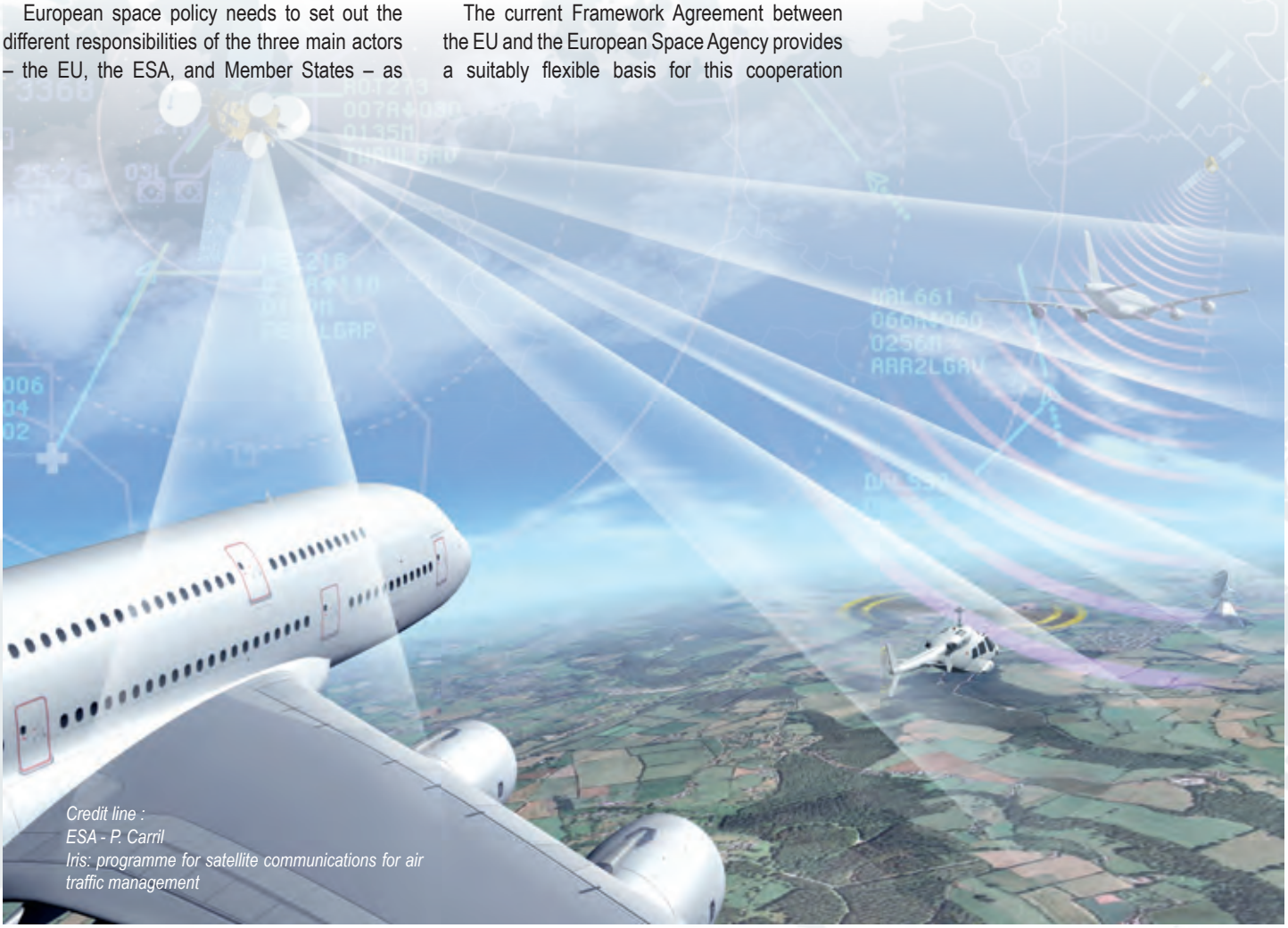
Europe owes its excellent position not least to the work of the ESA and its successful industrial policy, which has played a massive role in enabling the European space industry to develop so strongly. In order to successfully implement the priorities of European space policy, we need a constructive partnership of equals between the European Union, the Member States, and the ESA. I therefore believe it is important for the ESA to continue to be independent from the EU.

European space policy needs to set out the different responsibilities of the three main actors – the EU, the ESA, and Member States – as clearly as possible. In my view, it is particularly important that the EU gears its space activities towards the needs of European sectoral policies. I therefore believe that European space policy needs to place a particular priority on application-related infrastructure like Copernicus, as well as on the field of earth observation, on Galileo for navigation, on the setting of policy conditions such as those for satellite data security, and on the development of new markets. I am firmly convinced that taking measures at EU rather than at national level will lead to much more effective results. Berides, we must make sure that all of the measures taken by the EU in the area of space technologies either complement or supplement existing activities by the ESA, the Member States, and the specialised user organisations such as EUMETSAT. Any duplication of activities needs to be avoided.

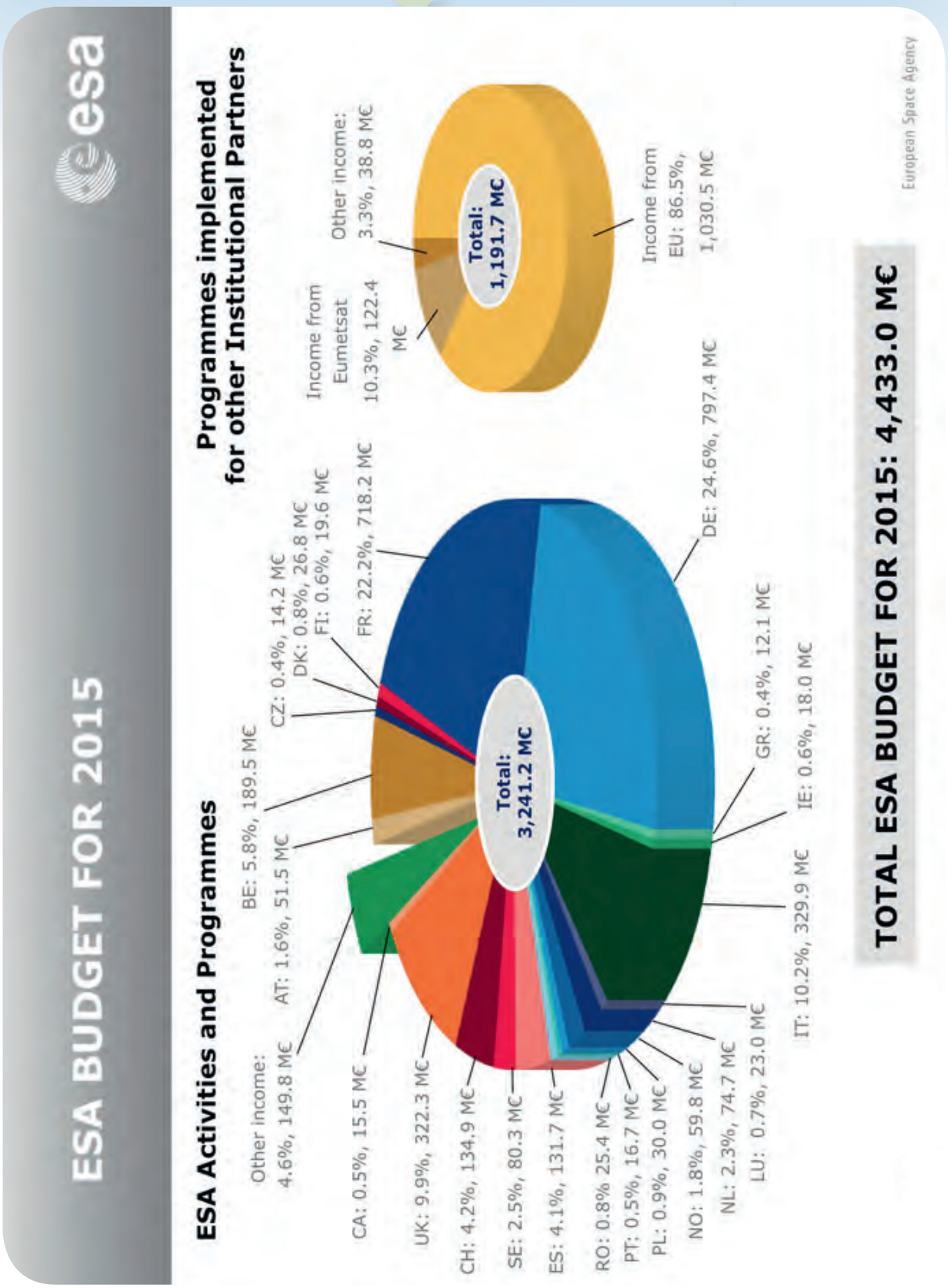
The strengths of the ESA lie particularly in the scientific fields and in core space technologies, including launchers. The ESA needs to remain the driving force in these fields within Europe.

The current Framework Agreement between the EU and the European Space Agency provides a suitably flexible basis for this cooperation and one which I believe has proven its worth. The Agreement lays the foundations for the Space Council – a joint meeting of the Council of Ministers from the ESA and the EU – and, in doing so, provides a good, high-level political framework for cooperation between the EU, ESA, and the Member States. Regrettably, the Space Council has not met since 2011. If we are to take the coordination of space activities seriously, the ESA and the EU need to hold a Space Council meeting in the near future – something which a number of Member States have made repeated calls for.

Given the strategic importance of maintaining a strong European aerospace industry that is able to implement European space policy effectively, it is crucial that we in Europe confront the challenges that are currently facing us. We already have everything in place at national level, within the EU and the ESA in order to do this. All of the relevant players in Europe are now called upon to tap the potential that space technologies offer for developing innovation, for boosting economic growth, and for creating jobs.



Credit line :
ESA - P. Carril
Iris: programme for satellite communications for air traffic management


ESA BUDGET FOR 2015
esa
ESA Activities and Programmes
Other income: 4.6%, 149.8 M€
BE: 5.8%, 189.5 M€
AT: 1.6%, 51.5 M€
CZ: 0.4%, 14.2 M€
DK: 0.8%, 26.8 M€
FI: 0.6%, 19.6 M€
FR: 22.2%, 718.2 M€
CA: 0.5%, 15.5 M€
UK: 9.9%, 322.3 M€
CH: 4.2%, 134.9 M€
SE: 2.5%, 80.3 M€
ES: 4.1%, 131.7 M€
RO: 0.8% 25.4 M€
PT: 0.5%, 16.7 M€
PL: 0.9%, 30.0 M€
NO: 1.8%, 59.8 M€
NL: 2.3%, 74.7 M€
LU: 0.7%, 23.0 M€
Total: 3,241.2 M€
DE: 24.6%, 797.4 M€
GR: 0.4%, 12.1 M€
IE: 0.6%, 18.0 M€
IT: 10.2%, 329.9 M€
Programmes implemented for other Institutional Partners
Income from Eumetsat 10.3%, 122.4 M€
Other income: 3.3%, 38.8 M€
Total: 1,191.7 M€
Income from EU: 86.5%, 1,030.5 M€
TOTAL ESA BUDGET FOR 2015: 4,433.0 M€
European Space Agency

The EU industrial space policy: a boost for an innovative and competitive EU economy

Monika HOHLMEIER
MEP, Chair, Sky and Space Intergroup, European Parliament

Each and every citizen of the European Union benefits from space every day. The list of examples ranges from navigation, which has become a mass market in any car or phone, over meteorology, to banking, as well as access to TV and internet in rural areas. Further, a variety of specialized sectors uses space technology such as farmers analyzing satellite images to spot the need for water and fertilizers or scientists monitoring climate change through satellites. When our daily life is disrupted by catastrophes like earth quakes and floods, we are heavily relying on satellites to evaluate damages and develop rescue strategies - thus enabling a better crisis management.

The picture becomes clear: Space has arrived in almost any field of today's modern technology.

It is especially for its dual nature that makes Space activity such a vital actor in Europe's economy. Two domains are covered: the space infrastructure industry at large (manufacturing of satellites, launchers and ground stations) and the services sector creating the conditions of large activity via mass market applications and equipment. These two domains have huge potential of growth and serve as a fertilizer for the European economy at large. As confirmed by a 2014 ESA report, one-third of ESA's spending in launchers directly contributes to the growth of non-aerospace industry. Hence, innovative space services allow other sectors to grow more quickly. It does therefore not come as a surprise that the political heavyweights of this world (e.g. USA, Russia, China) increase their investments to benefit of such future opportunities. That's why Europe should not lose track of playing a crucial part in the Space sector by maintaining its status as one of the key players in this area.

Europe has demonstrated outstanding results in the past, be it the landing of the Philae robot more than ten years after its departure from Earth – or by building the most reliable launchers such as the Ariane launcher. Further, European Telecommunications satellite operators build the top-notch of the largest operators worldwide. It is thus our biggest challenge to keep European space policy staying competitive in the next years to come.

For 2015, this means especially the full implementation of the two European flagship programs Galileo and Copernicus. With several launchers of new satellites this year, both programs will continue to be the driver for economic growth, not only by delivering their services to citizens, but by giving huge potential for innovation and business development especially to SMEs.

Credit line:
ESA - S. Corvaja
Programme:
IXV
Title:
Vega VV04 ready for liftoff

We now have to prepare the future by ensuring that European Industries will remain competitive and are on the front line of the needed technology. In space, the insight that no preparation today will lead to no success in the future is especially true. With the European investment plan starting and the MFF mid-term review in front of us, it is the right time for the European Parliament to stay involved and dedicated towards EU Space policy. Supported by the Sky and Space Intergroup, the Parliament will be an active actor and will bring its full support for long term orientation to ensure large expected economic benefits in terms of jobs and growth in Europe, thus contributing to strengthen EU industry.

‘Look up at the stars!’

Michel PRAET
Head of the EU Relations Office of ESA

In 2005, the landing of the spacecraft HUYGENS on Titan, Saturn’s largest moon, has granted ESA a worldwide recognition. It was indeed the first time that a spacecraft landed so far out in the solar system.

Last year, the landing of PHILAE (‘passenger’ of the ROSETTA probe) on the ‘Chury’ comet has also been a worldwide first and has also drawn unprecedented interest.

The main driver of all this was neither strategy, politics, economy or research; nor science. The main driver of space activities has always been and will always be **curiosity**.

Yes, curiosity.

Remember the words expressed by Stephen Hawking (from his wheelchair, speaking through his famous computerised voice system for communication) at the opening ceremony of the Paralympic Games in London: *‘Look up at the stars and not down at your feet; be curious’*.

‘Be curious’: this is precisely what space policy is about. More particularly: it is about knowledge. Knowledge about what? About whom?

Going to space gives access to **knowledge about us** and about the place where we live. Telecommunications satellites, meteorological and other “Earth observation” satellites make us understand better how to take up the various challenges we have to face.

To mention three very concrete examples: more than half of the essential data to understand climate change and, as a consequence, to better implement a climate policy, are coming from space; the COPERNICUS satellite system will be the fourth largest big-data producer in the world; and the PLANCK mission has provided unprecedented detailed maps of the very early universe from where our sun and planets were born.

Access to space gives access to knowledge about the Earth and also about the world, the solar system, the outer space and beyond.

But space is also, and I would even say that space is in the first place, **knowledge about ourselves**. About who we are. About our way of approaching the universe through our psychology, through our philosophy.

Setting foot, a human foot, on the Moon was certainly a great achievement in research and technology. But it was above all *‘a giant leap for mankind’* as Neil Armstrong rightly expressed. It changed the anthropological viewpoint of humankind upon its place in the universe, like the “E pur si muove!” by Galileo Galilei in 1633.

Indeed, since July 21st 1969, the most prominent man or woman, but also the poorest one, knows, observing the Moon, that he or she has been there. Because he or she is, in essence, a human being and can identify himself or herself with the astronauts that made his or her human dream become reality.

And this factual perception has tremendous repercussions on our society, our economy, our way of living but also our way of thinking. This perception creates openness, and we mainly owe to space and to space exploration the fact that being ‘open minded’ is something more than just a concept. It is not by chance that even at the worst times of the cold war, international cooperation in space never stopped.

That is why **space policy counts** and is definitely not just a technical policy.

Although space policy is linked, no doubt, with research and innovation (research that can be summarised with the formula ‘to give money to create knowledge’ and innovation with ‘to give knowledge to create money’), space policy is above all a **cultural endeavour** to go above and beyond.

The similarities between culture on one side and space on the other appear very clearly.

Space policy, the space venture is adding knowledge and value to our system, to the human system.

Culture has to do with curiosity, with beauty and with serendipity. And so do science and philosophy. And so does space:

- Space is driven by curiosity, as I already stated.

I always keep the words of Aristotle in mind: *‘Science consists in falling from wonderment into wonderment’*. So does space.

- Space is also driven by beauty

Remember the words of Daniel Zajfman, the President of the Weizmann Institute, stating that there is no good research without aesthetic emotion and reminding us that the laser was invented because it was beautiful, not because it was useful, even if it turned out to be also useful. Let’s remember the pictures from HUBBLE.

- And Space is activated by serendipity
- Serendipity is the best method to find something you are not looking for. It is a multidisciplinary and transversal approach that provides unexpected results that take humankind forward.

Last year, Europe celebrated fifty years of European space. With an ESA budget around € 3,5 billion a year, and with an EU Multi-annual Financial Framework planning to spend € 1.6 billion a year over seven years for space related activities, we are, in Europe, definitely on the good track to help solving the challenges our society is facing. Let’s continue to walk on this track and to act consequently. As Winston Churchill, the great wise man we commemorate these days, once said: *‘Continuous effort – not strength or intelligence – is the key to unlocking our potential’*.

Strengthening the competitiveness of the European Space Industry

Antonio TAJANI
Vice-president of the European Parliament, Honory President of the Sky and Space Intergroup

After a long crisis of over six years, the EU economy has come to a standstill. Despite signals of recovery, grow is fluctuating and the recovery has not taken off yet in full.

Having said this, Europe has many assets: we are a market with over 500 million citizens with a per capita income above 25.000 euros; we are the largest trading block and the largest trader of manufactured goods and services; we have good infrastructures, solid education systems and stable societies thanks to the 'rule of law'.

I think that with these assets and the determined growth policy that the EU has already started to implement, we can look at the future with optimism. The 'Industrial renaissance' remains a core objective of the new Commission led by President Juncker. And the priority is for the real economy, of which the space sector has an important part to play.

Space is strategic for Europe's independence, job creation and competitiveness. Space activities create high-skilled jobs, innovation, new commercial opportunities, and improve citizens' well-being and security. This is why we need to reinforce our European space policy to best exploit its social and economic opportunities for industry and SMEs.

While the EU is a strong player in the global market for commercial launchers and telecommunication satellites and services, it faces increasing competition from emerging industrial actors in countries such as China and India - competition posing a challenge to the further development of the EU's industry.

To address this issue, we need to increase industry skill levels, to make finance and investment more readily available, to ensure the EU's independence in space and also to reshape the EU's legislative framework to make it a driver for industry - for example with legislation to promote the production and dissemination of data from satellites for commercial purposes. But to achieve that it is absolutely essential to have a long-term financial commitment for these programmes and to think about new financial models.

EU investments in space-based infrastructures open up new opportunities for businesses in Europe. But we need to do more. Without a vibrant space industry in Europe, we will not be able to reap the benefits of our investments. We must provide the conditions to allow our industry to compete at global level, and to create a real internal market for innovative space-based services.

We in Europe have the know-how to make space a key instrument for economic recovery; we must give ourselves the means to use this expertise to enable our citizens to benefit from all the advantages it offers. The financial benefits from space are too great to be ignored. This is why back in 2013 I fought to have a budget dedicated to space programmes and fought against cuts proposed by Member States.

I am convinced that Europe's Galileo, EGNOS and Copernicus space programmes are proving their value in revitalizing the EU economy and creating jobs.

Talking about Galileo, the system is entering its exploitation phase and I think we should now try to develop innovative project financing initiatives, venture capital projects focussed on entrepreneurial projects, as well as project bonds. The Green Paper on the project of a Capital Market Union presented by the Commission last February is in this sense important. As Initiatives in the short and medium term could include a review of the current prospectus regime with a view to making it easier for SMEs to raise capital, simplifying the information included in the prospectus; or developing alternative sources of financing such as venture capital and crowd funding.

I am confident. The successful launch of two Galileo satellites last March proves that we are on the right track. This takes us one step closer to a global European satellite navigation system. We must continue along this line and must keep the objective to provide full services by 2020.

Finally, one word about the GSA. As I said before, it is important to creating tangible benefits for European citizens and businesses. And on this, the GSA has an important role to play. As you know, I opened the Agency in Prague back in 2012 as Commissioner in charge of Industry and Entrepreneurship. I am therefore very happy to see that three years after, the GSA makes sure that our satellite navigation systems are up and running. We have to be proud of the implementation of the Galileo system, which is the first European infrastructure. It's a sign of ambition and our willingness to be a global player.

Investment in Space Industry as an Avenue for Growth

David PARKER
Chief Executive, UK Space Agency

The UK's space sector is booming, growing at more than 7% a year. And yet, most people still have no idea how often they use space on an average day, getting to work, watching TV, communicating with loved ones. That can be a problem – each business case for a space investment can feel like starting from scratch - but it is telling that the private sector is increasingly active in space, offering purely commercial services in telecoms, Earth observation and human space flight. There is money to be made in space.

It is this recognition that space investments can deliver growth and jobs that has led the space renaissance in the UK. It is delivering impressive results - we are welcoming record numbers of companies into the UK and have created 5,000 new jobs in the sector in the last 2 years alone.

Our strategy is to work closely with industry to define shared goals and opportunities. Together, we have identified 15 markets where space can generate significant growth, set out in the Space Innovation and Growth Strategy for 2014-2030. We have consciously targeted investments in growing markets such as telecoms, and in innovative and disruptive technologies for small satellites, novel engines and new facilities that could deliver far cheaper access to space directly from the UK. Our objective is to capture a greater share of the growing global space market over the next 15 years through these targeted investments.

But we also recognise that space facilitates the growth of more and more of the economy. As services, shops and opportunities move on-line, we need to ensure that everyone, privately or in business, has affordable access to fast broadband even if they live in remote areas. And as the amount of data that we use each day soars, we need to ensure that the networks can cope and that the satellites that will need to be part of the solution are available. Is there a strategy in place in Europe to ensure that we have the satellites that we need so that we don't run out of network capacity? Are regulations and standards creating the right framework for the use of space in transport and agriculture, or are they barriers, preventing us from using the latest technologies? In short, are we thinking about space strategically enough to deliver the maximum growth?

Science often raises questions that can only be answered by launching instruments or probes into space and conducting experiments from afar. This places extraordinary demands on technology. The degree of innovation that is needed for a space mission, where large machines are miniaturised to fit in the palm of your hand, would simply not take place outside the demands of a space project. Entirely new uses for the smaller, lighter or more powerful technology suddenly become possible. We aim to exploit the benefits of this science through Government backed organisations such as InnovateUK and the Satellite Applications Catapult near Oxford, part of the Harwell space cluster.

Where we invest in space to support our activities on Earth, space agencies have a responsibility to ensure that we properly exploit taxpayers' investments in space infrastructure, that we 'sweat the assets' if you will. We are just starting to see the wave of data that will come from new Earth observation systems such as Copernicus. This 'Big Data' challenge could lead to entirely new uses of space data and services. It is very interesting that the European Commission has created a new unit to look at this. Similarly, as a civil service, Galileo will offer services that were previously only available to the military – another innovation that we need to take full advantage of. Some UK pilot work on Galileo services is showing interesting results.

Part of the trick is to mix experts from different disciplines, so that innovative approaches to problems are developed. The Harwell centre in the UK has a wide range of high-tech specialisms and we expect that it will become a hub for innovation in the use of space. The ESA's Centre for Satellite Applications and Telecoms will open its doors for business in July, marking another significant milestone.

Space can also help deliver growth by exciting the younger generation to study science, maths, engineering and technology so that our high-tech industries can recruit qualified staff that they need. Tim Peake's flight to the International Space Station this autumn provides an enormous opportunity to raise awareness of the importance and potential of space.

Investments in space are generally collaborative and need to be coordinated but this has not been done as well as it could have been between ESA Executive and the European Commission. This only serves to give our competitors outside Europe time to get ahead of us. Europe must work together better to compete with the new wave of space entrepreneurs.

We want to make the UK one of the best places to establish and grow a space company. In the 4 years since the UK Space Agency was created, we have made an excellent start in delivering that ambition.

Exciting and dangerous times for the European space industry

Jean-Loïc GALLE

President and Chief Executive Officer of Thales Alenia Space and Senior Vice President of the Thales group

New challenges for the European space Industry…

Today, Europe achieves a comparable result to the US on accessible commercial markets. This demonstrates the technological excellence of the European industry and rewards the efforts we make to relentlessly improve our competitiveness. These efforts make space one of the few high-technology sectors where Europe ranks at the very top worldwide.

Actually, and I cannot emphasise it enough : the very existence of the European space industry — and therefore of any European space policy! — depends on our competitiveness and our capability to win on open commercial markets (private operators and public export markets). The fact that the European space manufacturing industry relies for half of its turnover on the open market is a unique situation: in all other space powers, the share of institutional sales is much higher.

Nevertheless, this global open market is very limited, highly variable, and unable to ensure the required stability for the industrial base. And the competition is distorted by other space faring nations significantly supporting their industry through major public space programmes, adapted legislation and an ambitious "economic diplomacy". In addition, to compensate for the stagnation of US public budgets, the US space industry is increasingly present and aggressive on the export markets.

At the same time, our market is deeply changing: breakthroughs and new investors from the digital world and new business models are completely moving the frontiers with, for instance, the projects of large "low-cost" constellations in telecommunications and in Earth observation, or anchor tenancies with long-term institutional support.

Thales Alenia Space has a long experience with constellations and is already in this increasingly important business for now more than ten years, but public space institutions in Europe cannot ignore this new trend, and the absence in Europe of similar private investment capacities and initiatives.

… will require increased, and innovative, support from the public side

The European space agencies should make their role evolve in this framework, from the one of a customer to the one of a "sponsor", and concentrate their actions also on improving or setting up new manufacturing and production processes. We all have to make our mind, our culture and our global processes evolve !

But on the more "traditional" role of public institutions in space, increased and sustained efforts continue to be needed.

In its Communication of February 2013, the European Commission stated that: "*Space is more than a technological issue. It always had and will continue to have a strong political dimension which has not been developed properly at European level so far*".

We cannot agree more.

Given the high costs of technology development and low production rates, and in an overall context of uneven playing field, we cannot but emphasize enough the need – at the EU and national levels – for policies and measures aiming at safeguarding the competitiveness of the European industry worldwide, retaining the developed capability/know-how, together with guaranteeing the European strategic non-dependence.

Such approach would require to promote a level playing field through increased institutional procurement in Europe, offering European value for European investments, as well as to devise space-specific procurement rules and policies. Indeed, a solidarity among Member States – and with the EU – is needed regarding space procurement, which should take into account the strategic aspects of space and the nature of space programmes that are by nature long-term and high risk, and should also take into account the procurement policies of other space powers, which are all aiming at independence.

An efficient industrial policy should also rely on an ambitious and coherent R&D policy: Industry needs a long-term approach, much more adapted to the market needs, and much more focused on competitiveness and non-dependence.

Of course, Europe needs also to sustain its investments in space operational infrastructures such as Galileo/EGNOS and Copernicus (complementing the already existing public operational capabilities in meteorology, access to space…) and prepare their evolution. This should be done in parallel with actions aiming at encouraging the use of the European space infrastructures for EU policies' needs, including in security and defence matters.

Finally, as the Council of the EU invited to do in its conclusions in December 2014: we should start now to prepare the European space programmes of tomorrow.

Exciting subjects are starting to emerge where space is capable of providing an indispensable input: monitoring of CO2 sources in the frame of climate research and international policies, secured telecommunications for governmental needs, high-speed broadband access for all, maritime surveillance, integration of remotely piloted aircraft systems (RPAS) with space systems… Thales Alenia Space is looking forward working with European institutions to turn these ideas into reality, at the benefit of growth, jobs, and the efficiency of public policies.

European leader for satellite systems and at the forefront of orbital infrastructures, Thales Alenia Space is owned by Thales (67%) and Finmeccanica (33%) and forms with Telespazio the "Space Alliance". Thales Alenia Space represents a worldwide standard for space development: from navigation to telecommunications, from meteorology to environmental monitoring, from defense to science and observation. Thales Alenia Space has 12 industrial sites in 6 European countries (France, Italy, Spain, Belgium, Germany, United Kingdom) with over 7500 employees worldwide

The Major Challenges Facing Europe's Space Sector: Power, Space services, Independence and Security

Franck PROUST

MEP (EPP Group), member of the Committee on International Trade and the Committee on Transport, Vice-chair of the "Sky and Space" intergroup.

"The space sector, an industry like any other". Not many people know that. In fact, it is a sector with its own commercial logic, which includes manufacturers, products, private and public clients, a growing market, a distribution channel, and better still, competition between companies and countries.

"The space sector, an industry like any other". This concept laid down the foundations for my first mission, i.e. to demystify Space to the general public. This mission is even more logical and natural considering the constituency that I represent: the great South West of France. This part of Europe is the champion in all categories of the Space sector. The expertise and know-how of those regions are renowned worldwide. The Space sector employs thousands of people. It is a daily reality for many families and companies.

I wish to extend this reality, which touches only a few, and fight to make Space useful for all. Some countries in Europe, spearheaded by France, have developed their own space policy. But when I say "usefulness for all", I mean "usefulness for all Europeans", and therefore programmes and other related matters developed by the Commission and the ESA.

The usefulness of Space is measured by the demand, both existing and emerging, in terms of space applications and services.

During the Cold War, the major powers waged a fierce fight to send humans ever farther, ever higher. In the 21th century, the paradigm of the conquest of Space has changed: it is no longer about sending up humans, but satellites, into space. It is no longer about praying for success during launches but to understand how, why and how often we are going to use those satellites once in orbit. Nowadays, the conquest of Space is being played out mainly through the demand, the services and the concrete applications for the citizens, companies and states.

At times this demand is obvious, but at other times, a lot less so. I addressed this issue at the last conference on the European Space Policy (Brussels, January 2015).

The demand is obvious as we expect satellites to become more and more efficient at monitoring geographical positioning, telecommunications and climate change. Europe largely meets this demand, either through public programmes (Galileo and Copernicus) or through the competitiveness of our companies (telecommunications). But the demand is less obvious as it covers areas where Space is not necessarily expected to play a part in, like security, defence and sovereignty matters. These issues are in the interest of all people, and more particularly every state, in Europe. Whereas the conquest of Space is no longer a security and sovereignty issue, space policy in the broad sense has remained one.

This raises several questions.

As opposed to American technologies, the majority of the signals emitted by Copernicus and Galileo are open access in order to boost innovation. It is a choice. But as Europeans who have invested billions of euros into these programmes, how can we be sure that we will have an actual return on investment for our jobs and our economic growth? Isn't this a naive position? Why then not restrict some access to European companies alone, at least initially?

Our independence, our sovereignty is at times threatened regarding certain critical equipment (our dependency upon foreign technologies and the lack of maturity of our own research programmes). There may be some strategic limitations to the game of scientific cooperation. Doesn't the solution lie in massive investment in favour of critical technologies, even if it means redirecting a part of the Horizon 2020 programme in order to catch up and overcome our lagging behind?

What about the issue of security matters, namely at our borders? Frontex has recently started using Copernicus. Why not replicate this on a larger scale?

Finally, in defence matters, too: as we are talking about a European defence, why not use these technologies for this common defence, if the latter were to become a reality.

And the answers can be relatively straightforward.

The European Space industry is the highest-performing and most competitive industry in the world, but it is also very modest: with a staff budget 10 times smaller than the United States for example, it boasts an equivalent - if not higher - degree of technological development. The European Space industry is a tool that should be preserved for its contribution to growth (6% of the GDP depends on space technologies) and for the tens of thousands of non-relocatable highly qualified jobs that it represents.

Considered as a whole, Europe is clearly a Space power. But it has only just started to see its relevance. As opposed to the other powers, we don't appreciate the fact that the Space industry is a political tool. All over the world, space powers are launching programmes, financing research and opening up market opportunities. This is less true in Europe. Yet, without a strong public input, without public support, the share of the European Space sector in the world is likely to shrink. Is Europe going to take the step?

Airbus Safran Launchers: a new "Made in Europe" world-leading company in the launcher sector

Alain CHARMEAU
Airbus Safran Launchers CEO

Airbus Safran Launchers – the equally-owned Joint venture between Airbus Group and Safran combining their strengths on launcher activities and related propulsion systems - has been operational since January 2015 only six months after its announcement by the two major European aeronautic groups in June 2014.

The creation of Airbus Safran Launchers opens a new chapter in the history of the launcher industry in Europe and this initiative is tightly interlinked with the decision taken in December 2014 at ESA Ministerial conference to start the development of Europe's next-generation launcher – Ariane 6.

Indeed, Airbus Safran Launchers is taking the reins for the development of Ariane 6 launcher system, combining the proven expertise from Airbus Defence and Space both in France and Germany as prime contractor for current Europe's Ariane 5 launcher system and the undisputed competencies from Safran in liquid and solid rocket propulsion.

At the same time, Airbus Safran Launchers is responsible for reinforcing Ariane 5's success story with its 65 consecutive successful launches from the European spaceport in French Guiana since 2003. This unmatched reliability led Europe to its current number 1 position on the global commercial launch service market in an increasingly competitive environment.

Reflecting the joint ambition of Airbus Group and Safran to create the conditions for a long term sustainability of the European Launcher sector, Airbus Safran Launchers is now developing a modular family of versatile, high-performance and extremely cost-competitive launchers, as Ariane 6 in its two versions – Ariane 62 with two boosters and Ariane 64 with four boosters – is designed to meet the needs of both European institutional and commercial customers from 2020 onwards. To secure a timely and cost efficient development and set solid grounds for the exploitation phase, the new Prime contractor will also take a much larger share of risks and responsibilities in parallel to a major simplification of the launcher sector governance.

As time is of the essence, Airbus Safran Launchers has been set up at a record speed bringing together in a first step the programme teams from Airbus and Safran in charge of Ariane civil launchers since January 2015. In a second step planned by end 2015 after completion of the social consultation procedures, Airbus Safran Launchers will encompass all the activities on civil and defence launchers and related propulsion systems, taking benefit from the large synergies between rockets and ballistic missiles technologies.

Airbus Safran will then be established as a world leading company in the launchers sector with around 8000 employees and their invaluable knowledge located in Europe.

Key figures

Key managers: Marc Ventre (Chairman of the Board), Alain Charmeau (CEO)

Capital: 50/50 held by Airbus Group and Safran

Employees: 450 in phase 1 (until end 2015) / 8000 in phase 2

Turnover: ~ €1 billion in phase 1 / ~ € 2,3 billion in phase 2

Business scope: civil launchers in phase 1 / civil and defence launchers in phase 2

Prime contractor for Ariane 5, Ariane 6 and future civil launch systems in phase 1 + Prime contractor for M51 French ballistic missile and its evolutions in phase 2

Illustration 1: artistic view of Ariane 6 launcher

Consolidating a network of regions supportive of the development of the Space industry

Marian Jean MARINESCU
MEP, (Vice-President of EPP Group), Member of Committee on Transport and Tourism

Regional imbalances across Europe can be reduced through Global Navigation Satellite Systems solutions. Rural regions, communities in remote areas will be linked through fast access to internet services and other communication services due to improved telecommunication satellites support.

All the Member States will benefit from telecommunication satellites despite differences in approaches and interests.

Space provides various types of benefits for Europe›s regions through enabling inter-regional risk-management services, alert services or better coordinated planning.

Galileo Space technology will be increasingly active and interactive through Europe›s regions for a large number of very important uses: the monitoring of borders, the monitoring of maritime traffic, the management of humanitarian disasters, agricultural monitoring, estimates relating to food production, air quality, environmental assessments of forest ecosystems in Europe, early warning and floods prevention, forest biodiversity, biomass and growing stock assessments, etc

Europe›s regions are already getting several benefits from space technology. There are almost 200 EGNOS approach procedures in around 100 airports and 16 operators are currently flying with EGNOS avionics. Two thirds of the European farmers that use GNSS adopted EGNOS, and there is a large potential growth in precision farming, particularly in Eastern Europe. The GNSS use in railways has been increasing and it is expected to increase substantially, with forecasts showing that 30% of trains in use will be equipped with GNSS by 2022.

With EGNOS already delivering valuable services and Galileo to be soon providing its first services, space technologies are now in the hands of the market and of the citizens.

The network of regions supportive of the development of the Space industry will be consolidated through shifting from technology to its exploitation, from a question of “How do we do it?” to “What can we do with it?” And the answer to the latter is: first, develop applications through which the industry and the citizens can get the most out of the EU’s space technology; second, ensure EU-wide compatibility between Galileo and EGNOS and receivers used across various industries; third, when possible, impose the use of Galileo and EGNOS through various pieces of EU legislation, particularly in land and air transport, where precision and accuracy are crucial.

The best example in this respect is eCall and securing the compatibility with Galileo and EGNOS, legislation on which the European Parliament voted last week in the Strasbourg plenary. With the European Parliament stepping in, eCall, the in-vehicle emergency call to deploy emergency assistance using the signals emitted by the Galileo constellation of satellites, will be available on the whole European road network as of 2017.

The potential of GNSS technology-based applications clearly illustrates the growth of social and economic benefits arising directly from GNSS applications accros Europe, for its regions and cities.

Further activities available across Europe›s regions and cities that could benefit from such applications are road safety, fee collection, traffic and parking management, tracking and tracing of goods, online booking, safe shipping, digital tachographs, animal transport. Not to mention the benefits in terms of job creation — in Europe, about 300,000 people work for the space industry together in the upstream and downstream services, and it is estimated that about 15% from this number is GNSS-related. Through investing in space programs, Europe is building its human capital and know-how, which leads to technology and product innovations, as well as cutting-edge industrial capabilities.

When it comes to the exploitation of Galileo and EGNOS, the most important thing in my view is to ensure that the user on the ground benefits from the technology in the sky. This is why, as Rapporteur for the European regulation concerning the two programs, I have fought for the financing of the downstream market of applications both via the Horizon 2020 program, as well as through the provisions laid down in the EU’s GNSS regulation.

Europe›s regions will enjoy the services of all foreseen applications if the EU ensures proper functioning of a downstream market without unfair barriers for products.

I believe that the new Directive on Releasing the potential for economic growth in the space sector, currently debated in the European Parliament, will be able to ensure the development of the internal market of Earth observation satellite data for commercial purposes by establishing a transparent, fair and consistent legal framework across Member States. A comprehensive regulatory framework shall be set in order to improve the legal coherence and functioning of a European market for space products and services.

How launchers and satellites help to build the digital highway

Karim Michel SABBAGH
President & CEO, SES

Satellites are on the rise. A proven technology that has built a stunning track record over more than a generation – helping to create multi-billion broadcast, content and data business , markets and jobs – is now making another quantum leap into a new era of connectivity.

Satellites, and the launch and manufacturing industry needed to get them into space, are both undergoing amazing changes. While the tried and tested methods of building and launching satellites are well understood, there is now a true revolution under way, bringing dramatic savings and a real democratisation of the industry.

The new mantra for satellites consists of three key elements :

- innovative electric propulsion systems allow to significantly reduce or change the weight of a satellite
- digital on-board processors enable complex and cost-efficient two-way data connectivity
- and modular construction methods for satellites allow to increase the time to orbit and therefore to market.

Through these changes, satellites can become highly adaptable and responsive to an exponentially growing variety of market demands

The new concepts unlocks enormous potential and commercial advantages and will take satellite well beyond its boundaries and far beyond the video business, into numerous areas of fix and mobile data transmissions and into governmental as well as institutional solutions. The innovations and step changes will help satellite embrace new markets, new business and many new customers.

Our challenge is to create universal digital highways that are scalable, sustainable, flexible, transparent, and ecological.

The digital divide between the well-connected and the poorly- or un-connected must disappear. But there is not enough capacity in the fixed networks for the demands even of the nearest future, and the upgrades necessary would cost hundred of billions of dollars in road repairs, cables and tower construction.

Only a hybrid solution – combining satellite and terrestrial infrastructures – can be effective almost immediately, removing most of the weight of the anticipated global traffic from terrestrial backbones and the aching joints of fixed access networks.

In joining forces and with a regular and constructive dialogue with European institutions on that matter, we can create an inclusive mix of infrastructure, combining the unique strengths of satellite with other technologies and creating a hybrid formulation for next generation video and data networks - for everybody's use - and benefit.

SES, Luxembourg, 22 June 2015

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What industrial policy for the European Space sector?

Jean-Jacques TORTORA
Secretary General of Eurospace

Introduction

Space is one of the few areas of technological and industrial excellence of Europe. The European space industry, despite its limited size as compared to its international rivals, performs very well, delivering worldwide highly regarded scientific missions and demonstrating its competitiveness on the commercial markets accessible to satellite manufacturers and launch service providers.

This was achieved thanks to the consistent and persistent investments made by Member States since the 70's.

However, despite its commercial performances, the European space industry remains heavily reliant on public markets. Institutional programmes are key drivers for the development of new technologies, would it be in the field of earth sciences, astronomy, space exploration or security and defence. No commercial market at the moment can sustain the level of investment required to keep up with the evolution of technical requirements in these areas, and only institutional programmes can bear the level of risk associated to the in-orbit qualification of the new technologies at stake.

The fact that industry needs a sustained institutional market is undisputable, and the renewed interest of governments in industrial matters, along with the growing involvement of the European Union in the space sector, is the occasion to revitalise reflections on the merits of a sound industrial policy at the European level.

As a matter of fact, the key question is to assess whether the current rules are adapted to achieve such important political objectives as the preservation and enhancement of the industrial autonomy of Europe in the space sector by:

- Capturing industry Research, Technology and Development needs so as to strengthen the competitiveness, efficiency, and reliability of its products,
- Enhancing the European non-dependence and ensuring unrestricted access to the state-of-the-art in all technological domains at acceptable economic conditions,
- Contributing to a balanced industrial development across EU Member States.

From Manufacturers to Capacity Providers to Service Providers

Beyond hardware manufacturing, space business developed downstream and gave birth to a set of space operators who now play a decisive role along the value added chain. In turn, space operators are actually capacity providers and are key customers of the space manufacturers.

Further downstream, the ambition of European institutions is to trigger the development of a new set of players, such as the service providers, which will process the data delivered by space systems such as Copernicus or Galileo and thereafter reach end-users by bringing adequate added value to the data for them.

The potential development of this sector is promising and is a necessary condition for the growth of the demand and for the effective use of public investments in space.

Space Infrastructures Paradigm

In any case, the sustainability of services can only be ensured by long-term guarantee of availability of space infrastructures. This raises the question of the most efficient way for public bodies to ensure such sustainability.

Basically, two different options are offered to institutions:

- ***Owning the infrastructures:*** This implies procuring them and overseeing their operations. It requires a strong and long-term involvement in industrial processes,
- ***Relying on the private sector for the development, deployment and exploitation of future European space infrastructures:*** In this case, the private sector invests in space systems and delivers on a commercial basis services and/or data for the fulfilling of 'public needs' against long-term commitments for the procurement of such services and data.

After a long and painful political process, it was agreed that Galileo and Copernicus would be publicly owned and managed. However, some successful examples like Paradigm in Europe, or many uprising initiatives in the USA, show that the alternative model is somewhat relevant.

It comes along an in-depth redefinition of the customer/provider relationship between institutions and industry in which institutions define long-term needs in terms of service requirements and adhere to them.

On the other hand, more initiative is left to industry to optimize the design, production and operations of the systems, going along with the acceptation of a higher degree of risk.

Is such model desirable for Europe?

It has some merits for both public and private parties:

- For institutions, it allows a flat-rate multi-annual budgetary profile since most of the technological risks of development and deployment phases are transferred to industry. It ensures continuity and stability

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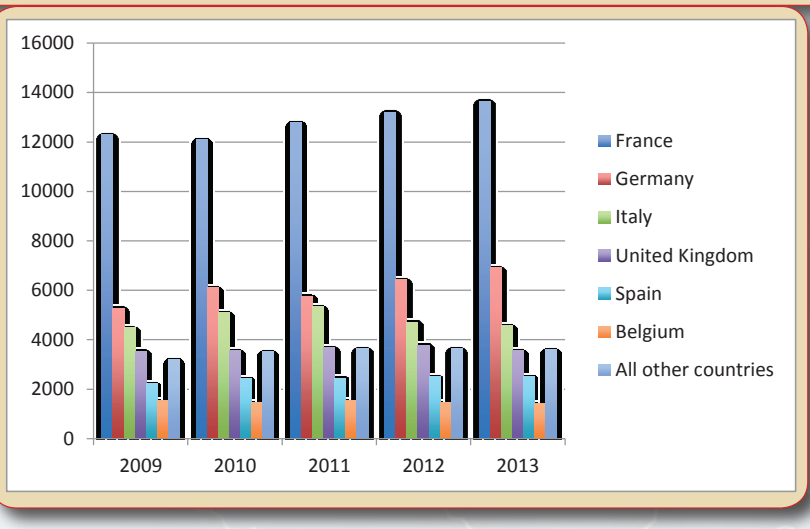
Space industry employment in European countries (FTE)

Employment (FTE)	2009	2010	2011	2012	2013
France	12288	12082	12778	13205	13641
Germany	5270	6112	5752	6425	6898
Italy	4490	5095	5331	4711	4578
United King	3532	3554	3667	3777	3553
Spain	2212	2439	2444	2493	2518
Belgium	1523	1446	1542	1438	1405
All other co	3201	3519	3629	3629	3590
Employment (FTI	32516	34247	35144	35679	36184



of services aiming at fulfilling public needs on fixed price basis once the systems are operational.

- For industry: It offers a greater autonomy in the management of developments and offers long-term stability. However, the traditional risk-sharing scheme with institutions in the development and deployment phases is then replaced by a more complex approach where the private sector bears a much higher degree of technical risks against a long-term tenancy from public bodies in the exploitation phase.

Is Europe ready for such a radical move?

A pre-requisite is to structure and foster the Europe-wide public demand for space-based services. To date, this market is scattered throughout Europe and cannot compare to the needs expressed by the US administration in all the areas of space applications.

A second issue is the elaboration of technical specifications. What industry needs is a competent public customer knowing what he wants and determined to get it. Currently, the European Space Policy approved by EU members States in 2007 foresees a split of roles between ESA, in charge of developments with the "upstream" sector, and EC in charge of the "downstream".

In such scheme, there is no continuity along the added-value chain and none of the two bodies has the ability to capture the needs of the users and to turn them into the right technical specifications providing a proper frame to the development phase.

Instating such continuity should be one of the objectives of the revisit of the European Space Policy proposed by the outgoing Italian Presidency of the EU.

New paradigms and innovation in the space sector

Marco FUCHS
CEO, OHB SE

In 1967, an essay by French journalist Jean-Jacques Servan-Schreiber sold over 10 million copies worldwide and caused a great stir across Europe. In "*Le défi américain*" ("*The American challenge*"), Servan-Schreiber argued that a fragmented Europe faced the risk of becoming increasingly irrelevant when confronted to the triumphant United States and its dominant firms. One full chapter of the book was devoted to the conquest of space, allowing Servan-Schreiber to make the painful comparison between the tremendous American successes in that domain and the complete failure of the Europeans to start an effective program of their own. Servan-Schreiber concluded that the only way out was the establishment of some kind of "federal European NASA".

The European Space Agency (ESA) was indeed founded 8 years later, and for more than 40 years has helped European space scientists and industries challenge and successfully match the bar set by the United States. During this time frame, space was mainly about science, TV broadcasting and meteorological services.

Fifty years have passed since Servan-Schreiber's distressful findings and the time has probably come for a new wake-up call aimed at both European policy makers and industries. And despite the undisputable progress achieved by many emerging space faring nations, the challenge Europe has to take on originates once again from the other side of the Atlantic.

Indeed, new contenders – most of them did not exist 20 years ago – are entering the space market via the back door. The most powerful players in today's digital economy, the US companies Google, Apple, Facebook and Amazon all want to make their internet services available to even more consumers around the globe, wherever they live and whatever their level of resources might be. For this to happen at an affordable cost, mass production of space infrastructure is a key. Established space manufacturers will probably have to reinvent themselves if they do not want to be wiped out in the long run.

Disruptive technologies such as electric propulsion are already reshuffling the satellite telecommunications market in a profound way. Satellites are lighter and therefore cheaper to launch, offering a direct advantage to the companies that operate them. As a result, spacecraft manufacturers are now engaged in a race for developing and selling new satellites based on this promising technology.

Exactly at the same time, the launcher sector itself is being shaken by the new paradigm of privately funded companies offering their services to commercial and institutional customers alike. The innovation here lies not so much in the technologies used as they are usually well-established, but in the business model itself. Those American companies – led by Space X – are (in) directly backed by the US government, but they attract customers from all over the world, jeopardising the future of a less flexible European launcher sector.

For Europe to keep pace in this evolving environment will require new ambitious measures. There is fortunately a general agreement that the EU is the right level to implement a consistent space policy: indeed, the challenges for which space technologies can make a contribution are global in their very nature (security of borders, climate change, air pollution…) and extend beyond national borders. Furthermore, building the public infrastructure required exceed the capabilities of any single member state alone (Galileo is a good example). Finally, the European Union single market and its millions of consumers willing to embrace new applications based on space technologies is one of EU's greatest achievements.

So, how can the EU contribute to more innovation in the space sector? Quite a few levers are available to EU policy makers. The most obvious one is likely to be the dedicated R&D instrument aimed at fostering innovation called Horizon 2020. Available funding are on the rise but have to support more directly the global competitiveness of the European space industry.

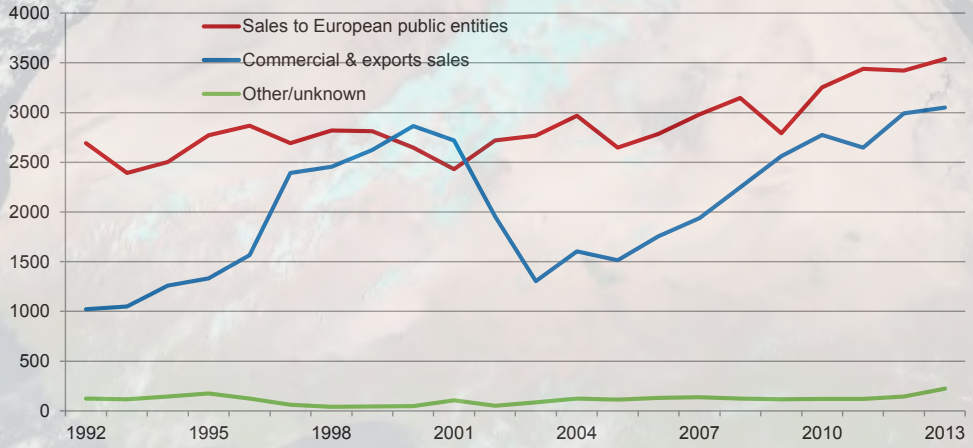
More generally, the current tight budgetary context also means the European Union should more than ever ensure the broadest competition possible for all its own space-related procurement. This will indirectly compel industry to be innovative and look for the most cost-effective solutions, for the greater benefit of the European taxpayer.

Even if they are not limited to space alone, creative funding mechanisms should also be promoted. Europe lacks philanthropic billionaires and business angels willing to reward ingenious innovators on their own wealth, but new alternatives are quickly emerging. For instance, crowd funding of space infrastructures and services is still in its infancy.

In the long term, Europe will also need skilled engineers and scientists to develop, build and operate the space infrastructure and services of the future. Not only should Europe avoid a "space brain drain", the European Union should also become the destination of choice for anyone willing to come up with innovative ideas and start a new business linked to space.

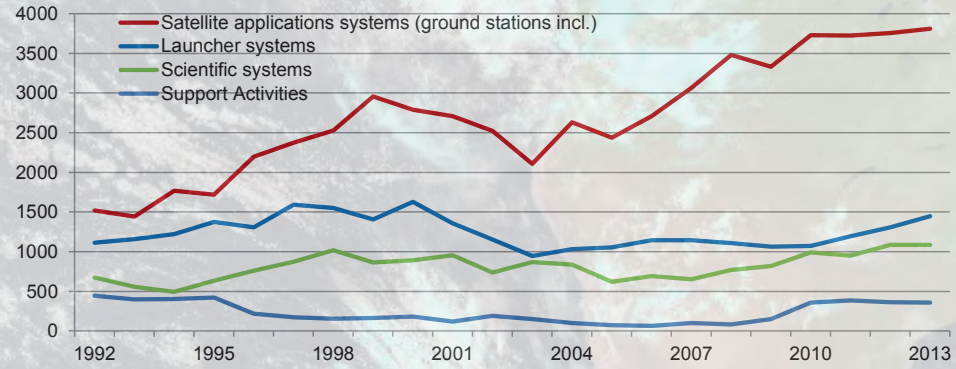
When Servan-Schreiber wrote his book, space predominantly was about science, national prestige and publicly-funded programmes. Creating jobs, making profit and boosting the economy were not objectives assigned to the space sector. In 2015, this is nevertheless what the new challenge is all about. No doubt innovation will be key to address it.

European space industry sales by main market segment - European public entities vs Commercial and exports (M€)



1992 1995 1998 2001 2004 2007 2010 2013

European space industry sales by main market segment - type of system (M€)



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The Future of Launchers: a shift towards independent European access to space launchers with Vega-C and Ariane 6

Roberto BATTISTON
President, Italian Space Agency (ASI)

2014 set the scene of a new European launcher sector:

- ESA Member States strengthen the foundation of a European independent and affordable access to space
- Ariane 6 and the Vega evolution (Vega-C) are now on the right track;

The preparation of the ESA Ministerial Council held in Luxembourg in December 2014, required last year a very intense calendar of meetings and fruitful discussions in order to agree upon a common vision for the future of European Launcher sector.

The willingness of all involved ESA Member States to properly shape a more competitive, efficient, affordable and reliable European independent access to space, eventually allowed to approve the new Ariane 6 and the Vega evolution (vega-C) developments, by making also available an associated budget of almost 4 billions of Euro, representing the most important ESA development program.

It is worth to mention that these decisions have been made taking duly into consideration, on one hand, the European institutional needs (including the financial affordability of ESA Member States along a ten years' time frame in the launcher domain) and, on the other hand, the need to exploit a family of European manufactured launch vehicles capable to be competitive in the worldwide commercial sector without further institutional support.

Before the ESA Ministerial Council several events contributed also to radically change the overall reference landscape and some important boundary condition. At European level the decision to evolve the shareholding of the European launch service operator, the constitution of a French Joint Venture between Airbus and Safran and the confirmed request of ESA Member States to make an adequate budget available for Space science, exploration and applications. Worldwide, the implementation of the US policy for access to space and the emergence of new non-European strongly competitive launch service operators.

All these elements influenced the debate and allowed to agree the new principles of a renewed Governance scheme for European Launchers, including new roles of institutional and industrial sector, with an increased responsibility for the latter. In particular, an increased industrial responsibility during development (on the basis of institutional High Level Requirements – HLR) and exploitation, an extended perimeter of exploitation tasks for the launch system Prime and last but not least, an industrial financial contribution to the development of Ariane 6.

Conversely, they strongly affected also the technical assessment related to the new European large and small-medium launcher (i.e. Ariane 6 and the Vega evolution) in term of system architecture, staging, type of propulsion as well as possible real synergies between the two launchers.

One of the main result of the trade-offs performed last year, is the so-called P-120C solid rocket motor, which represents the main building block of the European family of new launchers. Indeed, it will be used as first stage motor of the new Vega-C launcher as well as Ariane 6 strap-on booster (2 motors for the Ariane 6 version 62 or 4 motors for the Ariane 6 version 64, depending on the actual mission needs). It is obvious that this circumstance provides consequent direct benefits in terms of i) overall development cost reduction for the two launchers, ii) production cost reduction by the increased production volume and rate, iii) increased competitiveness and flexibility of both launchers. It has to be underlined, in this respect, that solid propulsion has been and it will remain for the next 20-25 years' time frame a major factor determining the competiveness and the reliability of the European family of launchers due to both its intrinsic simplicity and possible modularity with respect to liquid propulsion and its lower production cost. The new P-120C solid rocket motor is therefore one of the main pillar of the family, providing reliability, low cost, modularity and flexibility of performance.

Ariane 5 vs Ariane 6.2 and 6.4 configurations

Feb 2012 Vega maiden flight photo

As far as the new Governance scheme is concerned, as mentioned above, a transfer of shares of the European launch service operator is foreseen from public sector to industry. In order to thoroughly assess the impact of such a change, further analysis and reflections are on-going specifically in order to ensure the fulfillment of the interests of all actors involved and to ensure a profitable business case for both Ariane 6 and Vega-C. This shall necessarily include also the identifications of necessary potential amendments to be introduced on existing Intergovernmental agreement such as the Launcher Exploitation Declaration (LED) and lower level arrangement governing ESA-Arianespace relationship such as the Launchers Exploitation Arrangements (LEA).

All the mentioned decisions and activities are expected to strongly improve the competitiveness of the European family of launchers, avoiding future public support. In the meantime, it is foreseen to discuss if possible additional activities (e.g. Lox-Methane liquid propulsion for Vega upper stage and the future Ariane 7) may be started, while remaining in the agreed ESA "financial corridor " for launchers.

Furthermore, taking into account that the developments of the new members of the European launcher family have already been decided and consolidated in the ESA framework, it is now necessary to continue and to widen the discussions on a possible European access to space policy with the European Union (EU) and with ESA and EU respective Member States. The goal shall be to put in place the right conditions for a consistent and progressive growth of the institutional demand of launch service in Europe, in other word to create one of the main ingredients of a competitive European space sector.

How to unlock the potential of the Copernicus programme

Philippe BRUNET
Director for Space Policy, Copernicus and Defence - DG Growth, European Commission

Copernicus is the European Union's Earth observation and monitoring programme. It provides accurate and reliable information in the field of the environment and security, tailored to the needs of users and supporting other Union policies, in particular relating to the internal market, transport, environment, energy, civil protection and civil security, cooperation with third countries and humanitarian aid.

Copernicus aims at maximising socio-economic benefits and stimulating smart, sustainable and inclusive growth by promoting the use of Earth observation in applications and services and by fostering the development of a competitive European industry currently aiming towards an annual growth rate of 7%.

The programme is moving into full-scale deployment and already demonstrating what Copernicus can do for environmental monitoring, emergency response, climate change understanding and civilian security. Two of its services, emergency management and land monitoring, are already established and operational; the atmosphere and marine environment monitoring services are switching to operational mode, to be followed by the security service and climate change monitoring service later on. It is through these six core services that Copernicus reaches and serves the needs of policy makers, scientists and researchers, the public at large, and private and commercial users.

Copernicus is a complex system which collects data and information through multiple sources: Earth observation satellites and in-situ sensors such as ground stations, airborne and sea-borne sensors. The first dedicated satellite, Sentinel 1-A, launched in orbit in April 2014, is already delivering images of excellent quality. Judging by the number of registrations (more than 8,000 individual users by May 2015) and the rate and volume of downloaded products, its user uptake has been enthusiastic.

The programme promises to bring socio-economic benefits for Europe many times larger than the size of the investments made. It spans the entire value chain of the Earth observation market and is a driver for innovation and the creation of highly-skilled jobs, with direct and indirect benefits for the EU economy. Studies estimate that thanks to Copernicus some 40,000 qualified high-tech jobs will be created or maintained in the EU and €30 billion (equal to 0.2%) will be added to the EU GDP through 2030. The potential downstream market turnover directly attributable to Copernicus is estimated to be €1.8 billion by 2030.

The time has come for Europe to reap the full benefits of Copernicus.

The key to unlock the value of this public investment is a data policy based on the principle of free, full and open access to all Copernicus data and service information. This will stimulate new services and business models, and will create new opportunities both in the space and non-space sectors (e.g. agriculture, traditional and renewable energies and power generation, transport and infrastructure development, urban planning, non-life insurance, among many others.)

The full Copernicus constellation will produce unprecedented amounts of data (up to 8 Terabyte/day). Together with additional data from the contributing missions, this information needs to be processed, disseminated and archived so that an increasing number of public, commercial, scientific and private users can exploit it.

Ensuring effective, easy and fast access to this data is one of the most important challenges Copernicus faces. First, because the multiplicity of partners involved in the Copernicus dissemination activities requires both flexible and effective coordination. And second, because the sheer volume of data and information to be disseminated and used puts Copernicus at the forefront of the Big Data challenges.

This new paradigm requires a change of approach and a technological leap to both ingest processing and make available the increased volume of Copernicus data and information. In return, the Big Data paradigm offers new perspectives for data intensive activities where Europe could still close its technological gap with the US with huge industrial implications.

The free, full and open data policy will support the development of a strong Earth observation downstream service industry if an effective and scalable Copernicus dissemination system is implemented to meet the Big Data exploitation challenges. The Commission is therefore investing in ramping up the data processing and distribution structures of Copernicus and scaling-up the necessary IT infrastructure and services.

Through Horizon 2020, the Union's framework programme for research and innovation, we will support the development of state-of-the-art Big Data solutions, know-how and technologies to foster the evolution of Copernicus. Big Data and Cloud solutions will become an integral part of Copernicus. This should enable the broad uptake and exploitation of its resources, spurring a vibrant European downstream sector.

Another challenge is to support the user uptake of Copernicus data, information and services. For this, specific accompanying measures are built into the programme to increase the awareness of existing users and reach out to new users for Copernicus products through awareness and training events, networking and clustering of

Title Sentinel-6
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user communities, exchange of best practices on how to integrate Copernicus services in specific user environments, development of different test cases and showcases, which have proven a successful way to demonstrate the usefulness of the open Copernicus products. The use of light innovation voucher schemes, for instance service vouchers, is also considered as a means to link users to expertise available on the integration of Copernicus products and tools into work processes and business practices. Organisation of Copernicus applications competitions, like the Copernicus Masters, and developer camps are additional ways to increase the uptake of Copernicus.

To complement these efforts the Commission is also mobilising the tools and resources available under Horizon 2020 to support the development of downstream applications and services using Copernicus data and information and their smart integration with other related technologies (including positioning and ICT). In 2015 we focus on innovation actions bringing Earth observation applications to the market by supporting the development of commercial service platforms. The goal is to capitalise on investments made in Earth observation and generate economic return. Upcoming priorities include development of downstream services for public authorities through innovation procurement. The objective is to launch demand-driven innovation actions by public authorities at national, regional or local levels, aiming at customising Copernicus information for their specific needs.

We need to further mainstream the use of Copernicus into EU and national policies and legislation. A growing number of directives already take direct reference to Earth observation as a tool for verification, which is a clear indication of the growing importance and potential of Copernicus in policy making. Many policy areas can use Copernicus generated information and the Copernicus core services already deliver policy relevant products. We will continue to analyse existing and planned EU legislation to see where Copernicus data and information could add value. More concerted action is also needed to create awareness and interest among different Commission departments and EU agencies as users of the Copernicus information.

To unlock the commercial potential of Copernicus we have to create the right conditions and incentives for the development of a downstream sector on the basis of data and information provided by Copernicus. The tools and instruments available at EU level (primarily Horizon 2020 and COSME[1]) should be mobilised to intensify research and innovation activities engaging the private sector and particularly innovative SMEs, strengthen the links to business incubation and consolidate the knowledge triangle linking academia, industry and service providers. This will create a vibrant eco-system capable of transforming Copernicus information and data into innovative value-added products and services, using advanced Big Data technologies and serving a Europe-wide and even global market.

Looking ahead, we should facilitate the emergence of new business models along with innovative concepts for upstream, midstream and downstream sectors, including new partnering schemes addressing public-public (P2P) and public-private partnerships (PPP). This will allow evolving towards a robust and sustainable European Earth observation capacity which, in turn, is expected to stimulate further investments.

The challenges ahead are big as technological and market shifts, emerging mostly from the US, force us to rethink the way we do business in Europe. The models of Google, Amazon, Facebook and Apple clearly show that space technologies are becoming part of a new, much more integrated business model, including services, Big Data management and an integrated user-driven dimension. In order for Europe to keep its rank in this changing global competition, we need to take a leap forward beyond these changes and enable a European response.

Copernicus is a great opportunity for Europe. It can foster the creation of strong and competitive European Earth observation-enabled markets where data, information and service providers flourish. This offers a huge potential for innovation, growth and job creation.

If we set things right with Copernicus, the European industry has a unique chance to become a leader in this global, fast growing market. Europe should not miss out on this opportunity.

1 COSME is the EU's programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises running from 2014 to 2020.

Space combating climate change
Europe's contribution towards the COP21

Jean-Yves LE GALL
President of CNES

The coming months from now to the end of the year will be pivotal to the international effort to curb climate change and global warming.

Following almost 20 years of negotiations, the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) will be held next December in Paris. Set to be the largest diplomatic conference ever held in France, the COP21 will bring together the international community to agree for the first time on a universal, legally binding agreement, succeeding the Kyoto Protocol.

Such a binding commitment will enable an effective response to climate change and speed the transition to resilient, low-carbon societies and economies in order to ensure a sustainable future for humankind. To achieve this goal, the future agreement must focus equally on mitigation efforts, like for example substantially reducing greenhouse gas emissions to limit global warming to less than 2°C and adapting societies to cope with current climate changes.

The COP21 opens a very unique window of opportunity because, as the French Minister of Foreign Affairs recently pointed out, we are the first generation to become aware of the threat hanging over us and the last that can effectively deal with it.

To support these ambitious objectives and their enforcement, timely and accurate information about Earth's environment is paramount. Coupled with other sources of data, the global picture provided by observation from space is today crucial to provide a better understanding of climate change, to monitor our planet and environmental pollution, disasters and dwindling natural resources, and to help shape the right response. Out of the 50 Essential Climate Variables (ECVs) defined by the Global Climate Observing System (GCOS), 26 can only be monitored from space.

While conceiving measuring systems for this purpose is extremely challenging, for instance to detect trends of one-tenth of a degree in 10 years for surface temperature or a few millimetres for the average height of oceans, space-based systems provide by far the most data for climate models and are thus helping to continuously improve their forecasting ability.

Nonetheless, acquiring relevant, frequent and up-to-date data on a global scale is an overwhelming task no single country or space agency, even those with the most resources, can accomplish alone. For this reason, the role of multilateral partnership initiatives such as GEO (Group on Earth Observation), CEOS (Committee on Earth Observation Satellites) or more recently GFCS (Global Framework for Climate Services) is critical if we are to succeed in providing the necessary data to inform decisions in the years ahead.

Europe's contribution to this worldwide effort has picked up pace and the Earth-observation environment has evolved considerably. We have seen significant institutional changes with the emergence of operational programmes pushing the envelope beyond weather forecasting to ocean monitoring and a global approach to environmental monitoring through Copernicus, the European Union's second flagship space-related programme with Galileo. In this respect, the current and future fleet of European satellites represents a major contribution to the global community and a wide range of different ECVs.

These include the Eumetsat weather satellites, carrying multiple meteorological instruments; the European Union's game-changing Copernicus programme and its Sentinel satellites, moving us toward operational monitoring from space to a hub of critical parameters for climate and other applications; ESA's successful Earth Explorer missions, pushing back the boundaries of Earth science; the French-U.S.-European Jason series, measuring sea level rise and the upcoming SWOT mission to measure freshwater levels; and the French-Indian Megha-Tropiques and SARAL-AltiKa missions, monitoring the tropical water cycle and complex ocean exchange processes. Actions are also envisaged to fill some of the gaps in ECV observations, like the French-German MERLIN mission and ESA's potential Carbonsat and Biomass satellites to monitor greenhouse gases, whose effect is well established on global warming. Additional efforts on greenhouse gases, especially for understanding and monitoring the carbon cycle, also appear necessary.

Europe is thus at the forefront of efforts to understand and monitor climate change from space. Moreover, these efforts are providing a new breeding ground for applications based on the continuous and rich flow of data which, coupled with data from other sources, will drive development of products and services for businesses and general users. For instance, social and economic studies led by the European Commission show that for each euro spent by the European taxpayer on Copernicus a public return of 10 euros is expected and that by 2030 Copernicus may generate up to 83,000 additional jobs in Europe.

Combating climate change is a sustained endeavour that requires a firm commitment for continuous data provision over the long term. Guaranteed provision of data over 15 or 20 years is the necessary condition to achieve the expected economic and societal benefits and to confirm Europe's role in the international arena. Great deals of expectations are riding on the European Union's commitment to pursuing Copernicus well beyond 2020.

Europe is showing the way and COP21 offers the opportunity to make a historic change for our planet and societies. France's strong commitment to securing a fair and ambitious agreement next December in Paris is commensurate with its responsibility as the host and chair of the Conference. It also already has one of the lowest levels of greenhouse gas emissions in the world and is laying the foundations for its own energy transition to a low-carbon future.

We have no other option but to succeed for, as the United Nations Secretary General has so rightly stated, "There is no Plan B, since there is no Planet B".

"EGNOS-Galileo: How to mobilise public policy and the final users to benefit more completely of this European infrastructure?"

Matthias PETSCHKE

Director of the European GNSS programs – Galileo and EGNOS – at the European Commission (EC)

EGNOS and Galileo are the two EU satellite navigation programmes. EGNOS is a regional space-based augmentation system which improves the GPS signal. EGNOS covers the European continent and is fully operational since 2011. Galileo, on the other hand, is a global satellite navigation system which is still under deployment. Our aim here is to provide initial services as early as possible in 2016.

The ultimate aim of these two programmes is to provide state-of-the-art navigation and timing services to users. In this context, establishing Galileo in the market place and increasing user uptake of EGNOS is one of our major objectives.

To ensure user uptake our activities have to be commensurate with the state of deployment of both systems. To that effect we have at our disposal a series of tools, but also a specific governance set-up. We are in the lucky position that we have a dedicated European GNSS Agency which supports, as one of its core tasks, the market development of EGNOS and Galileo.

Our public policy instruments to ensure the market uptake of EGNOS and Galileo by users range from awareness-raising campaigns to R&D funding, developing standards and regulatory measures. Each of these tools has a specific role to play. Awareness-raising aims at a wider dissemination of what our two programmes can offer to the final users, whilst our R&D funding is aimed at bringing innovative applications to the market. Developing standards is about ensuring that new applications can be taken up throughout the EU market and beyond. Regulatory measures are only used where we pursue specific public policy objectives, such as for example ensuring safety or security.

In terms of awareness-raising, the European GNSS Agency is doing a range of campaigns, e.g. on 7th May the EGNOS Flying Event in Toulouse, where journalists from all over Europe were invited to see on a real plane how EGNOS helps in improving safe landing on airports.

As to R&D funding, the European Commission has been funding innovative satellite navigation applications since the 6th R&D Framework Programme. In Horizon 2020 more than 150 million Euro are available for innovative applications based on EGNOS and Galileo. To provide just one example: several projects focus on the use of EGNOS in agriculture, for precision farming. Today, two thirds of all satellite navigation enabled tractors in Europe use EGNOS.

The new Galileo Regulation (1285/2013/EU) earmarks 100 million Euro for doing specific research on receiver and chipset development. This is very important because applications can only be based on EGNOS and Galileo if the underlying chipset and receiver is EGNOS- and/or Galileo-enabled. To that effect, over the coming years we will invest into R&D for new chipsets and receivers in particular in those market segments where it is less obvious for private companies to reach out, for example in the field of safety or liability-critical applications such as mining, or for receivers used in very harsh environmental conditions such as the Arctic. One of the objectives of this budget is also to ensure that receivers exist for innovative features offered by our European navigation systems.

Standards are also an important tool for ensuring a barrier-free internal market and to speed up the development of products fit for a broad range of applications. For several years we have been developing standards to enable the use of EGNOS and Galileo in multiple application domains, ranging from transport to mass market. In the future we have to ensure that new user needs, as well as the further development of EGNOS and Galileo are duly taken into account. This is all the more important in an increasingly competitive environment.

Finally, as regards regulatory measures we have to be aware that all other providers of satellite navigation systems, be it the US, Russia or China have put in place regulatory measures that support their own systems. Looking at the EU acquis, we see two conditions emerging:. First of all, regulatory measures should be limited to where there is a clear public policy objective, such as for example ensuring safety or security. Secondly, regulatory measures should be the last resort where no other viable option is available.

A good example is eCall, which has just been adopted by Council and the European Parliament. It provides for cars to automatically send their location to a public safety answering point in case of an accident. The location will be determined through satellite navigation. The system is to be compatible with at least EGNOS and Galileo. Such a measure clearly supports the objective of increasing safety and saving human lives. Today no other technical option is available that would be able to provide the precise location of a car in case of an accident at any time and anywhere.

What is the result of all this activity? EGNOS is well on track and we see an increasing number of users, in particular in the aviation domain and in agriculture. In aviation, we have today 141 airports in the EU where it is possible to use EGNOS landing procedures. As regards Galileo, the situation is not comparable, as Galileo is still in the deployment phase. However, we are stepping up our efforts, not only to have initial Galileo services available in 2016, but also to see initial Galileo users take up these services.

The Importance of Linking Space to User Needs

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Carlo DES DORIDES
Executive Director, European GNSS Agency (GSA)

Satellite technology is a powerful force, driving change and innovation in such diverse areas as agriculture and aviation. But because it often works in the background, most people never even think of the space technology that is present everywhere and the impact it has on their daily lives.

For example, did you know that one-third of all smartphone apps today leverage information from Global Navigation Satellite Systems (GNSS)? And one-third of all vehicles in Europe come with standard-equipped built-in satellite navigation systems? Smartphones and cars are part of almost everyone's daily routine, which is why the European GNSS Agency (GSA) is constantly listening to user needs in order to provide the most useful and tangible services to European citizens.

A Uniquely EU Endeavour

Tasked with the responsibility of translating space technology into actual services that directly benefit the day-to-day lives of European citizens, the GSA is a unique European Union body whose main raison d'être is to make space tangible.

The European GNSS programmes, EGNOS and Galileo, are prime examples of how Europe is using space as a solution. Central to this undertaking is the GSA, which, since the beginning of 2014, has been responsible for the operations and service provision of EGNOS and, recently, has been delegated a similar role for Galileo from 2017. With this responsibility, the GSA is transitioning Galileo and EGNOS from technology-focused to service-orientated programmes.

A prime example of how the GSA is ensuring that European GNSS technology provides a real service is Galileo's civil nature and its interoperability with other GNSS constellations – meaning the end user benefits from a more accurate and reliable positioning service. EGNOS, on the other hand, is providing an array of enhanced user services and helping to improve efficiency and accuracy in such important market sectors as aviation (today over 150 airports across 18 European countries are benefiting from EGNOS approach procedures), maritime, rail, road, mapping and location-based devices.

Tangible Impact for Business and Society

The GSA's recently released 2015 GNSS Market Report highlights technology trends and future developments of GNSS, as well as how GNSS contributes to Europe's economy. The report confirmed that location information matters now more than ever, and exists across a range of industries.

According to the Report, there are currently 4 billion GNSS devices on the global market, mostly in the Location Based Services (LBS) and road sectors. In road transportation, GNSS-enabled applications provide a host of benefits to users, including safety and productivity improvements. Emergency services like eCall and insurance telematics help protect drivers, and Advance Driver Assistance Systems (ADAS) promote safe driving with precise positioning.

In the future, GNSS will go beyond the vehicle itself and will also include infrastructure, regulations, safety and mobility. The market report also found that GNSS has become the preferred solution for electronic tolling, as users can be charged on different criteria such as type of road, time, distance, vehicle type and level of emissions without relying on costly ground-based infrastructure.

In the maritime sector, GNSS-enabled solutions are increasingly used to monitor the operations of fishing vessels. GNSS also enhances the safety and ease of navigation by integrating all navigational tools in an all-encompassing bridge system. This benefits not only ship masters, pilots and port authorities, but also passengers, consumers of sea products and companies served by the maritime supply chain.

GNSS has an immense impact on aviation, where it benefits almost a billion European passenger journeys each year. As the aviation industry continues to grow, this number can only increase. Particularly for 'Performance Based Navigation', the future navigation concept for civil aviation, GNSS use is on the rise. The opportunity to rely on a multi-constellation system gives the aviation industry additional protection, making flights even safer and reducing the industry's environmental impact.

Without EGNOS, airspace would be more congested, small airports and hospital helipads would not be accessible in bad weather, and there would be more delays, diversions, and cancellations. With EGNOS, airline passengers enjoy improved safety (with a 74% reduction of controlled flight into terrain), lower costs of airport ground-based nav aids and more on-time arrivals at their desired destinations. In fact, EGNOS will contribute to the reduction of an estimated 80,000 flight delays and 20,000 diversions over the next 10 years.

In precision agriculture, farmers are benefitting from significant savings thanks to GNSS-enabled steering systems. Without EGNOS, smaller farms could not afford satellite navigation-based solutions that enable more efficient crop management, yield management, and proper application of chemicals. EGNOS allows 15-30cm reliable lane-to-lane precision without fees or additional ground infrastructure and will save an estimated 4,500 tons of pesticides over the next 10 years, reducing environmental pollution. GNSS provides visible benefits for farmers and anyone interested in sustainable agriculture in Europe.

The Safe Choice

European GNSS also makes our daily lives safer. For example, the eCall system, which just recently received approval from the European Parliament, will use EGNOS and Galileo to

provide faster emergency response to a vehicle accident.

With the eCall system, when a serious accident occurs the vehicle automatically dials '112', Europe's single emergency number. A call can also be triggered manually, for example by someone witnessing a serious accident. Once the eCall link is established, the system immediately communicates the vehicle's exact location to emergency services, as well as the time when the incident took place and the direction of travel (of particular importance on motorways). The system works even if the driver is unconscious or unable to operate the system him or herself.

Per the European Parliament's recent vote, as of April 2018 all newly manufactured cars intended for sale in the EU must be equipped with eCall.

In addition, from mid-2016 with the launch of Initial Services, Galileo will help Search and Rescue (SAR) operators respond to distress signals faster and more effectively while lowering their own exposure to risk. Galileo's SAR capabilities will be integrated into the International COSPAS-SARSAT Programme – a satellite-based SAR distress alert detection and information distribution system

Real Results

In summary, the GSA can clearly provide strong evidence that satellite navigation services enhance our daily lives. As Europe's tool to deliver Galileo and EGNOS-powered services to citizens, the GSA is providing tangible, real results for Europeans. By investing in space technology, we are giving the benefits of space directly to the users, keeping them safe, efficient and economically viable.


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Weather, climate and Copernicus: EUMETSAT's contribution to the European Space Policy

Alain RATIER
Director-General, EUMETSAT

Today, 30% of the GDP of the European Union is "weather sensitive", and this includes vital sectors like transport, energy and agriculture. Economists have thus recently estimated that the socio-economic benefits of weather forecasts are in the order of 61 B€ per year in the EU, out of which 40 B€ represents direct added value to our economy, as opposed to costs avoided in protecting property against severe weather. Owing to an increased presence in the media, including the Internet, weather information is also part of the day-to-day life of citizens, fulfilling their ever more demanding expectations. But most importantly, weather forecasts and warnings save hundreds of lives every year.

A major success of the European Space Policy

Weather forecasts rely on the combination of observations, numerical modelling and human expertise, and observations from meteorological satellites have become indispensable to provide the best possible initial state to the forecast and account for 64% of the reduction of forecast error due to all observations available. Therefore, a significant fraction of the benefits of forecasts can be attributed to meteorological satellites, with the highest benefit coming currently from Europe's Metop satellites, estimated at 4.9 B€ per year in the EU.

This figure reflects one major success of the European Space Policy, built on the creation and growth of EUMETSAT, Europe's operational meteorological satellite agency, its cooperation with the European Space Agency (ESA) and the competitiveness of European industry, which altogether have made Europe the world leader of satellite meteorology.

Founded in 1986, EUMETSAT now counts 30 Member States and exploits three families of satellites - Meteosat, Metop and Jason - monitoring weather, ocean, air quality and climate from geostationary and low Earth orbits, to deliver data to users worldwide. With their very frequent observations - every five to fifteen minutes - the Meteosat geostationary satellites focus on forecasting of rapidly developing high-impact weather up to six hours, whereas the Metop polar-orbiting satellites deliver the less frequent but more detailed global measurements of ocean, land and atmospheric parameters needed for forecasting up to ten days.

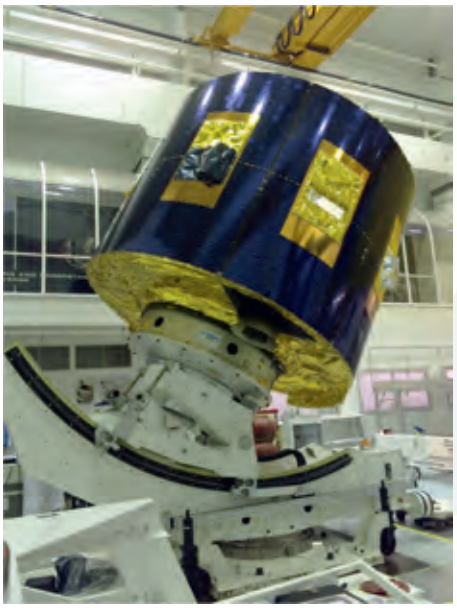
To develop future satellite systems like Meteosat Third Generation (MTG) and the EUMETSAT Polar System of Second Generation (EPS-SG), EUMETSAT cooperates with ESA in a model making best use of respective competencies. ESA develops innovative satellites fulfilling EUMETSAT's requirements and procures recurrent satellites on its behalf, while EUMETSAT develops the comprehensive ground systems needed to control the satellites, acquire and process their data and deliver services to users in response to their rapidly evolving needs. EUMETSAT also procures all launch services and exploits the full system for the benefit of users. Last but not least, European industry delivers all components of the system and supports its operations through contracts with ESA and EUMETSAT.

The success is not only in terms of capabilities and performances but also of cost efficiency: the cost per annum of operations has always decreased from one satellite generation to the next, despite massive improvements, and the benefit to cost ratio of the EPS-SG system being jointly developed by ESA and EUMETSAT is in the order of 20, under very conservative assumptions.

From weather to climate

The mandate of EUMETSAT was expanded in 2000 to include climate monitoring. This is because modern meteorology, like climate monitoring, requires not only observations of the atmosphere, but also of the ocean, the cryosphere and land surfaces. In addition, the very existence of EUMETSAT and its infrastructure, along with the committed continuation of its multi-satellite programmes over decades, constitute unique assets for cost-effective climate monitoring from space.

Indeed, after careful recalibration, the 35 years of Meteosat data now provide an invaluable source of information for climate research and information services. Moreover, EUMETSAT's operational programmes provide a robust observation base for anchoring research missions targeting key processes, whilst including a number of highly accurate instruments that deliver reference measurements for cross-calibrating



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less accurate complementary missions. This is the case with the Infrared Atmospheric Sounding Interferometer (IASI) developed by CNES and flown on the Metop satellites, and with the Jason-2/-3 high precision altimeter missions exploited in partnership with CNES, NASA and NOAA for monitoring mean sea level and ocean currents.

A business-neutral partner for an efficient Copernicus programme

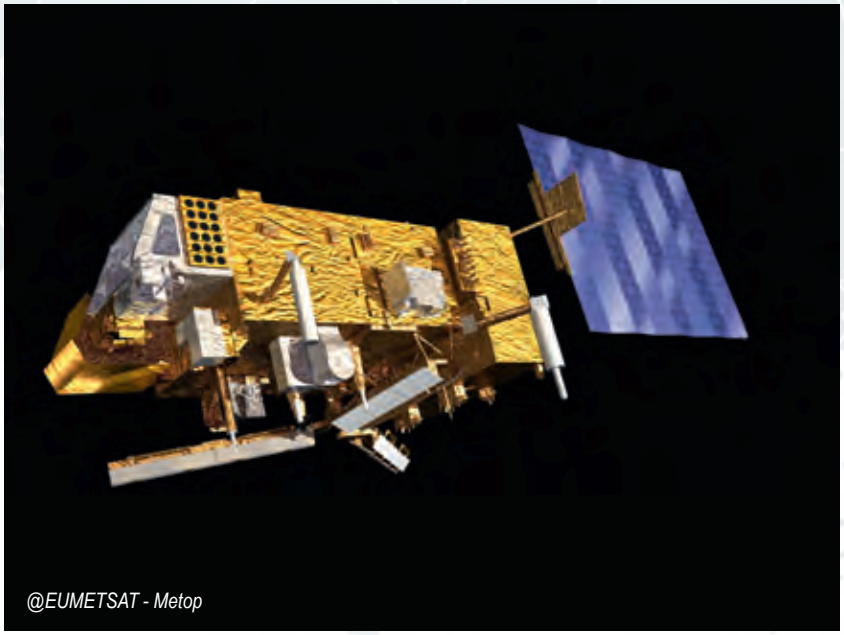
The next opportunity was the possible synergy between relevant Copernicus missions and EUMETSAT programmes. For the benefits of users and tax payers, this was achieved in 2014 through an agreement whereby the EU entrusts EUMETSAT to exploit the four Sentinel missions (Sentinel-3, -4, -5 and -6) dedicated to the monitoring of the ocean and atmospheric composition, in cooperation with ESA.

The Sentinel-3 marine mission will, together with Jason-3, form the European backbone of an international ocean observing system from space, while the Sentinel-4 and -5 missions will be implemented as part of EUMETSAT's MTG and EPS-SG systems, thus saving the cost of dedicated satellites and ground segments and offering the opportunity to observe a broader range of trace gases through the combination of co-orbiting Sentinel-4/-5 and EUMETSAT sounding instruments.

In its role as a data service provider EUMETSAT is not involved in applications and so it has no conflict of interests with Copernicus information service providers and users. Its only ambition, therefore, is to deliver fair and equal access to all users across the EU and EUMETSAT Member States and to offer the broadest possible range of opportunities through the provision of data streams integrating observations from Copernicus, EUMETSAT and partners' missions, via its EUMETCast satellite data broadcasting service. EUMETSAT will, in particular, support the development of environmental forecasting across the atmosphere and oceans, capitalising on its unique experience of operational interactions with the user communities.

As a public, business-neutral operational agency, EUMETSAT is committed to support Copernicus in the long term, based on series of satellites and multi-mission ground infrastructure providing data until 2040 and beyond. This, together with the high socio-economic benefits of weather satellites, reflects the essential and cost-effective contributions of public operational agencies to the success of the European Space Policy, which cannot continue to be ignored in the forthcoming revision of this policy.


@EUMETSAT - Jason-2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Galileo and EGNOS, a European success

Didier FAIVRE
Directorate of the Galileo Programme and Navigation-related activities, ESA

Since the early 1960s, Europe has built up technological know-how, an industrial base and infrastructure comparable in terms of performance to the best worldwide. Europe has been able to achieve this despite a level of public investment not in the same league as that of the world's great powers, which are also great space powers.

The European science programme is a success that is recognised by the world's scientific community, as has been shown by the recent Planck and Rosetta missions, the planetary exploration missions, the missions to observe the Earth and its environment, and participation in the international space station.

In the field of applications, Europe has also been able to develop operational product lines, in particular in telecommunications, meteorology – with the Eumetsat organisation –, oceanography, and observation of emerged land masses with optical and radar instruments, both for civil and military purposes.

Beyond responding to European public needs, European industry is present on the highly competitive commercial market in telecommunications, Earth observation and launch services.

Ultimately, none of this would be possible without maintaining autonomous access to space, with the Ariane and Vega launchers, as well as the Guiana Space Centre, considered to be the best launch site in the world.

All of this is the outcome of steady public investment which, from the advent of space activities, has mostly taken place in the framework of European cooperation.

Until the 2000s, satellite navigation was one of the few areas in which Europe did not have its own capability, despite that area's strategic and economic dimension and growing dependence on the US military system GPS.

As it had done regarding access to space in the 1970s, Europe therefore decided that it should master the key technologies for satellite navigation and deploy an operational infrastructure as do the great world powers, that is, the USA, Russia and China.

This is a technical challenge involving the development of specific technologies such as ultra-stable atomic clocks, the construction of a complex ground segment, and the very precise control of a constellation.

It is a long-term effort, more than 10 years' work, from initial concepts to the first operational launches, and a further 10 years are needed to achieve the full configuration.

The budget involved is very considerable, close to a billion euros a year, more than that for the science programme or launchers.

Given the strategic, economic, budgetary, and industrial balance implications, it is also a political challenge for Europe to achieve and maintain over the long term the political consensus and budgetary effort crucial to such an undertaking. European cooperation is essential to carry out the programme, which is inconceivable at national level, but at the same time presents thorny issues of governance and balance between European institutions, States and industry.

After the initial trial and error, and technical and programmatic difficulties inherent to any major programme, the first results are now visible.

The first system deployed, EGNOS, the European complement to the GPS, provides Europe with a certified operational service similar to the WAAS service provided by US civil aviation. Several national governments are considering not replacing some existing ground equipment and instead using EGNOS for their landing aid service. Airbus equips its A350 aircraft with EGNOS, and, looking ahead, new improved versions are undergoing preparation and geographical coverage is being increased.

In a similar approach as that adopted for meteorology, a worldwide service is being looked into, in which Europe would have an essential contribution to make.

Regarding Galileo, the first operational satellites were launched in 2011 and 2012, enabling the first positioning using European facilities to take place on 12 March 2013. This event marks European entry into the very select club of world powers with satellite navigation capability. This technological success is the reward of over a decade of effort, but it is only a milestone. The full system with 30 satellites must now be deployed in orbit, the operations and maintenance of this complex system have to be carried out and, above all, uninterrupted services must be provided to users, while ensuring quality, continuity and security.

Deployment is ongoing. There are now eight satellites in orbit, with another 18 under production and new satellites in the process of being purchased. Despite the uncertainties and risks to which all space programmes are subject, everything would seem to indicate that Europe is meeting this technical challenge.

However, that is still not enough. Users will adopt EGNOS and Galileo only if the services offered meet their needs. These needs of course change along with improvement in the quality of other worldwide systems and the emergence of new applications. Europe's next challenge is thus, after the technical success and the setting up of an operational infrastructure, to ensure the system's longevity and its evolution over the long term, in response to users' expectations.

The success of launchers with Arianespace, of meteorology with Eumetsat, and of telecommunications with Eutelsat and Inmarsat has paved the way for this.

Europe has all the technical know-how it needs to steer and execute this ambitious programme, and it also has the political support to do so, as reaffirmed by the European Parliament and European Council. It is now all systems go for Galileo.

Exploit better cooperation and synergies between civil and military research

Michael GAHLER

MEP and speaker on security and defence of the EPP Group in the European Parliament

In recent years, the EU has developed into a centre of gravity for space activities in Europe. This trend got even more accelerated with the entry into force of the Treaty of Lisbon and the consolidation of the European space policy. Given the existing military and civilian space assets in some Member States, the space capabilities of the European Space Agency (ESA) and the relatively new civilian security related space capabilities of the EU there is a lot of "space" for stronger cooperation. There are good reasons to better exploit civilian and military space research activities.

First, the call for more and better civ-mil cooperation derives from the new broader legal basis for the Union's space, security and defence policies. The European Parliament highlighted this in its resolution on the European Defence Technological and Industrial Base (EDTIB) in November 2013: "with the entry into force of the Lisbon Treaty the EU's industrial, space and research policies extend to the defence remit".

Second, EU space programmes have been developed for some time in parallel to the existing national or intergovernmental cooperative programmes. Instead of having uncoordinated research activities, coordination and cooperation are a must. We can observe the trend towards more Union led space measures because of the strategic dimension of space policy and very high costs which no member state can afford anymore alone: The EU has the overall responsibility for the programme on Global Monitoring for Environment and Security (GMES/Copernicus) serving security purposes in the field of earth observation. With the Galileo programme and the European Global Navigation Overlay System (EGNOS) the EU has owned global navigation and positioning satellite systems and capabilities In addition to the existing national space surveillance and tracking (SST) ground systems of some Member States and ESA, the EU started its SST support programme in 2013 in order to protect its own space capabilities. Some Member States pooled the demand of commercially available satellite communications within the European Defence Agency (EDA) in order to create a new capability for 2025.

Third, although specific formats for cooperation exist, the output has remained limited and does not meet expectations. Based on the European Framework Cooperation for Security and Defence Research (2009), EDA, ESA and the Commission have tried to synchronize R&T investments among themselves. An administrative arrangement (2011) between ESA and EDA tries to exploit potentially civil-military synergies in the field of earth observation. A study financed by the EP revealed in January 2014 that despite the existing EDA-ESA administrative agreement, common initiatives "should be put in place whenever security/defence capabilities are to be improved or new programmes launched". The same study highlighted that "Horizon 2020 [the current EU framework research programme] R&D funding for the development of integrated applications and services should be closely coordinated with the activities carried out by ESA".

In reading these suggestions the critical observer might ask what the three European institutions have done in the past five to six years to fully exploit obvious overlaps related to space policies within the institutional triangle of ESA, EDA, and the Commission. During the next European Council end of June 2015, heads of state and government have to give a clear signal towards better institutional cooperation in the field of civil-military research. Based on this hopefully fresh impetus, the incoming Luxembourg EU Council presidency should organize an EU Space European Council at the end of its term to keep momentum.

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The Security dimension of Space

Arnaud DANJEAN

MEP, Member of the EP's Foreign Affairs Committee and Chairman of the EP's Subcommittee on Security and Defence (SEDE).

The relationship between Space and defence issues is growing even closer. Recent military interventions and EU operations (notably EUTM Mali and EUBAM Libya), have shown how important modern space technologies are. Space assets are crucial for conducting military and civilian operations on the ground: indeed, satellites have become indispensable for the gathering of precise intelligence providing us with the ability to observe, to listen, to communicate and to disseminate information; all of which are essential capacities to ensure the safety of our troops and guarantee the efficiency of operations. The creation of the European Union Satellite Centre (SatCen), which provides geospatial intelligence services to the CSDP through the use of national Space assets, proves that Space assets are critical for Security and defence issues. As a matter of fact the EU SatCen plays an active role in the conduct of CSDP operations. In terms of military operations, it provides for instance, satellite services to EU NAVFOR[1], the EU naval operation aimed at fighting piracy in the Gulf of Aden. Thanks to the satellites made available by some Member States, the EU can control and detect all naval activities and efficiently deter pirates in the area. In terms of civilian missions, EUMM[2] Georgia for instance is also heavily reliant on SatCen's satellite assets (imagery, mapping…). This mission is dedicated to the monitoring of the borders between Georgia and its two separatist provinces of South Abkhazia and South Ossetia (secured by Russian Border Guards). In this case, Space assets are particularly determinant since they provide unbiased information that facilitates peaceful negotiations between the parties involved. I personally visited both EUNAVFOR and EUMM's Operation Headquarters (OHQ) in Northwood (UK) and in Tbilisi (Georgia), respectively. On those occasions, I had the opportunity to see with my own eyes how both operations are heavily dependent on satellite data.

Hence, since the usefulness of satellites is openly recognized in EU defence and Security matters, why not ensure that the EU has its own satellite capabilities?. The programme Copernicus for instance, that aims at providing accurate and reliable data on environmental and security issues through Earth satellite observation, could provide at EU level the much needed geospatial intelligence and situational awareness enabling us to prepare, to respond and to manage crises more efficiently.

In the wider context, the formulation of a strong EU Space policy will allow the EU to act independently with autonomous Space capabilities. In the field of security, Copernicus is certainly the most ambitious of all EU programmes, facilitating the development of EU Space technologies. The operationalisation of Copernicus services for some of the EU's research projects, for instance the 'contingency Plan Preparation', the 'Event Mapping', or the 'Critical Assets' detection would for instance, represent a great step forward for the EU as an independent and autonomous power. Having autonomous capabilities is particularly significant within the current international context: with growing uncertainties and multiple threats, the EU needs to be able to make decisions and to act using only its own means. We are already on the right path with the evolution of Galileo. In the future, for highly sensitive political decisions - such as the launch of military and civilian operations - the EU will be able to substitute Galileo for the American GPS (Global Positioning System) that it uses today. EU Space policy should continue to work towards the development of independent Space capabilities, as this is the only way to guarantee the autonomy of the EU, especially in defence and Security matters.

Finally, the development of a strong EU Space policy represents another asset for the CSDP: it ensures, in the context of tight budgetary constraints, a better synergy between civilian means and military means. Such an enhanced synergy would be particularly convenient in the frame of the CSDP, the purpose of which serves both civilian and military objectives. This could be ensured in two different ways: firstly, by pushing for more permanent structured cooperation between Member States (particularly because space military capabilities remain their prerogative), and secondly, by promoting the dual-use of Space technologies (guaranteeing that the tools made available can be used for both military and civilian purposes). Copernicus is a good illustration of a Space programme that relies on a civ-mil dimension. IN addition, promoting cooperation and the dual-use of Space capabilities also avoids duplication and consolidates the European industrial and technological base. Hence, maintaining a strong position in Space is both beneficial for Europe's Security and for its economic purposes.

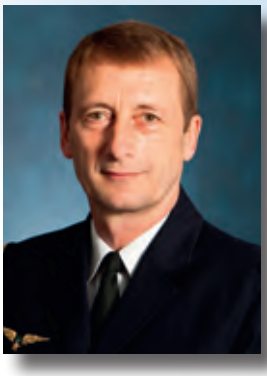
Conclusion

In matters relating to the Common Security and Defence Policy (CSDP), the EU has always struggled to define a strategy encompassing capability goals that are both ambitious and realistic. When rethinking the links between space and the CSDP, the debate needs to be enshrined in the broader acknowledgment that Space assets are essential defence and Security capabilities. Satellite systems can and must constitute one of those fields where the EU asserts itself as an industrial and technological actor – as it does today – but also where the EU imposes itself as a strategic actor. To that end, the Security dimension of space must be promoted: it is an indispensable investment if the EU wishes to play a role that lives up to the expectations of its citizens.

1 European Union Naval Force

2 European Union Monitoring Mission in Georgia

Space: we couldn't do without it



General Patrick de Rousiers
Chairman of the EU Military Committee

Space has become the new challenging battlefield of our century.

As we cannot imagine our life without GPS, meteorological forecast and connectivity provided by space-based assets, our modern military operations cannot be conceived without using space-based capabilities.

By giving us the capacity to see, to listen and to localize existing forces on land, air and sea, they represent a substantial advantage during conflicts.

From the early stages of planning, the military need to see what is happening on the ground in real time. Space-based capabilities provide knowledge, anticipation and evaluation of a crisis and therefore contribute to the command's decisions.

Then, during the conduct of operations, they also allow fast and secure exchange of information as well as facilitate permanent synchronisation of the actors.

Space-based capabilities have now increased significantly the efficiency of any military action and make a real difference on the ground, at sea and in the air.

They are indeed critical enablers for our EU military operations.

As an example, within the maritime operation EU NAVFOR ATALANTA launched in 2008 to counter piracy in the Gulf of Aden, satellite communications provide the link between the Operation Commander in Northwood (UK) and the Force Commander, deployed in the Indian Ocean, who operates in an area as large as Europe.

Furthermore, satellite-based imagery is used to survey continuously both land and maritime areas in order to detect pirate's activities, monitor their bases and search their training camps. It also makes certain that all the criteria set up by the Operation Commander in order to act against the pirate's logistic dumps are met. This level of precision ensures the validity of the target and reduces substantially the risk of collateral damage.

Other EU military operations and missions such as EUFOR ALTHEA, EUTM Mali or EUFOR RCA have also benefit, or continue to benefit, from space data and information. For instance, reference maps reporting relevant features in many locations of interest provide comprehensive information to forces engaged on the theatre.

Satellites also improve land and border surveillance, critical infrastructure protection, fights against organised crime and counter terrorism operations.

Trough optical remote sensors, they can provide high resolution images of land and maritime borders. Trough multispectral and hyperspectral sensors, it is also possible to obtain, all time and all weather, night data high resolution images.

In the fight against terrorism space-data can also provide important information on suspect's movements, hiding places or training camps.

Thus, Space is a highly strategic sector for the European Union which contributes to the enhancement of its both external and internal security.

Therefore, the European Union Satellite Centre (Satcen), located in Torrejón de Ardoz in the vicinity of Madrid, was set up in 2002 to support the decision-making of the European Union by providing analysis of satellite imagery and collateral data.

Furthermore, when the Treaty of Lisbon entered into force in 2009, Member States conferred to the EU a stronger role in space matters. For the first time a specific space competence for the European Union was introduced, enshrining space policy as a shared responsibility for the EU and its Member States.

This decision opened up new perspectives for developing an EU space strategy. Governments have indeed recognized that the implementation of a better cooperation through multilateral institutions would be more successful than to follow its own strategy in isolation.

In April 2011 the Commission set out the main priorities for the EU space policy which included, in particular, the necessity to ensure the success of the EU's two flagship space programmes Galileo and Copernicus, the protection of infrastructures and space exploration.

For us the military, this policy represents a real step forward because these programmes have also the potential to contribute to military crisis management.

Some others recent initiatives such as the Athena-Fidus communication satellite, with Ka- and extremely high frequency – band payloads for military and civil-government communication, provide evidence that there is a real common benefit in a civil-military approach to space-based capabilities.

For CSDP, the civil-military track is the only possibility to have guaranteed access to some space-based capabilities.

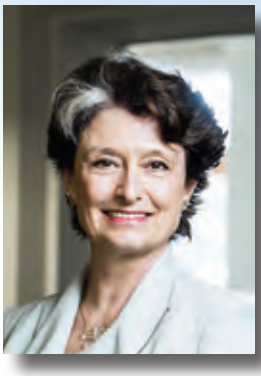
A good example is the Global Monitoring for Environmental and Security, the GMES system. When the system will be fully operational, it will provide CSDP with a fully reliable source of imagery to support the planning and conduct of our missions and operations.

However, there are certain conditions that these dual-use assets need to meet and which are not only expressed in terms of technical requirements.

Availability, continuity of service (which has to be provided 24/7), resilience, security traceability and resistant to interference must also be incorporated to the program early in the design phase.

Today conflicts and new security challenges are not decreasing and Space is definitely our 4th Battlefield: without it, the European Union would not be able to operate in a wide range of complex environments, defend the security of its citizens as well as its interests around the globe.

The European External Action Service's Role in Space Takes Off



Claude-France ARNOULD
Special Envoy for Space, EEAS

The EU and its Member States are becoming increasingly dependent on space assets. The EU's two main space programmes are evolving rapidly – *Copernicus* (earth observation) is now operational and initial *Galileo* (global navigation) services will be available from next year. The growing use of space-related capabilities as the means to realise the EU's Common Security and Defence Policy (CSDP) highlights the case for EEAS involvement in space issues.

Access to space, space assets and space services is crucial to maintaining the EU and Member States' security and economic prosperity. EEAS lies at the crossroads where space for security and the security of space meet. It makes sense therefore that the High Representative and EEAS are charged with responding to threats to the *Galileo* programme, for example. The security aspects of space observation must also be addressed and security dialogues with our main partners managed - EEAS will therefore become a key player in this field. This is why Federica Mogherini created the position of Special Envoy for Space, the post to which I was appointed in January, supported by a space task force.

Positioning, Navigation, and Timing

Galileo is the European Global Navigation Satellite System (GNSS) that by 2020 will comprise 30 satellites in medium earth orbit. With eight satellites already in orbit, initial services will be available from 2016. The space task force's principal priority is to implement a 2014 Council Decision which states that the HR is operationally responsible if a threat to *Galileo* arises. The operational procedures for the European GNSS security architecture ensure the readiness of the *Galileo* security chain of command in the event that a threat to *Galileo* requires an urgent decision from the HR. The first procedures have recently been approved by the Political and Security Committee. They have been successfully tested and detailed procedures will be discussed with all relevant actors as the *Galileo* system matures.

As regards security interests for the use of *Galileo*, the EU must be able to guarantee the integrity of *Galileo*'s signals and the physical integrity of satellites and ground stations, especially for the *Galileo* Public Regulated Service (PRS).

Earth Observation

The EU Satellite Centre (SatCen) in Torrejón, Spain, provides state-of-the-art geospatial intelligence based on both commercial and governmental satellite imagery, in support of EU and Member States' interests and decision-making. The HR, via EEAS, provides operational direction that includes oversight of SatCen tasking.

EEAS already uses SatCen products across a range of its core activities, from intelligence and situation analysis to crisis management and planning. EU civilian missions or EU military operations rely increasingly on these space-derived information sources, and the same can be said of Member States. The EU has also decided to support other international organisations with observation products, such as the OSCE, the Organisation for the Prohibition of Chemical Weapons (OPCW) or the IAEA.

The November 2013 European Council emphasised "the need to make optimal use of the EU Satellite Centre including by effectively addressing requirements for high resolution satellite imagery, including from governmental sources, to support EU's decision-making and CSDP missions and operations." Thus, the EEAS is in discussions with interested Member States about the using their high-resolution governmental imagery in the future.

In the years to come, the EU's *Copernicus* earth observation programme will also contribute to the EU's external action. This will be particularly interesting *when Copernicus* achieves higher resolution capacity. But the concept of free access to data that underlines the *Copernicus* raison d'être must preserve the security interests and external relations of the Union or its Member States.

Space Situational Awareness (SSA)

Space situational awareness must be a continued priority for the EU in light of the Union's growing responsibilities to protect its space assets from inherent vulnerabilities. Encouragingly, the European Parliament and the Council decided last year to establish a Space Surveillance and Tracking (SST) support programme which seeks to pool Member States' existing capabilities. The SST service, due to be fully operational by 2020, is expected to provide accurate information to protect space-based assets from collisions with other objects in space. The programme will also enhance awareness of the risks posed by the re-entry of space objects into the earth's atmosphere – a great example of the "space for security and the security of space" maxim.

However, more can and should be done. Significantly expanding the EU's SST capability will reduce European dependency on third parties for our own security in an increasingly congested and contested environment. This security concern is also why the EEAS is a driving force behind the International Code of Conduct in Outer Space. Jacek Bylica heads up the EEAS participation in this field.

Partnering

Looking beyond the boundaries of the EU's current space programmes, I firmly believe that, at the EU level, we are at a turning point as regards space. And I believe that this justifies EEAS making a significant investment in its space-related activities.

The maturing EU capabilities mean that the Union now occupies a significant position on the international arena. Outside of engagement with

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ESA - P. Carril
Programme:
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Member States, the relations with third states need to address the security aspects of space; the priority is undoubtedly the dialogue with the United States. The US shares the understanding that we must build our resilience to threats posed to space assets and that co-operation contributes to this resilience. There are numerous synergies between US and EU capabilities: GPS and *Galileo*, US SSA and EU SST, for example. As the US competent authorities, notably the Pentagon and State Department, look to European counterparts for solutions to its domestic resilience, the EEAS must step up to the plate.

Space is clearly a major consideration for security and foreign policy makers as the number of space-faring nations grows. That is why, alongside the Commission, the European Space Agency and Member States, the HR and EEAS are central to the dialogues with these new players.

Future Collaboration

We must consider future space capabilities just as much as we do current capabilities, specifically in the fields of earth observation and communications. We must build on the synergies that exist between civilian and military activities and tools. The European Council is actively encouraging co-operation between Member States, the Commission, the European Defence Agency and EEAS with a view to ensuring increased European access to space capabilities.

Conclusion

The strategic context, the indivisible nature of security and the need for efficient co-operation leave no alternative but for EEAS to make a significant contribution to the game.

Why dual-use space programmes are critical for Europe

Jorge DOMECQ
Chief Executive, European Defence Agency

Introduction

Space assets are dual by nature, and this is a great strength for European military capabilities. The way we Europeans conduct space activities has no equivalent in the world: we have become a global player in the field mostly by relying on civil investments, unlike countries like the United States whose space sector benefitted from huge military investments.

This beckons us to be smarter about the dual-use potential of space systems, especially in times of budget austerity. Member States have acknowledged this and the EDA through its unique, tailored approach to capability cooperation in defence programme can contribute also to the Space domain, in close cooperation with partners such as the European Commission or the European Space Agency (ESA).

GOVSATCOM

In fact, the EDA has been home of an initiative endorsed at the highest political level by the December 2013 European Council: developing a future governmental satellite communication capability package (GOVSATCOM). Hand-in-hand with Member States, the EDA is developing in closed cooperation with the European Commission and ESA the basis for a future programme considering from the outset its dual-use dimension.. Not exploiting such synergies would be a loss of efficiency: in the current environment, we cannot afford to pay twice for the same capability.

GOVSATCOM will be a test case for Europe. Our very ability to do "better with less", to maximise our public investments and to make sure that military and CSDP forces receive the space services they require relies on the *trust* partners share.

In the field of satellite communications, the sovereignty aspects of the highly secure military communications segment (MILSATCOM) make it difficult to envisage multilateral cooperation. At the other end of the spectrum, less secure commercial communications (COMSATCOM) are being well developed by the market operators. Determined to follow a politically and programmatically efficient approach to reach viable solutions and real added value, the EDA offered to position a European initiative in the intermediate Govsatcom segment with a clear mandate: to prepare the next generation of systems in the 2025 timeframe.

Progress is already tangible. As planned, the needs of military users were approved by Member States in early November 2014; these needs constitute the working basis for a future programme. In cooperation with the ESA, the EDA launched the procedure for feasibility studies which will provide options to Member States by early 2017, if not sooner. It is worth noting that the Competitiveness Council in December 2014 calls for synergies to implement with similar work performed by the European Commission for the civil aspects.

This project also brings governance challenges. EDA and the Commission will steer together a dedicated "GOVSATCOM Coordination Group" to explore legal and budgetary issues: to be able to implement a programme at technical level, we need to clarify and perhaps invent ways to cooperate in a sensitive, complex institutional setting. This will allow us to manage programmatic rules from different frameworks for the benefit of all parties involved. Joint solutions are needed, because GOVSATCOM will not function with a civil or military-only outlook.

Earth Observation

Regarding imagery from space, the EU, through the EU Satellite Center (EUSC) depends on national governmental capabilities, and to a great extent, on the commercial market. Today, the Copernicus EU-led earth observation programme provides some limited capabilities to the EUSC but there is no genuine dual-use rationale behind Copernicus capability developments.

In that context, Member States tasked EDA to "collect shared military requirements for next generation Earth observation military systems and to focus synergies and technology development for next generation of very high resolution European imagery systems and applications." Preliminary discussions with national authorities and EEAS highlight the significant potential of dual-use capabilities and thus a GOVSATCOM-like cooperation in this essential security domain.

Navigation, Positioning and Timing

The EU's initial legitimacy in space stems from its decision to build the Galileo satellite navigation infrastructure, currently being deployed. Its Publicly-Regulated Service will provide tremendous added value to the military community. Although Galileo is a civilian system under civilian control, applications for armed forces are nonetheless possible since it is up to Member States themselves to decide upon its uses.

In that regard, bridging with the military community would be essential. EDA is available to perform this role providing military stakeholders with a dedicated forum to begin discussing Galileo opportunities.

Conclusion

Europe's ability to first define the scope and parameters of any future endeavour is central and must be done before considering solutions or processes. In space systems, as in other defence domains, a balance between national, sovereign capabilities and collaborative EU effort needs to be maintained. EDA work on future military space systems will not aim to replace national capabilities but instead strike a balance between national assets and other complementary capabilities which might well be European in nature. In this context, investigating synergies with the civil domain in order to fill potential strategic and tactical gaps not only makes sense: it is a fiscal responsibility. In order to achieve this, however, military communities should be involved and fully integrated via the EDA in the requirement generation of any civil space system, right from the start.

EU should support further synergy between military and civil research in space

Bogdan ZDROJEWSKI

MEP (Group EPP), Substitute of Subcommittee on Security and Defence (SEDE) and Delegation for relations with the NATO Parliamentary Assembly (DNAT)

It is easy to overlook the impact of military research on our everyday lives. Many of the products and technologies we use on a daily basis, such as the Internet, GPS navigation, touch screens, digital cameras, or microwave ovens have their origins in the defense sector. On the other hand, the civilian inventions are also widely used in the security domain, especially in the sphere of cybersecurity.

So called dual use items, which can be used both in civilian and military spheres, gain on importance in the context of dropping military expenditures in the last decade. According to Eurostat data, in 2012 the EU28 spent only 5.11% of their total research and development budgets on defense. Interestingly, ASD Europe estimates that out of the total sales in aeronautics sector, worth €128 billion, only €46 billion was devoted to military-related projects.

In this context, there is a crucial need in the EU to develop further synergies between the civilian and military research in order to boost our security and industrial growth. Also, in its conclusions from December 2013, the European Council underlined the need for the Member States to increase investment in cooperative research programmes.

According to the EU treaties, defense-industrial matters are still to a great extent treated as an intergovernmental domain. The EU has little competence to influence the defense policy as the EU Member States have consistently taken the defense sector out of all the EU treaties since the 1950s. When they find it useful to cooperate, they often choose intergovernmental arrangements rather than the EU institutions as a channel for discussion.

However, the situation is slightly different when it comes to space. Article 189 of the Treaty on the Functioning of the European Union (as amended by the 2007 Treaty of Lisbon) gave the EU, for the first time, clear competence in the area of space. Following, in February 2013, the European Commission presented five priorities for an EU space policy, two of which aim at the further development of a competitive, effective and coordinated industrial base in Europe. Particularly, the support for SMEs' participation and for the increased competitiveness of the EU space industry should make the sector more cost-efficient along the value chain. Additionally, the regulation 1334/2000 on the dual-use items categorizes both navigation and aeronautics technologies as products that can be used in a civilian and military capacity. Therefore, investing in space technology on the EU level can both contribute to citizens' security, as well as stimulate the economic growth.

A particularly interesting example of how satellite space technology can be used in civilian and military areas is Copernicus – an Earth Observation satellite system designed by the EU. Through its main areas of application, Copernicus offers a plethora of uses in the areas ranging from agriculture, environmental protection, humanitarian aid, public health, tourism, and transport to urban planning. The priorities of the program comprise: 1. crisis management in case of natural disasters such as volcanic eruptions, earthquakes, fires, storms or floods etc. 2. critical assets (such as observation of power grids), 3. surveillance of migration flows and borders that might occur particularly relevant in the context of current migration crisis in the Mediterranean Sea, 4. natural resources (changes in climate and environment, impacts on biodiversity and landscapes), and 5. non-proliferation (observation of nuclear plants and arms). All of them can effectively support civilian activity and security, and be used for military operations. The European Earth Observation services are delivered by 300 companies spread over most of the EU Member States. SMEs are the major players in that field as only 16 of the service-providers (5%) have more than 50 employees.

Galileo, a European navigation and positioning system, is yet another proof how the synergy can contribute to EU's economic growth. The EU's multiannual financial framework for 2014–20 dedicated €7 billion to both Galileo and EGNOS, a system which improves the precision of GPS satellite navigation signals. This amount will cover the costs of the completion of the deployment phase of Galileo, fund its operation (i.e. ground management, certification procedures, offer of services, replacement of satellites etc.), and the operation of the EGNOS system.

It does not cover, however, expenses related to the development of Galileo-related applications, for instance those linked to positioning and timing, which global market is estimated to reach €250 billion in 2020. Today, it is calculated that 6–7 % of the EU's GDP already relies on positioning and timing services (e.g. banking, electricity networks, road systems etc.). The successful engagement of private actors and researchers will be crucial to grasp the opportunities this sector creates for SMEs and the security of civilians.

Civilian and defence research reinforce each other. Many of the future opportunities for the EU reside in exploiting the dual-use nature of space assets and technologies to advance Europe's global competitiveness. It is, therefore, crucial to develop synergies that will make more efficient use of space technologies and infrastructure which can be used in both civilian and military domains. The EU is well-positioned to encourage improved coordination and integration in this field, especially when the Member States cannot afford to individually develop and maintain the technological excellence and capabilities required in an increasingly competitive space environment. Therefore, it should become EU policy to further stimulate dual use research in space.

European Sovereignty in Space

Angelika NIEBLER
MEP (Group EPP), Member of Committee on Industry, Research and Energy

Europe can proudly look back on a history in space of more than 50 years. Much has been achieved since then. The European Space Agency (ESA) in collaboration with the European Union has intensively worked on reducing our dependency in space. We have successfully launched Copernicus, the European Earth Observation Programme (formerly known as GMES). EGNOS, the European Geostationary Navigation Overlay Service, has paved the way to Galileo - our European, more accurate answer to the US-navigation system GPS. The first Galileo satellites are already up in space and the next launch is scheduled for September 2015. The first commercial services associated with Galileo will - hopefully - be available and of benefit to our European citizens by 2016. The full Galileo network operating with 30 satellites and their supporting ground stations is supposed to be completed by 2020. The European Parliament has from the very beginning always been a strong supporter of that flagship project.

However, if in the future Europe wants to become the world leader in space, challenge the United States or simply keep up with other striving space nations such as China or India, we have to build on these past efforts. Needless to say that one of the most important goals remains to continue to increase our independency in space. In February 2013 the European Commission issued a communication on "EU Space Industrial Policy". This was of course an important step towards the EU's independence in space technology from a strategic point of view. However, this communication completely omitted one of the most controversial topics when it comes to the discussion on space technologies: the relationship between the EU space industry and the EU's Common Security and Defence Policy (CSDP). I agree with Commissioner Elżbieta Bieńkowska when she says that we cannot get away from the fact that space has both a civil and a security and defence nature.

Already in 2007, the European Commission confirmed that the strategic mission of a European space policy will be based on the peaceful exploitation of Outer Space by all states and will also "seek to meet Europe's security and defence needs as regards space". In its opinion to the 2013 communication on space industrial policy, the European Parliament's committee on Defence and Security (SEDE) therefore stressed that EU space policy should be seen as an asset to the CSDP, providing a better synergy between civilian space means and military space means mirroring the CSDP's own dual civilian and military role.

But what is really meant when we talk about European sovereignty in space? To my opinion, sovereignty in space is much more than efforts towards a solid and vital space industry in Europe and an independent access to space, even though these two areas are without any doubt mainstays when it comes to securing and guaranteeing independence in space. Indeed, an independent and reliable access to space is an essential condition for any space-based defence and security activity.

New security challenges, not only of purely military nature, have emerged over the past years and will continue to emerge: be it to ensure internal and border security, to provide for a reliable disaster management, to counter terrorism, fight organised crime, strengthen cyber-defence or cope with migration.

At the end of 2013, the Heads of States and Governments of the European Union for the first time since the entry into force of the Lisbon Treaty, which provides the EU with a shared competence with MS on space issues, held a thematic debate on defence. A Common Security and Defence Policy does not only contribute to the safety of our citizens, but also to peace and stability in our neighbouring countries and beyond. At the same time we tend to forget that most of the data and information that is currently used in the military and security domains comes from or uses space-based systems. Earth observation data from space for example offer not only up-to-date, but also high-resolution information from parts of the world which are otherwise difficult to access.

Only recently, the European Parliament has called on the European Commission to create a permanent link between EU bodies and agencies in the areas of internal security (Frontex, Europol, ENISA) and external security and defence (European Defence Agency, EEAS) to join capabilities relevant to those policies. I believe that the European Commission's approach to strengthen the 'security' component of the Copernicus programme with regard to the monitoring of borders, support for the European Union's external action, maritime surveillance, complex emergencies, humanitarian aid and civil protection is the right one. Of course, the sensitivity of the data being handled and the need to protect privacy and other citizen's rights have to be taken into consideration.

Both at the EU and at the national level the awareness of the increasing benefits of space for the implementation and the success of internal and external security policies has risen. The EU is on the right path: A solid space industry and an independent access to space form an integral part to gain European sovereignty in space. However, some things are still to be done: We have to reduce duplications in order to be coherent and efficient. The small scale, very complex structures in Europe consisting of various players in industry, politics and science are large cost drivers. The difficulty lies in pooling and coordinating skills and experience. Finally, approval procedures are complicated and national sensitivities should not be underestimated.

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European Commission

Copernicus

Europe's eyes on Earth

Space