CENTRE FOR EUROPEAN REFORM

# EUROPE IN SPACE

Carl Bildt, Mike Dillon, Daniel Keohane,
Xavier Pasco and Tomas Valasek

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# Europe in space


**Carl Bildt, Mike Dillon, Daniel Keohane, Xavier Pasco and Tomas Valasek**

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# 1 Introduction
*Daniel Keohane*

An early draft of the European Union's new constitutional treaty said that one of the EU's objectives should be "space discovery". EU leaders dropped that noble aim from the final version of the constitution, which they signed in June 2004, although another clause does set out the basis for an EU space policy. Traditionally, 'space' conjures up images of rockets and moon landings – hardly the bread-and-butter of everyday politics. However, nowadays space also raises broader political issues that may not be immediately obvious but are important nonetheless: should the EU aspire to be merely an economic power, or should it aim for a more credible common foreign and security policy? Should its aerospace industry depend on US technology, or should the Europeans nurture their own technological base? And more specifically, is the EU's stated ambition of being able to manage autonomous military operations realistic, unless it develops satellite networks that can operate independently of America's space assets?

All these questions are relevant to Europe's hesitant efforts to develop a space policy and a space industry. Although divided on some of these questions, European governments appear to be renewing their efforts to build up capabilities in space. Some of the strongest supporters of a European space policy can be found in EU institutions. The European Commission published a space White Paper in November 2003 which highlights the value of space technologies for a variety of EU policies, ranging from environmental protection to internal security.

The current focus of European efforts is Galileo, a satellite navigation system which will cost more than €3 billion. As Tomas

Valasek points out in this pamphlet, the aim of Galileo is to do a similar job to the American Global Positioning System (GPS), a network of satellites whose signals can be picked up by small devices that reveal to the user his or her exact location. GPS technology will soon dominate the management of transport flows – whether the subject is air-traffic control, road congestion or rail networks. The 2003 military campaign in Iraq showed other uses for GPS technology: most of America's 'smart' bombs and cruise missiles were steered towards their targets by GPS signals. Indeed the origins of the GPS, like the internet, were military: the GPS system was created, and is financed and controlled, by the Pentagon.

EU transport ministers took the decision to back Galileo in 2002, and the new system should be up-and-running by 2008. Galileo's proponents claim that it will provide greater accuracy than GPS. Galileo will, unlike GPS, remain under civilian control. Therefore the signals should always be available. One of the concerns about the US system is that, because of its military management, the signals might be turned off in a security crisis or for political reasons – although Valasek maintains that, on closer inspection, many of these concerns are unfounded.

Carl Bildt and Mike Dillon argue in their essay that the most important reason for Europe to develop Galileo is to maintain its high-technology industrial base. If Europe lacked its own system, its companies would be unable to take the lead in developing many of the lucrative commercial applications of satellite positioning systems. The European Commission calculates that Galileo will benefit the European economy by creating more than 100,000 jobs.[1]

[1] *European Commission, 'Progress report on the Galileo research programme', February 2004. http://www.europa.eu.int/comm/dgs/energy_transport/galileo/doc/com_2004_0112_en.pdf.*

But Galileo, for all its importance, is only one part of the European space business. The European space industry has a total annual turnover of roughly €5.5 billion and directly employs 40,000 people.



Yet global space turnover amounts to roughly €70 billion. The US dominates global space expenditure: this year's US government space budget is close to €35 billion, with about half devoted to military applications and half on civilian projects. Indeed, the US accounts for over 90 per cent of the world's spending on military-related space projects.

European governments, by comparison, collectively spend a little over €5 billion on space, including all national and European programmes, both military and civil. Some European countries allocate more money to space than others. France and Italy are Europe's leading space spenders, devoting some 0.09 per cent of their GDP to space in 2001. Perhaps surprisingly, Belgium devotes 0.07 per cent of its GDP and Germany about 0.04 per cent. Britain comes some way down the European list, spending only 0.02 per cent of its GDP on space.[2]

[2] *Figures taken from Melissa Mean and James Wilsdon, 'Masters of the universe', Demos, 2004.*

The European space industry is much more dependent on the commercial market than its US counterpart. The American space industry receives 80 per cent of the value of its orders from government budgets, whereas for the European industry the figure is only 50 per cent. Europe has had some commercial success in the space market, including the Ariane series of launchers which account for about half the global market in commercial satellites. Astrium, a joint venture owned by EADS, the Franco-German-Spanish company, is one of the world's leading producers of satellites.

Bildt and Dillon claim that space is a 'strategic' industry and Europe therefore needs a coherent space policy. After all, telecommunications is already very dependent on space-based systems, while many other sectors, such as transport, will rely on the same technology to a much greater degree than before. And if EU leaders want to strengthen their ability to define and manage common foreign and security policies, they will need to pay more attention to their space capabilities.

Our French contributor, Xavier Pasco, contends that since space-based technology is now an integral part of modern warfare, Europeans need to step up their efforts in military space technology. In recent years, the US has pioneered a set of new IT- and telecoms-based military technologies, which are sometimes lumped together under the phrase the 'revolution in military affairs'. This is about gathering real-time information from sensors, processing the information, displaying the relevant elements of a 'battlespace' on a screen and ordering precision-guided munitions to strike the targets. Satellites are a crucial element of this 'digitisation' of warfare, both gathering and transmitting information.

Pasco adds that European defence ministries should explore how to take advantage of civil technology. Galileo has been conceived as a civil project but could certainly perform some military tasks.[3] For example, European soldiers on peace-support missions in the Balkans, or elsewhere, could use Galileo to define their positions or steer their munitions. But as Valasek points out, EU governments need to think carefully about how to manage Galileo's potential military roles, and ensure that Galileo's technology does not fall into the hands of those who would use it against European or American armed forces.

[3] *See Stefano Silvestri, 'Space and security policy in Europe', EU Institute for Security Studies, December 2003, and Gustav Lindström & Giovanni Gasparini, 'The Galileo satellite system and its security implications', EU Institute for Security Studies, April 2003.*

Traditionally, it is the issue of military observation satellites that has created the fiercest transatlantic disputes on space policy. The French President Jacques Chirac, has argued that unless Europe develops its own satellite capabilities, it will remain little more than a "vassal" of the US. The French have been in the vanguard of European efforts to develop observation satellites. They already have two small spy satellites in orbit, and Germany is building a series of radar observation satellites. Britain receives privileged access to imagery from US spy satellites. Therefore the British reluctance to develop national or European capabilities for satellite photography is understandable.



The Americans have tried to discourage European ambitions in this area, and not only because US defence companies hope to sell satellites to European governments. They argue that European military capabilities are so deficient in many basic areas – such as transport planes and precision guided munitions – that they should prioritise these before investing billions of euro in the luxury of spy satellites. And they argue that Europeans should focus their resources on improving intelligence assessment rather than more expensive intelligence collection capabilities – especially since metre-resolution imagery is now available from commercially-run US satellites. To which the French retort that they do not trust the American government never to exercise 'shutter control' and switch off the commercial imagery in a crisis.

The arguments for European space capabilities are both economic and strategic. Despite divisions among the Europeans, the EU is moving slowly forward in its ramshackle, muddled way. Many European politicians – even in Britain – appear to understand that indigenous European space capabilities will be an asset to their environmental and industrial policies; and – on those occasions when the EU may wish to act alone – a help to their embryonic foreign and defence policies.

# 2 Europe's final frontier
## *Carl Bildt and Mike Dillon*

A Europe without a clear space policy is a Europe that lacks ambition. That was the central conclusion of the European Space Agency's so-called Wise Men's report four years ago.[1] Since then governments have slowly started to understand that they need to take space policy more seriously than they have done in the past, and that the European Union should be the focal point for the development of new European space policies.

[1] *Carl Bildt, Jean Peyrelevade and Lothar Späth, 'Towards a Space Agency for the European Union', Report for the Director-General of the European Space Agency, November 2000. Available from http://esamultimedia.esa.int/docs/annex2_wisemen.pdf.*

During the last few years, the EU has set increasingly ambitious goals for itself in a number of areas. One example is the on-going process of EU enlargement, to bring stability and security to new parts of the European continent. Another is the aim of creating the most competitive, knowledge-based economy in the world by 2010 (known as the 'Lisbon process').[2] A third is the effort to develop the EU's role as a player in international security. In this area, the EU has laid out its ambitions in the 'European Security Strategy', which EU governments approved in December 2003.

[2] *For a review of the Lisbon process see Alasdair Murray, 'The Lisbon Scorecard IV', CER, March 2004.*

Investing in different types of space technology can help to bring about success in some of these areas. Space can play a major role in developing Europe's high-tech industry. For example, the development of telecommunication systems across the EU depends greatly on space-based technology. In addition, space technology can help governments with their security policies,

whether they want to track developments in conflict zones or monitor the environment. Aid agencies already use a disaster monitoring system called UNOSAT, which provides satellite images to aid workers to help them locate and get relief to victims of natural disasters.[3]

*[3] For more on the public use of space technology see Melissa Mean and James Wilsdon, 'Masters of the universe', Demos, 2004.*

In the 1960s, governments realised that no European country could have an ambitious space programme on its own and that they needed to combine their efforts if Europe was to have any meaningful role in space at all. Their attempts to merge their launcher projects and research activities during the 1960s led to the creation of the European Space Agency (ESA) in 1975. Paris-based ESA has 15 member-states, and almost 2,000 people work there. In 2003, ESA had a budget of €2.7 billion, which is re-invested in each member-state through industrial contracts worth more or less the value of each country's contribution. While military concerns have dominated and driven the American and Russian space programmes, the focus of European efforts has been civil in nature, and more orientated towards scientific research.

The success of the rocket maker Ariane as a commercial venture is a good example of the European approach. Europe has also developed a competitive satellite operations industry, especially in the telecommunications and direct broadcasting sectors. To illustrate: Luxemburg-based SES Global is the world's largest satellite operator. Other European successes with commercial space operations include Eutelsat, a company that supplies regional communications for fixed satellite programmes; Eumetsat, an inter-governmental organisation that offers satellite imagery data to national meteorological services; and Inmarsat, a company that provides wireless technology for mobile communications. The European space industry has three major players: the Franco-German-Spanish firm EADS, the French company Alcatel Espace, and Alenia which is based in Italy. And there are a host of smaller companies providing services and technologies for programmes



dominated by these companies – such as Magna Steyr, an Austrian engineering company that makes cryogenic fuel lines for Ariane rockets; and a Denmark-based firm, Terma that designs software for satellites and manned space missions.

Despite these European successes, it is the United States that dominates global space efforts, undertaking around three-quarters of all publicly financed space programmes. The primary reason for this massive American investment in space technology is its central importance to US national security policy. The Pentagon has different space systems for everything from target intelligence to advance warning of an incoming attack. Given America's global security commitments, the Pentagon considers it necessary to maintain a major space programme that is geared to the concept of 'space dominance'.

In contrast, these types of security concerns have been virtually absent from European space efforts. British and French nuclear forces were designed to hit cities rather than silos, and that required far less precise intelligence on targets. Furthermore, to this day, European security concerns remain more regional than global in nature. Consequently, European governments have not seen the need to develop and maintain a similarly vast range of space technologies and assets. There is, however, a growing realisation across Europe that space technology is increasingly important for various aspects of security policy. More importantly, political and business leaders are recognising the role that space-based assets can play in the development of various sorts of economic activity on the ground. Space has, in this sense, come down to earth.

## EU space programmes

In 2000 the 'Wise Men's Group' called for a much stronger link between the European Union and ESA, to help integrate space policy into other EU priorities. The Wise Men also proposed that the European Council, which brings together EU heads of

government, should set strategic goals for European space efforts in the same way it sets strategic goals for other policy areas. The European Commission and ESA already work well together. The November 2003 Commission White Paper on European Space Policy was written in close collaboration with ESA.[4] Furthermore, the Commission and ESA have signed a framework agreement that should enable future close co-operation. And over time, ESA should and probably will become the EU's space agency. But in the short-term, there is no need to engage in lengthy negotiations to integrate the two institutions. This is because there are important institutional differences between the supranational European Commission and the inter-governmental ESA. Both organisations also have different memberships. Instead, EU governments should concentrate on developing space programmes and technologies that would be useful for implementing the Union's various policies, and on promoting a viable and competitive European space industry.

*[4] European Commission, 'Space: a new European frontier for an expanding Union', November 2003. http://www.europa.eu.int/comm/space/whitepaper/whitepaper/whitepaper_en.html.*

The Galileo satellite navigation system will be a landmark programme, for a number of reasons. Galileo is the first EU space programme. It will have worldwide coverage and will be available to customers around the globe. In this sense Galileo will give Europe a global presence. Galileo is also the first major space programme to be financed through a public-private partnership. It is already generating significant international interest. China, India, Israel, Mexico and Brazil have all expressed interest in becoming partners in the system. Russia would like to investigate synergies between Galileo and its similar – but more military-oriented – Glonass navigation system.

Initial US opposition to Galileo, especially from the Pentagon, was fierce. Critics claimed that Europe did not need to build another navigation system when the American Global Positioning System (GPS) system was available for free; or they said that EU governments wanted Galileo so that Europe could become a stronger commercial



– and even military – rival of the US. But these critics missed the main reasons why Europe is investing in Galileo. While the US government has opened parts of GPS to non-US and non-military users, it remains a system defined by American military requirements, and it ultimately remains under US government control. In contrast, Galileo is primarily a non-military system, and therefore promises to offer non-military users both better and more reliable access in the future (see Tomas Valasek's essay). Since positioning and navigation systems are rapidly becoming crucial for the operation of transport networks – from tracking containers to monitoring air traffic – it is hardly surprising that Europe sees the need for an autonomous and reliable navigation system. Washington has now accepted Galileo, and the EU and the US signed an agreement in June 2004 to co-operate more closely on positioning systems.

## Money, money, money

The key to Europe's future in space will be adequate funding for new programmes. Governments should assess the question of funding in the wider context of their need to boost spending on high-technology research and development (R&D). EU governments agreed at the Barcelona summit in March 2001 that European R&D spending should rise from the present level of almost two per cent of GDP to three per cent by 2010. This is an important objective, not only for developing high technology, but also for halting the scientific 'brain-drain' from Europe to well-resourced American laboratories. Between 1991 and 2000, two-thirds of the 15,600 EU-born doctorate recipients in the US studied science or engineering, and 70 per cent of the Europeans with American PhDs planned to stay in the US.[5]

*[5] European Commission, DG Research/MERIT 'Brain drain study', 2003. http://europa.eu.int/comm/research/era/pdf/indicators/merit_exsum.pdf.*

Europe's long-term competitiveness will depend on greater spending on high-technology R&D. Intense manufacturing competition from China and elsewhere in the Far East, combined

with more outsourcing of services to countries such as India, are compelling European governments to focus more on creating new types of industrial and service jobs. Space programmes that bring together many of today's advanced technologies can help to ensure that European high-tech industry remains competitive. As a start, EU governments should agree to increase their space spending by 50 per cent over the coming years (an extra €2.5 billion a year). If they did so, a substantial part of the increase should go to the ESA budget while the rest should go to Commission-run space research programmes. In particular, governments should fund new programmes that would help them fulfil their EU policy objectives.

In addition, although 'spin-off' services from space-based technology, such as navigation and communications, are still in their infancy, European governments should consider spending more of their space budgets on developing the space services sector. Currently governments spend most of their space money on manufacturing infrastructure, i.e. satellites. However, there are signs that not only do space services companies have substantially larger profits than space manufacturers; they are also experiencing significant revenue growth. In 2001, the British National Space Centre (BNSC) estimated that the earnings of the manufacturing end of the UK space sector were £436 million, while the turnover of the services end was £2.5 billion. The BNSC says that the income generated by the services sector grew to £3.4 billion in 2003, whereas the manufacturing sector remained more or less stagnant.[6] For major cross-border satellite programmes, like the €3.2 billion Galileo satellite navigation system, the revenue potential for spin-off services is enormous. The European Commission estimates that the market for navigation products and services was worth €10 billion in 2003, and this figure could rise to €300 billion by 2020.[7] Frost & Sullivan, a consulting company, has forecast that the European market for satellite-based navigation services could be growing 15 per cent annually by 2012.[8]

[6] *British National Space Centre, 'Size and Health of the UK space industry: 2003 update study', March 2004. http://www.bnsc.gov.uk/assets/Exec%20Summary%20v9%20new%20pic%20v2.pdf.*

[7] *European Commission, 'Progress report on the Galileo research programme', February 2004. http://www.europa.eu.int/comm/dgs/energy_transport/galileo/doc/com_2004_0112_en.pdf.*



[8] *Frost & Sullivan, 'Global Positioning System and Galileo: lift-off time for application markets', February 2004.*

The Commission has calculated that it will spend roughly €230 million on space this year.[9] EU governments are already negotiating the outlines of the next EU budgetary package, which will run from 2007-2013.[10] As part of its proposals for the next budget, the Commission has suggested a substantial increase in its research budget, some of which would be spent on space. Presently the Commission's research budget amounts to €4.4 billion a year, and it wants this figure to rise to €10 billion (ten per cent of the total EU budget). The Commission would also like to set up a more specific 'security research programme', with a minimum budget of €1 billion a year. The security programme could fund new technologies like space-based communications systems, which would help police, emergency response services and armed forces to react more effectively to natural disasters or terrorist attacks.

[9] *European Commission White Paper, 'Space: a new European frontier for an expanding Union', November 2003. http://europa.eu.int/comm/space/whitepaper/pdf/spwhpap_en.pdf.*

[10] *For an overview of the EU budget debate see Iain Begg, 'The EU budget: common future or stuck in the past?', CER briefing note, February 2004.*

EU governments should back these proposals. However, most space programmes in Europe are run on a national basis, which means they are less cost-effective than common European programmes. Furthermore, there is an artificial firewall between ESA programmes, which are strictly non-military, and the more security-oriented national or multinational programmes.

## The military option

European governments need to break down the old-fashioned firewall between military and civilian space programmes. More and

more space programmes are 'dual-use', meaning that they can have both military and non-military purposes. Galileo is primarily a civil project but it could have security applications as well. In the area of earth monitoring, companies are developing environmental, commercial and military systems together, using similar technologies for each. The same dual-use potential also applies to communications systems.

According to its mandate, ESA can only work on programmes that are designed entirely for 'peaceful purposes'. Traditionally, governments have interpreted this to mean that ESA could not run programmes with any military content, such as the construction of a spy satellite. But they have since revised this definition. European governments now agree that ESA may develop systems and run space programmes, such as those involving monitoring and surveillance satellites, which European armed forces could use for non-aggressive military activities like peacekeeping. The EU already has a satellite imagery centre at Torrejon in Spain, and governments have used imagery from Torrejon to assess Israeli settlements in the West Bank. ESA has its own monitoring centre at Frascati, outside Rome, which surveys environmental developments. Over time, it would make sense for EU governments to merge these two satellite centres and their analyses.

There is also a case for European governments to develop a more advanced surveillance system, which they would design and run collectively. Numerous states around the world are acquiring space-based surveillance systems. Israel, to take one example, already operates several military reconnaissance satellites. For the EU, it would be logical to build on existing French-run, and future German, observation satellites, as well as ESA's environmental-monitoring programmes (see Xavier Pasco's essay). European governments should use these existing programmes to construct a more coherent and advanced European group of satellites for security and environmental monitoring.



## Broadband boom

European governments should also invest in space-based broadband communication systems. Broadband is not simply a faster way to connect to the internet – it fundamentally changes the way people use it. Connections are immediate and large volumes of data, from emails to television, can be transmitted almost instantly. Broadband services can be delivered in numerous ways. In some cities, companies transmit broadband services through underground fibre optic cables. Other companies use terrestrial systems based on third-generation mobile communications (so-called 3G networks).

Europe has, and must retain, a strong position in all these sectors, not least because of the massive investment in broadband in the US and parts of East Asia. For instance, the South Korean government provides access to broadband internet for all of its citizens. This investment has led to a massive growth in the amount of goods that are bought on the internet instead of in shops. According to Euromonitor, a market analysis firm, internet retailing accounted for over four per cent of all sales in South Korea in 2002, rising from 0.1 per cent in 1998.[11]

[11] *Euromonitor, 'Home shopping in South Korea', July 2003.*

There are areas, however, where terrestrial systems face limitations. These include more remote and sparsely populated parts of today's EU, where investments in terrestrial systems are simply too expensive. If the EU could make broadband more easily and cheaply available to these areas it would help to bridge the 'digital divide' between those who have internet access and those who do not, especially between the old EU-15 and the ten new member-states. But there could be potential political gains for the EU as well, in the areas that constitute Europe's 'near abroad'. The Middle East and North Africa are two large areas that would benefit from access to a space-based broadband programme. At the moment, these countries have some of the lowest levels of internet penetration of any region in the world, and this is undoubtedly an obstacle both to their economic development and to the opening up of their political

systems. Similarly the benefits of an EU-funded broadband system would also apply to the Balkans, Turkey and the countries in between the EU and Russia.

Hellas SAT, a Greek-Cypriot satellite telecommunications consortium, is already planning to offer broadband services to customers in the Balkans, parts of North Africa, and on isolated Greek islands. The consortium has a satellite, confusingly called Hellas SAT 2, which cost roughly €140 million, and it transmitted much of the television coverage of the 2004 Athens Olympics. The EU, in collaboration with ESA, should go a step further, and fund a major programme to develop space-based broadband services across Europe and beyond. It should be possible for the EU to use some existing satellites to provide European citizens with cheaper, space-based broadband services. ESA is currently developing a more powerful satellite platform that would be well suited for such a programme. As with Galileo, ESA and the EU could develop and deploy the first satellites to demonstrate the technologies, and then open up the system to a public-private partnership or even fully commercialise it. Alongside Galileo and other earth monitoring systems, a broadband initiative would be a logical extension of Europe's efforts to use space technologies to help achieve its policy objectives.

## Let's work together

European governments and institutions should also be prepared to take a lead in developing international space co-operation. A number of countries around the globe are building up their space assets, including some low-wage economies. China, Canada, Japan, India, and Pakistan all have active space programmes, although their respective budgets and technologies vary greatly. The first Chinese astronaut (known as a *Taikonaut* in Chinese) flew into space in October 2003. Although Chinese scientists were trying to build rockets over 800 years ago, the present space flight programme was approved only in 1992. In a relatively short time, the Chinese government has developed the skill base for key space technologies,



for both civil and military uses. The Chinese space industry makes launchers, communication satellites, systems for gathering and disseminating sensitive satellite imagery, and navigation systems.

The Canadians have very close ties with the space industries of the US and Europe in many areas; they made the crucial robot arm for the American space shuttle programme, and they have been actively involved with the Europeans in developing software for analysing satellite imagery of the environment. The Japanese space programme has created real success stories for some of its companies, especially in launchers and the environmental monitoring field. The Japanese ADEOS-MIDORI satellite – which gathers environmental data such as changes in the Earth's atmosphere and the ozone layer – was launched on Japan's H-IIA rocket. Pakistan has a space programme called SUPARCO, to develop low-orbit satellites for gathering images; and in 1997, India started a ten-year plan to launch its own satellites for scientific observation.

However, Europe's most important space relationship by far will remain the US. In January 2004, President Bush announced that the US space programme would focus on sending humans back to the moon by 2020, and then to Mars. The President also said that the US would phase out its space shuttle programme by 2010. Europe now needs to decide how much involvement, if any, it wants to have in what may become a real Mars programme. And the Europeans will have to discuss with the Americans and other international partners how the phasing out of the American space shuttle programme will affect the future of the International Space Station (ISS). The ISS is being built through collaboration between the US, Russia, Japan, Canada, and Europe, and ESA sent the first European astronaut there in 2001. At the moment, only American space shuttles can carry large cargoes to the ISS, and the station might have to close when US space shuttles are no longer running.

Europe's other major space partner will be Russia. Although it has had difficulty finding money for its programmes, Russia still has an

ambitious approach to space. The Russian space industry offers a wide range of products that can give it a prominent place in any collaborative project. For example, Lockheed Martin and Boeing, the companies that supply expendable space launchers to the US, depend on rockets manufactured in Russia. The EU governments and Russia have signed many declarations to develop their space co-operation. But these paper commitments have not yet led to anything concrete.

### Opening up Europe's final frontier

It is time for European leaders to take space policy more seriously. EU governments should understand that a limited space policy constrains Europe's prospects on earth. If EU governments wish to succeed with their current array of policy goals, they will have to make a new and expanded commitment to their space policies. European governments should build on the success of ESA, while also integrating space issues into other EU policies. The European Council should include space policy among its future priorities, devising a coherent framework for national, ESA, and Commission-run space programmes.

The Dutch presidency of the EU, which runs until the end of 2004, is leading a discussion on the Commission's 2003 space White Paper. The timing of this discussion is apposite, given the current negotiations on the next EU budget. These negotiations will include a debate on whether or not the Commission should have more money for research. In spring 2005, EU governments will conduct a halfway review of their Lisbon economic reform agenda. This would be a good time for governments to agree on how to implement their stated commitment to increase R&D funding – including for space technology. With all these reviews in mind, it is time for governments to put space issues at the centre of their discussions on their future ambitions for Europe. Ultimately, governments must recognise that Europe's success and competitiveness on earth will partly depend on its success and competitiveness in space.

# 3 Ready for take-off? European defence and space technology

*Xavier Pasco*

The continuing evolution of space technology is changing the very nature of warfare. Crises can erupt anytime and anywhere, and space technology can help defence ministries respond more quickly and effectively. The US has pioneered the military use of space-based and other new technologies to gather and process information from sensors, define troop positions, and guide missiles to their targets. But European governments have been slow to invest in space-based military technologies. The 25 EU governments collectively spend about €40 billion on buying and developing military equipment (out of the €180 billion they spend on defence). Of that €40 billion, the Europeans spend only €550 million a year on space-based military technology. In sharp contrast, the US pumps roughly €15 billion a year into developing space-based military technology, and accounts for over 90 per cent of the global figure.

The huge disparity between American and European investment in space technology will almost certainly increase the gap between American and European military capabilities – already, inadequate equipment makes it difficult for Europeans to work with American soldiers. Perhaps more significantly, if Europeans want to manage their own military operations, they need to develop satellite networks that can operate independently of America's space assets. The 'European Security Strategy', agreed by EU leaders in December 2003, says that the EU should be prepared to deal with a number of security threats, ranging from humanitarian

crises to the proliferation of weapons of mass destruction (WMD).[1] In particular, European governments will have to adapt their intelligence and information resources to cope with more volatile situations – possibly involving the use of WMD – and more elusive enemies such as international terrorist networks.

[1] *See Steven Everts, Lawrence Freedman, Charles Grant, François Heisbourg, Daniel Keohane, Michael O'Hanlon, 'A European way of war', CER, 2004.*

EU defence ministries have already agreed that they should acquire some space technology, along with more transport planes and precision-guided missiles. This is because they recognise that space-based technology is a crucial element for developing better intelligence, surveillance and communications resources. However, only a small number of EU governments own space-based military systems (Britain, France, Germany, Italy and Spain). The challenge for Europe is to transform a collection of disparate and relatively modest national programmes into a European space system that can perform a number of military tasks. European governments, therefore, should assess what space systems are necessary to fulfil their military requirements, and to help their armed forces work more effectively with American soldiers.

## The military use of space technology

The military use of space-based technology was born out of a very specific context: the nuclear confrontation between the two superpowers at the end of the 1950s. While developing their ballistic arsenals, the US and the Soviet Union wanted to find a way to observe their construction, detect their use by the enemy, and locate the sites where missiles were stored so that they could be destroyed. Since the end of the Cold War, the Americans have greatly extended their use of space-based technology to a number of military functions. Commanders in distant headquarters can now use information from space to locate on a screen, in real time, their forces and those of their opponents, and to guide weapons precisely to their targets.



A comparison of recent conflicts shows how much space technologies are already integrated into US military practice. Coalition forces used 21 military and commercial satellites in the 1991 Gulf war, and over 50 satellites in Iraq in 2003. The 50,000 US troops in Afghanistan in 2001 used five times more satellite communication bandwidth than the 500,000 troops deployed in the 1991 Gulf War. In particular, the Pentagon is increasingly using satellites to guide missiles. While the Pentagon used less than 1,000 precision-guided missiles in the 1999 Kosovo war, US armed forces launched over 5,000 such satellite-guided missiles in Afghanistan in 2001, and over 6,000 in the 2003 Iraq war.[2]

[2] *All figures taken from Michael O'Hanlon, 'Neither star wars nor sanctuary: constraining the military uses of space', Brookings Institution Press, 2004.*

In essence, space technology helps defence planners run faster and more effective military operations, and keep the number of casualties on the ground to a minimum. In time space applications may have a more central place in the way armed forces organise themselves. The 'digitisation' of the battlefield encourages military officers to think in terms of communications 'networks' that link air, naval and ground forces, rather than to focus on traditional 'platforms' such as aircraft, ships and tanks. The American concept of 'network-centric warfare' suggests that space applications may be about to enter into a truly new era, evolving into the role of a military 'nervous system'.

During the 1990s some Europeans questioned the usefulness of new technology. In particular, some military commanders feared that excessive use of space-based technologies would lead to the human factor gradually disappearing from military operations – situations that often require extremely subtle decisions and actions. The idea that war fighting can become more like a video game, with commanders pressing buttons on their consoles while looking at the enemy on a big screen, understandably makes some military leaders nervous. However, the military operations in Kosovo in 1999 and in Afghanistan in 2001 dramatically exposed the downside of Europe's hesitancy about using space-based technologies for military purposes.

The Pentagon's extensive use of space assets in Kosovo, Afghanistan and Iraq means that access to space technology is now more or less a prerequisite for active participation in NATO or American-led operations. And space technology is not only helpful for warfighting; space can also be useful for peacekeeping missions. In the stabilisation mission that followed the 1999 Kosovo war, American troops had secure space-based communications systems. Some Europeans soldiers had no such technology and had to make do with commercial mobile phones, which enemies can easily interfere with or intercept.

Even though their space technologies are lagging far behind US developments, the Europeans do not need the vast number or variety of American systems. But they do need access to some space-based capabilities for better intelligence, surveillance and communications. And they have to ensure that their space technologies can mesh with American systems, so that they can work alongside the US.

## Existing European military space systems

European countries already possess some space-based military assets. These programmes cover two main areas: earth observation and telecommunications. Only France has its own spy satellites, although Germany is developing its own system. The UK has privileged access to imagery from US spy satellites, which makes the British reluctance to develop a system for satellite photography understandable. And France, Italy, Spain and the UK all have some telecommunications assets.

France started the first European military spy satellite programme, Helios, in 1986, and the first satellite was launched in 1995. Assessments based on Helios imagery led to the French decision in 1996 to disassociate itself from US bombings in Iraq, due to 'questionable' American information. That episode, together with differences over targeting during the Kosovo conflict, and the 2003 controversy over the alleged presence of WMD in Iraq, have



reinforced France's determination to continue their information-gathering activity from space. The French government plans to use a new Helios 2 series of spy satellites, starting in 2005. Not only the French question 'erroneous information' from Washington. After North Korea's missile test in 1998, and during the 2002 football World Cup, Japan was also dissatisfied with the lack of information from the Americans about potential missile attacks. As a result Japan launched its own spy satellite in 2003.

The German ministry of defence is developing SAR-Lupe, a constellation of five spy satellites that will be ready in 2006. In the mid-1990s Germany contemplated joining a satellite programme with France, but this idea stalled due to financial problems. Later, the experience of participating in the US-led coalition during the Kosovo conflict made Germany decide to develop SAR-Lupe: the US failed to provide satellite intelligence that was relevant to the security of German forces. This convinced Germany that if it was going to participate in coalitions it would need its own intelligence-gathering satellites.

The scale of European military telecommunications systems varies greatly. Britain uses its own Skynet system, a constellation of three satellites with worldwide coverage, for the British armed forces. In 1998 the British government decided to develop Skynet V, a new generation of military telecommunication satellites. By 2008 Skynet V should be fully available to the British government in times of crisis, but the managing organisation can sell the use of the system to private companies for the rest of the time. In 1995 Britain and France signed an agreement to lend each other their telecommunications systems in case of a defect in one or the other. France signed other agreements of this kind with NATO in 2000 and Spain in 2001.

Currently, the French armed forces use a civil satellite system, Telecom-2, which carries military transmitters. However, using this civil system requires the French ministry of defence to pay for the

system even when it does not use it. This extra cost, plus the need for higher rates of data transmission and more robust telecommunications, has prompted the French military authorities to opt for a new military-only system. This programme, Syracuse III, will consist of two satellites, and should be fully up-and-running by 2006. Italy and Spain, in contrast to the UK and France, have limited military telecommunications systems.

## From national to multinational programmes?

Even though European governments have combined their non-military space activities since the 1960s, defence programmes have remained strictly national ventures. But as the cost of military systems continues to rise, no single European country can afford to develop a wide range of space assets. As a result, European defence ministries are starting to realise that if they want access to a greater variety of space-based military systems they need to share and develop some of these technologies together.

Earth observation is the only field with any concrete co-operation between European governments. Since 2001, EU governments have used the EU satellite centre in Torrejon, Spain, for interpreting satellite images. Most come from civilian satellites but a small number come from the Helios military system. However, the usefulness of the satellite centre is limited. Some defence ministries complain that its output is slow and of poor quality. Thus, despite the existence of the EU satellite centre, Belgium has gone ahead with constructing its own satellite-image interpretation centre.

Since 1999, the governments of Belgium, France, Germany, Italy and Spain have been working on an agreement titled the 'Common Operational Requirements for Global European Earth Observation System by Satellites'. It is more commonly known by its French acronym BOC (*Besoin opérationnel commun*). The aim of the BOC is to define common requirements for future observation systems. The BOC is significant because this is the first time that European



governments have tried to agree on their space-based military requirements. Traditionally, European governments have simply paid another government for the use of a space system. Belgium, Italy and Spain all bought 'shares' in the French Helios system so that they could use it – but the French government alone decided the design of the Helios programme. If the governments can agree on their common requirements and sign the BOC, they could then jointly develop spy satellites.

Telecommunication satellites are a good example of the potential for, and the difficulties of, integrating national systems. For years NATO has tried to develop allied space-based telecommunications, through a programme called NATO Satcom Post-2000. This programme is supposed to define how future co-operation between allied information systems would work, and reach agreement on common technical standards. In particular, NATO governments have not been able to agree on their choice of wave frequencies. The US is putting strong pressure on NATO to adopt the Extremely High Frequency (EHF) standard. The Pentagon already uses EHF communications, which are very difficult to jam or intercept, but allow a large amount of data flow. However, the Europeans do not want to be forced to use enormous data flows that their forces do not really need, especially since their communications programmes are much less developed than American systems. So far, the other NATO governments have resisted adopting the American EHF standard. The British, French and Italian ministries of defence teamed up to offer their less-demanding telecommunications systems for use by their NATO allies and the NATO governments accepted their offer in March 2004.

Three other areas are potential candidates for future European military space systems: early warning, electronic intelligence, and space surveillance. Early warning of the launch of an enemy missile can be useful by itself or as part of a missile defence system. The US has used early warning satellites for over 40 years, but the Europeans have only carried out some research in this area. Given their geographical position, close to a number of countries with

missiles, the Europeans are more likely to suffer a short or mid-range missile attack than a long-range one, whereas the US focuses more on countries that have long-range missiles. It is especially difficult for defence scientists to develop sensors that can detect the launch of short to mid-range missiles. This is because the boost phase of these missiles occurs entirely inside the earth's atmosphere. To detect these missiles early, defence scientists should master delicate infrared sensing technologies and precise missile tracking methods. Moreover, detection experience is vital in order to prevent false alarms caused by solar reflections or other natural phenomena. A European early warning system would need at least two satellites above the regions near Europe. And such a European system would need to work easily with a larger US missile defence system.[3] France has already started an experimental early warning programme, called SPIRALE, and the French ministry of defence plans to launch two satellites in 2008.

*[3] See Bruno Tertrais, 'US missile defence: Strategically sound, politically questionable', CER, 2001.*

A European electronic intelligence (ELINT) system could take the form of a few small satellites orbiting at a low altitude to monitor electronic activity, such as terrorist 'chat rooms' on the internet. In Europe, only the French have started work in this area. The Helios system has an ELINT component, and France will launch four ELINT micro-satellites called ESSAIM in December 2004.

In the long-term, as the economic and military importance of space technology grows, and more and more countries develop space technology, there is the prospect of the 'weaponisation' of space. In 2025, one of the main priorities for defence ministries may well be to protect satellites from attacks, which would make the surveillance of space a crucial activity. The Pentagon is already drawing up concrete plans to counter weapons in space. Prior to his appointment as US defence secretary in 2001, Donald Rumsfeld headed a commission that warned of a "space Pearl Harbour", if the US did not develop its satellite defences. In Europe, however, only experimental work exists in this area, in France and Germany, with



no real prospects for developing space surveillance programmes.[4]

*[4] For more on the weaponisation of space see Theresa Hitchens, 'Mis-framing the debate: find room for nuance on space weapons', Defense News, September 6th 2004. See also Michael O'Hanlon, 'Neither star wars nor sanctuary: constraining the military uses of space', Brookings Institution Press, 2004.*

Developing European military space systems need not be a costly venture. European defence ministries already know that they need to spend more of their defence money on new equipment, and less on conscript troops and outdated weapons programmes. Investing a bit more of their defence budgets in space technology would help European governments get much more 'bang for their buck', for relatively little money – collectively just over €700 million a year. The following table, compiled by the Space Bureau of the French ministry of defence, shows the rough cost of a full-range European military space system.[5]

*[5] See Daniel Gavoty, 'L'espace militaire, un projet fédérateur pour l'Union européenne', Défense Nationale, October 2001.*

## Cost of a full-range European military space system

| Programme | Programme cost | Programme duration in years | Annual cost |
|---|---|---|---|
| Telecom | €3.1 billion | 15 | €207 million |
| Observation | €2.3 billion | 10 | €230 million |
| Galileo* | €150 million | 8 | €19 million |
| ELINT | €1.2 billion | 10 | €120 million |
| Space Surv. | €760 million | 10 | €76 million |
| Early warning | €760 million | 10 | €76 million |
| **Total** | **€8.3 billion** | | **€730 million** |

**The Galileo figures are an estimate of the cost of adding a jam-resistant military signal to the system.*

## The 'dual-use' option

Even if they cannot find the money to pay for all the programmes in a wide-ranging military system, European governments could certainly use some non-military space systems for military tasks – so-called 'dual-use' systems. The advantage of a dual-use system is that defence ministries can share the cost of building the satellites with other government departments and/or the private sector. There are two major European programmes with dual-use potential: Galileo, the European satellite navigation system, and the Global Monitoring for Environment and Security (GMES) programme.

Galileo's potential military use is already well known, since it will do a similar job to the American Global Positioning System (GPS), which the Pentagon has used extensively in Afghanistan and Iraq. Indeed, the GPS started life as a military technology, helping US soldiers to define their positions and to guide missiles. Galileo could perform similar tasks for European soldiers on peace-support missions in the Balkans or elsewhere (See Tomas Valasek's essay for an extensive description of Galileo's military potential). Even though they now welcome Galileo's potential usefulness, European defence ministries were originally not particularly supportive of the project. For example, at the height of the European debate on whether or not to fund the programme in January 2002, the then French defence minister, Alain Richard, indicated that "he saw no compelling military case for Europe to launch its own fleet of satellites to match the GPS network already in space."[6] Afterwards, an unambiguously supportive statement in favour of Galileo from the French foreign ministry contradicted Richard's position. But Richard's views represent a traditional conservative position, often found in European defence ministries, that prefers the status quo. Moreover, very tight national defence budgets limit European choices. Spending money on space programmes has never ranked high on most defence ministries' priority list, except for strictly controlled national programmes like the French Helios series.

[6] *International Herald Tribune, January 31st 2002.*



The European Commission is trying to develop the GMES programme, a collection of observation satellites, due for launch in 2008. GMES was originally conceived as an environmental monitoring system, but the Commission now says that the programme should perform more general 'security monitoring' as well. EU governments have not yet agreed on the security aspects of the programme, which is still in its early research phase. The Commission says that GMES could monitor natural or humanitarian disasters, assess damage, and assist rescue operations. Since many of these disaster situations would require military help, GMES could be a very useful tool for European military planners. GMES could also detect and analyse industrial pollution, which would help EU governments meet their environmental commitments under the Kyoto protocol. And GMES could potentially even do a similar job to military spy satellites, observing missile developments in other countries to verify if disarmament treaties were being implemented or violated.

Not all European dual-use programmes need to be EU-run. France and Italy agreed in 2001 to develop Pleiades-Cosmo, a civil observation system that could be used for military purposes. The system should be fully ready by 2007, costing just over €1 billion. Pleiades-Cosmo may prove to be a test bed for the future replacement of national programmes, such as the French Helios series, with a multinational system. Furthermore, the increasing cost of military observation systems means that dual-use programmes, like Pleiades-Cosmo, are likely to become more common.

## Conclusion

The US has a 'do-it-all' approach to space-based military technology. The Pentagon is developing technology not only to help its armed forces on the ground, but also to protect its satellites, so-called space control systems. Realistically this approach cannot be a template for Europe because of its limited defence budgets. Furthermore, 'space control' technology is irrelevant for the types of

peace-support missions the EU aims to undertake. However, European armed forces would greatly benefit from access to space technologies that are useful to the soldier on the ground – intelligence, navigation and communications systems. The first priorities for European space efforts, therefore, should be observation and telecommunications systems. The inter-governmental discussions on a European earth observation standard (the BOC) and NATO's nascent satellite telecommunications network are steps in the right direction.

But European governments should also consider developing their own early warning satellites for detecting missiles. Not only because there is a growing number of countries around the world that have WMD (such as North Korea), or are suspected of developing them (for example Iran) – but also because of the danger that those technologies could fall into terrorist hands. The US is pressing ahead with its own missile defence system, and wants to involve its NATO allies. An early warning programme would place Europe in a stronger position, both as a provider of intelligence and as a potential contributor to any transatlantic anti-missile system.

Finally, European governments should also promote innovative ways of using space technology for 'security' in the broadest sense. For example, satellites designed for environmental monitoring could also be useful for dealing with other threats, such as checking insecure industrial or armaments installations in the former Soviet Union. Furthermore, space-based technologies are especially useful for 'joining-up' the different parts of a government that deal with security. For example, they could help police, emergency response services and armed forces to co-ordinate their actions in the case of natural disasters or a terrorist attack by using shared communications, navigation technology and satellite imagery.

In other words, military satellites should form part of a collection of European space-based security systems that can integrate both civil and military programmes. If European defence ministries do all of



these things – make the most of their existing space-based technologies and decide to invest in some new ones – they will not only help their armed forces run more effective missions but also help Europe play a much greater role in international security.

# 4 Galileo's 'strategic' role
*Tomas Valasek*

'Strategic' is a word that politicians and officials tend to use thoughtlessly. The US Department of Defense lists 28 different uses of the word in its online dictionary.[1] Nuclear weapons, intelligence and bombing campaigns can all be 'strategic'. The European satellite-based navigation system, Galileo, has earned the same sobriquet. The European Commission, which jointly funds the project with the European Space Agency (ESA) and national governments, has written that Galileo will reduce the European Union's "dependence on the American Global Positioning System (GPS) for *strategic* and economic reasons" (emphasis added).[2]

[1] *US Department of Defense, Online Dictionary of Military Terms. http://www.dtic.mil/doctrine/jel/doddict/.*

[2] *European Commission, 'Galileo – involving Europe in a new generation of satellite navigation services', February 10th 1999. http://europa.eu.int/scadplus/leg/en/lvb/l24205.htm.*

Is Galileo of strategic importance for Europe? Yes and no. Yes in the sense that satellite navigation is becoming an integral part of everyday life. As more and more Europeans rely on it, it becomes imperative for European governments to guarantee that satellite navigation is available and working well. Galileo would help them to do that. But Galileo is not strategic in the way nuclear weapons are. The system is essentially civilian. It does, however, have potential military uses. It is Galileo's potential for 'dual-use' that makes running the system so difficult for the EU.

## Satellite navigation: like water and electricity?

The US government made the GPS fully available for commercial use in 2000. Since then, businesses have made ingenious use of it.

Most sailing boats and more and more cars use GPS for navigation; GPS allows air traffic controllers to guide planes; farmers use it to measure crop yields; ambulance drivers get to accidents more quickly with the help of GPS; GPS allows taxi companies to locate the nearest free cab to you; and it allows advertisers to bombard you with information about the shop you have just passed.

America's GPS is financed by the US taxpayer and free to users worldwide. So why should Europe spend billions of euro to duplicate its services? One reason is that there is a growing tension between Europe's need for the system and its ability to ensure it is functioning. The more Europeans rely on satellite navigation to get around and communicate, the greater the pressure on EU governments to help maintain and improve the service. European transport would suffer severely if the GPS failed one day. But European governments have no say in the day-to-day running of GPS. Moreover, Galileo is not simply a duplication of GPS. It promises to improve the service's stability and predictability. Many users have found GPS' coverage patchy and unreliable, in particular in densely populated urban environments. A combined GPS-Galileo receiver with access to twice as many satellites would vastly improve the chances of uninterrupted coverage. The US-EU agreement of March 2004 to use the same frequency for their free signals will make it easier to build dual-system receivers.

The European Commission claims that even by itself Galileo would provide better coverage. The GPS can locate a user with an accuracy of about ten metres. This is good enough for preventing an airplane from straying into enemy airspace, but it is not enough to guide a plane's landing. Galileo, which will feature some new technology, would narrow accuracy down to a couple of metres. It could help airplanes land at busy airports, trigger an alarm when trains approach each other on the same track, or even monitor whether EU farmers are growing crops in contravention of EU subsidy rules.



Galileo would not only benefit end users, but also boost Europe's high-tech industries by creating new jobs and increasing funds for research & development (R&D). The European Commission claims that Galileo and other aerospace projects are indispensable "to maintaining competition in world markets ... and safeguarding Europe's freedom of action in its external policies".[3] The Commission, like national governments, wants to protect industries with actual or potential military significance, retain their highly qualified workforce and generate spin-off technologies. Therefore, although US companies have won some Galileo-related contracts, most of the business generated by the project will go to European companies. Even if this kind of discrimination is questionable from an economic point of view, it is standard practice in both the US and the European defence industry.

[3] *European Commission, European Advisory Group on Aerospace, 'STAR21: Strategic Aerospace Review for the 21st Century', 2002. http://europa.eu.int/comm/enterprise/aerospace/report_star21_screen.pdf.*

Last but not least, Galileo carries immense political significance. Europe-wide industrial projects such as Galileo, the airplane manufacturer Airbus, or the rocket maker Ariane, show that the EU can be a vehicle of innovation and the creation of high-quality jobs. Such projects can help to make the benefits of the EU more visible for European businesses and citizens.

## Pentagon priorities

All this makes Galileo very useful to the EU. But is it indispensable and strategic? The Commission (supported by ESA and other proponents of Galileo) warns that Europe's commercial dependence on GPS is risky. It argues that since the Pentagon is in charge of the GPS, military considerations will always take priority over commercial ones: "The predominantly military character of GPS means that there is always a risk of civilian users being cut off in the event of a crisis".[4]

[4] *European Commission, 'Galileo: The European project on radio navigation by satellite', March 26th 2002. http://europa.eu.int/comm/dgs/energy_transport/galileo/doc/galileo_info_note_2002_03_26_en.pdf.*

GPS may be less than fully reliable for technical reasons. But warnings that Europe should not rely on GPS because it is under Pentagon control are misplaced. GPS has long outgrown its military roots. Just like the internet, the Pentagon has inadvertently handed the private sector a revolutionary new technology, which businesses have been quick to exploit and spread. As long ago as 1996 the US government understood the system's economic potential and declared it to be 'dual-use' – available for both civil and military purposes. It opened GPS to commercial and scientific users worldwide, free of charge.[5] And this remains official US policy today. Although GPS continues to be financed from the US defence budget, a civilian board, whose chain of command goes straight up to the White House, oversees it.

[5] *The White House Office of Science and Technology Policy, National Security Council, 'US Global Positioning System Policy', March 29th 1996.*

More importantly, perhaps, the US economy is even more dependent on GPS than the European one. The US Department of Transportation reported in 2001 that GPS was moving beyond its obvious uses for positioning and navigation and into less apparent uses in "supporting systems, such as timing reference for the national power grids and telecommunications systems". It went on to warn that "the civil transportation infrastructure, seeking the increased efficiency made possibly by GPS, is developing a reliance on GPS that can lead to serious consequences if the service is disrupted".[6]

[6] *US National Transportation Systems Center, 'Vulnerability Assessment of the Transportation Infrastructure Relying on the Global Positioning System', August 29th 2001. http://www.navcen.uscg.gov/archive/2001/Oct/FinalReport-v4.6.pdf.*

Europeans may also take reassurance from looking at previous incidences of war. Some people claim that the US cut off or at least degraded the accuracy of the GPS signal during the 2003 Iraq war. But in interviews with this author the US military denied this: "This station has not degraded the civilian GPS signal anywhere at anytime since 2000", insisted a high-ranking official in the 50th Space Wing at Falcon Air Force Base in Colorado, which operates the 28 GPS satellites currently in the orbit. John Pike, an independent weapons technology expert and founder of GlobalSecurity.org, explained to this author: "There is a lot of downside to turning off GPS and little to be gained by doing so. The Taliban or Saddam's Republic Guards didn't use satellite positioning."



What is more, the Pentagon may jeopardise its own war efforts by turning the GPS off. Military receivers found in tanks and armoured vehicles use their own code, the so-called P-code, for positioning and navigation. The P-code is more accurate than the Coarse Acquisition (C/A) code, which is used for commercial purposes. But military receivers briefly need the C/A-code to locate and 'tune in' the P-code. If the civilian signal were turned off, US tanks would be left in the dark. Moreover, many US soldiers on the ground rely heavily on the kind of commercial devices used for example by sailors. A businessman at Garmin, one of the major manufacturers of commercial receivers, discounted stories of the Pentagon turning off GPS during the first Gulf War. He told this author "We were laughing our heads off – we had just shipped 5,000 units for use by the British Army."

## Using GPS against the US

There is no evidence that enemy forces have ever used GPS-guided equipment against the US military in combat. But this may change. All recent wars pitted the US and its European allies against 'low-tech' enemies. Iraq's crude attempts to jam GPS signals in 2003 were repulsed almost immediately. The unfortunate Iraqi jammers in Baghdad brought doom upon themselves, as the US Air Force locked onto their signal to guide missiles to their base. Potential enemies in the future may gain access to GPS technology. Some Pentagon officials think that China is already developing its own version of satellite positioning technology, using a hybrid of the available GPS enhanced with a domestic ground-based radar system. Hypothetically, in a US-China conflict over Taiwan,

American forces could find themselves the target of precision weapons guided by their very own global positioning system. To deny the enemy the use of GPS, the Pentagon will soon introduce technology that would allow for a complete separation of military and commercial signals. The new generation of military receivers is capable of acquiring the higher quality P-code directly, without the aid of the C/A-code. Sometime after 2005, a new M-signal will give the Pentagon the option of jamming the civilian signal while maintaining the use of its own military signal.

It is this scenario that lies behind the European Commission's warnings against relying on the GPS. What would happen to European commercial users if the Pentagon jammed the civil GPS signal? The answer is: very little, unless these users happen to find themselves in the middle of a battlefield. It is extremely unlikely that Washington would turn off the civil GPS signal worldwide, disrupting commercial operations outside the immediate area of combat. The Pentagon is getting better at disrupting signals in a narrowly defined land area, using ground and aircraft jammers. And there is no reason to assume that it would want to cause more disruption than absolutely necessary.

## The ultimate dual-use system

While the US is working hard to ensure that future enemies will not have access to the GPS, the same does not hold true for Galileo. What if a hostile army used Galileo signals to guide missiles against European forces? Or US ones? The Commission insists that "there is no question here of coming into conflict with the United States". But the prospect of the EU inadvertently aiding US enemies is worrisome. Galileo's carefully crafted image as a predominantly commercial and civil system owes more to the political sensitivity of the EU's emerging European Security and Defence Policy (ESDP) than the system's true capabilities. Galileo is the ultimate dual-use system. It could easily replace GPS across the spectrum of defence products that depend on satellite



navigation. Galileo could eventually allow the Europeans to conduct precision bombing, navigate their forces in a battlefield, and co-ordinate missile strikes – all without the help of GPS. Or the European system could be Europe's 'Plan B' in case the US restricts third-party access to GPS for military purposes.

Barry Posen of the Massachusetts Institute of Technology has listed Galileo alongside Skynet, a British military communications system, and the A400M military transport aircraft as the foundations of truly autonomous European military capability that could be ready for use "in a bit less than a decade".[7] Another American study notes "Galileo's ...accuracy and availability in conjunction with the existing GPS signal will remedy deficiencies in critical requirements, especially in urban operations. This outcome will benefit US, Canadian and other forces as much as it benefits European ones."[8]

[7] *Barry R. Posen, 'ESDP and the structure of world power', The International Spectator, January-March 2004.*

[8] *James Hasik and Michael Rip, 'An evaluation of the military benefits of the Galileo system', GPS World, April 2003. http://www.gpsworld.com/gpsworld/article/articleDetail.jsp?id=53279.*

The importance of satellite positioning to modern warfare is growing. Precision-guided missiles, launched from fighter jets, are the best-known military application of GPS. The British and US armies are now trying to fit tiny, resilient GPS receivers into artillery shells, which would allow them to change course in mid-flight. GPS receivers can also help soldiers walk through mine fields, guide unmanned aerial vehicles, and fix inconsistencies in outdated maps. Soldiers carry their own GPS receivers to avoid capture. Such a device helped an American pilot, Captain Scott O'Grady, to escape Serbian forces after he was shot down over Yugoslavia in 1999. The US Rangers killed in Somalia in 1993, and depicted in the film 'Black Hawk Down' were less fortunate. Many died because the ground convoy sent to rescue them got lost in the urban maze of Mogadishu. GPS might have helped, but at that time receivers were only issued to aircraft and helicopter pilots.

The European Commission insists that Galileo is "a civilian system under civilian control", although it has admitted in the past that "Galileo will also give the EU a military capability".[9] The line between civilian and military uses of satellite navigation is blurred, and Galileo is likely to have a limited military use from the beginning. Europe's paramilitary forces such as the French *gendarmerie* or Italy's *carabinieri* – which operate under the control of their respective ministries of defence and frequently take part in peacekeeping operations – will have access to an encrypted Galileo signal. With or without official approval, European soldiers will buy commercial receivers to use on military operations. Those receivers, especially if they have access to both Galileo and GPS signals, could be a vast improvement over current GPS devices. In other words, Galileo could bring major dividends for military users in Europe.

[9] *European Commission, op cit, March 26th 2002.*

Traditionally, European defence establishments have shown little interest in satellite-guided munitions. In the 1999 NATO war against Yugoslavia, US aircraft carried out over 90 per cent of air strikes precisely because so few European allies had precision bombs. Since 1999, the experience of two more wars, in Afghanistan and Iraq, has underlined the utility of 'smart bombs'. Key EU countries, such as France and Britain, now emphasise the need for more precision strike capability in their defence planning documents. The UK is acquiring thousands of Paveway IV bombs from Raytheon, which fighter pilots can launch from their jets and guide to hit precise targets, even if those targets are behind their plane. But EU defence ministries will depend on GPS to steer these weapons, even for European-made precision missiles such as the Franco-British Storm Shadow/SCALP.

## Regulating Galileo as a military system

Until recently, Commission officials tended to emphasise Galileo's 'strategic' significance for Europe, implying military rivalry with the US. But Galileo's dual existence – civilian in principle, military in potential – carries real risks. In the wrong hands, Galileo could become a weapon not only against US forces but also European ones. The European Commission and the Council of Ministers, which jointly run Galileo, have so far made little progress in addressing this risk. This has not only unnerved Washington, but also EU governments which worry that their forces end up on the receiving end of weapons guided by European technology.



Any satellite-navigation receiver can turn an old-fashioned 'dumb' bomb into a 'smart' one and guide it to its target with great precision. A missile using an encrypted receiver would be doubly dangerous, because it would be impervious to many forms of jamming, the usual defence against satellite-guided munitions. The EU, therefore, has to carefully regulate access to Galileo's high-quality encrypted signal, the so-called Public Regulated Service (PRS). In practice, this means controlling access to information about the signal and – more importantly – to the special receivers required for its use. If the special receivers fell into the wrong hands, future adversaries could use them to manufacture their own receivers, or to develop other forms of technology that would disrupt European and American precision-guided weapons. Moreover, when an adversary is suspected of using Galileo receivers in combat, the signal itself becomes a form of weapon. The EU must be ready, in extreme situations, to turn off Galileo's signal, possibly at very short notice.

A number of non-EU countries, such as China, Brazil and Israel, have expressed interest in getting commercially involved in the Galileo programme. Not all potential partners may be motivated entirely by the financial and intellectual benefits of the European system. The EU must scrutinise those requests with the greatest care. To deal with this and other challenges, the European Commission has suggested setting up an institutional structure to manage Galileo. A 'supervisory authority' – managed by six representatives from the Commission and the Council of Ministers

Secretariat – would in effect run Galileo, control the flow of money to the system, and sign Galileo-related agreements with non-EU countries. As part of its mandate "to ensure the safety and reliability of the system against attacks (malicious or otherwise) and to prevent its use for purposes that run counter to the interests of the European Union and its Member States"[10], the supervisory authority would scrutinise each of Galileo's features (such as its range of signals), as well as deals with outside countries, for their security implications.

*[10] European Commission, 'Proposal for a Council regulation on the establishment of structures for the management of the European satellite radionavigation programme', July 31st 2003.*

In cases of emergency, another institution would enter into the picture: The 'centre for security and safety' would function as a crisis-management headquarters for Galileo. Headed by the Council's High Representative for Foreign Policy, Javier Solana, the centre would take instantaneous decisions on crisis measures, including jamming and cutting the signal. It would also advise Galileo's supervisory authority on all security aspects of the system's operations.

The Commission's institutional proposals seem sensible, but the devil is in the detail. For example, what happens if the centre concludes that a Commission proposal for an agreement with a non-EU country could jeopardise EU security? Would the centre have the power to block the Commission's proposal? Given Galileo's potential military use, the centre should have blocking power over the supervisory authority. The Commission's proposals are not clear on this point.

In addition, the EU agreed in 2003 to move the encrypted PRS signal off the frequency band that will soon be occupied by a new GPS military signal. This means that Washington can jam all satellite navigation signals in battle-zones, including Galileo's PRS, while preserving its own military signal. The EU made a sensible decision to change the Galileo signal so that it would not jeopardise



US operations. The US should now repay the favour. In March 2004 Washington committed itself to "protect the PRS signal", although it has not yet specified how it will do this. The US authorities need to reassure the EU that Galileo's vital PRS signal will not be disrupted unnecessarily. They should spell out under what circumstances they would resort to the extreme measure of disruption, and work out a system that allows for the maximum possible advance warning to PRS users in the affected region.

Although there are many issues still to be resolved, both the EU and the US have improved their public handling of Galileo. The two sides signed an agreement in June 2004 on satellite navigation, which clears the way for the development of joint civilian receivers, while untangling the potentially dangerous knot of encrypted signals interfering with each other. The most important issue still to be resolved is the EU's institutional infrastructure for supervising Galileo – making sure that commercial and political interests in sharing Galileo technology with other countries do not trump very real security concerns. The EU needs to strike this balance carefully, irrespective of US concerns about Galileo's technology falling into the wrong hands. It is very much in Europe's interest that its own satellite navigation technology is not used against its armed forces and those of its allies.

★

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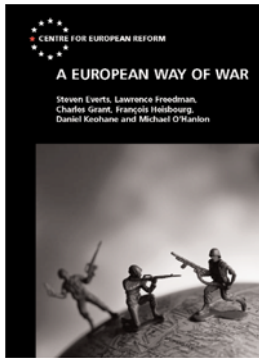
## A EUROPEAN WAY OF WAR

**Steven Everts, Lawrence Freedman, Charles Grant, François Heisbourg, Daniel Keohane and Michael O'Hanlon**




The Europeans should develop their own distinctive approach to warfare, argue the authors of this pamphlet. Although the Europeans can learn from the Americans on how to prepare for the most demanding sorts of military mission, they should build on their core strengths of peacekeeping, nation-building and counter-insurgency. Britain and France, having the most battle-honed armed forces, should take a lead in defining the European way. And the Americans have plenty to learn from the Europeans when it comes to stabilising countries after a conflict.

**Lawrence Freedman** is professor of war studies at King's College, London; **François Heisbourg** is director of the Fondation pour la Recherche Stratégique, Paris; **Michael O'Hanlon** is a senior fellow at the Brookings Institution, Washington; **Steven Everts, Charles Grant** and **Daniel Keohane** all work at the Centre for European Reform.

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**Katinka Barysch**


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**Katinka Barysch** is chief economist at the Centre for European Reform and also runs the CER Russia programme.

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**Carl Bildt, Mike Dillon, Daniel Keohane, Xavier Pasco and Tomas Valasek**

Europe should invest more in space-based technology to promote its economic and security interests. The authors argue that major satellite projects such as Galileo not only boost Europe's high-tech industry and competitiveness. They can also help governments to pursue broader political and social goals such as monitoring the environment, managing military operations and increasing broadband internet access across Europe. European governments should develop international co-operation in space, working with new space powers such as China and India, as well as Russia and the United States. Ultimately, Europe's success on earth will partly depend on its success in space.

**Carl Bildt** is a former prime minister of Sweden; **Mike Dillon** is the chief executive officer of ESYS plc; **Daniel Keohane** is a research fellow at the Centre for European Reform; **Xavier Pasco** is a senior research fellow at the Fondation pour la Recherche Stratégique in Paris; and **Tomas Valasek** is director of the Brussels office of the Center for Defense Information.

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