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EUROPE'S SPACE POLICIES AND THEIR RELEVANCE TO ESDP

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Europe's Space Policies and their relevance to ESDP

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Europe's Space Policies and their relevance to ESDP

Contents

Glossary of Terms

ABM: Anti-Ballistic Missile
ALTBMD: Active Layered Theatre Ballistic Missile Defence
ARTEMIS: Advanced Relay and Technology Mission Satellite
ASAT: Anti-Satellite (weapon)
ASI: Agenzia Spaziale Italiana
BMD: Ballistic Missile Defence
BNSC: British National Space Centre
BOC: Besoins Opérationnels Communs
CDTI: Centro para el Desarrollo Tecnologico Industrial
CFSP: Common Foreign and Security Policy
CNES: Centre National d'Études Spatiales
COI: Community of Interest
CONOPS: Concepts of operation
COPUOS: Committee on the Peaceful Uses of Outer Space
COSMO: Constellation of small Satellites for Mediterranean
CTBT: Comprehensive Test Ban Treaty
DDR: Disarmament, demobilization and reintegration
DGA: Délégation Générale pour l'Armement
DG ENTR: Directorate General Enterprise
DG RTD: Directorate General Research Technology and Development
EADS: European Aeronautic Defence and Space (also EADS-Astrium)
EC: European Commission
ECAP: European Capability Action Plan
EDA: European Defence Agency
EGAS: European Guaranteed Access to Space
EHF: Extremely High Frequency
ELDO: European Launcher Development Organisation
ELINT: Electronic Intelligence
EMC: European Military Committee
EMP: Electromagnetic Pulse
EO: Earth Observation
ERRIDS: European Regional Renegade Information Dissemination System
ESA: European Space Agency
ESDP: European Security and Defence Policy
ESRO: European Space Research Organisation
ESRP: European Security Research Programme
ESS: European Security Strategy
EU: European Union
EUMETSAT: European Organization for the Exploitation of Meteorological Satellites
EUSC: EU Satellite Centre
FGAN: German Research Establishment for Applied Science
GDP: Gross Domestic Product
GEOSS: Global Earth Observation System of Systems
GMES: Global Monitoring for Environment and Security
GNSS: Global Navigation Satellite Systems
GPS: Global Positioning System
HCoC: Hague Code of Conduct
IADC: Inter-Agency Debris Committee

IOV: In-Orbit Validation
ISS: International Space Station
LEO: Low Earth Orbit
MEADS: Medium Extended Air Defence
MIUR: Italy's Ministry of Research
MoD: Ministry of Defence, UK
MOWGLY European Mobile Wideband Global Link System
MTCR: Missile Technology Control Regime
NASA: National Aeronautics and Space Administration (United States)
NATO: North Atlantic Treaty Organization
NEO: Near Earth Objects
NMD: National Missile Defence
NPT: Nuclear Non-Proliferation Treaty
OCCAR: Organization for Joint Armament Co-operation
ORFEO: Optical and Radar Federated Earth Observation
PASR: Preparatory Action Plan for Security Research
PSC: Political and Security Committee
RMA: Revolution in Military Affairs
SAMP/T: Surface-to-Air medium range air defence system
SAR: synthetic-aperture X-band radar
SPASEC: Panel of Experts on Space and Security
SOPT: Satellite Pour l'Observation de la Terre
TIRA: Tracking and Imaging Radar
TMD: Theatre Missile Defence
TSS: Tether Satellite System
UAV: Unmanned Airborne Vehicle
UN: United Nations
WMD: Weapons of Mass Destruction

Europe's Space Policies and their relevance to ESDP

Executive Summary

Outer space is now recognised worldwide as an important commercial and strategic resource and territory, with implications for security and economic development. Not only have we come to depend on satellites in space to provide support for a host of daily activities, including telecommunications, banking, navigation and many computer-based planning and marketing activities; space also has a vital role to play in monitoring topographical changes, climate patterns, agriculture and other environmental developments, thereby underpinning security policies, including disaster prevention and management, emergency planning and rescue. Many of these technologies are dual use: they may be under the auspices or utilised by either civilian or military authorities. Led by US developments, these same technologies are increasingly used not only for force support, but also as military force enhancers and, increasingly, they are being extended to force application, including the targeting and deployment of conventional and nuclear forces.

This short paper has aimed to provide a preliminary overview of a complex and wide-ranging subject, bringing together information and analyses from across the spectrum of Europe's growing civilian and military space programmes. While it is of increasing urgency that the EU should develop a coherent European Space Policy, this paper raises some pertinent questions about ways in which the civil-military interface needs to be managed to enable Europe to benefit from a more effective coordination of technologies and assets for the purposes of enhancing European and international security, while preventing destabilising developments, such as the testing, deployment or use of anti-satellite weapons or weapons in and from space.

Space assets can contribute in many ways to Europe's security and defence, including through meteorological forecasting, terrain mapping, positioning (both of threatened populations, aggressors and EU personnel), navigation, observation, communications and intelligence. Many of the assets for providing these capabilities already exist or are under development, either in national space programmes or through joint projects like Galileo and GMES (the Global Monitoring for Environment and Security).

Though space can provide unparalleled resources for supporting Europe's security in relation to humanitarian and environmental crises and diverse natural, criminal and military threats, it is important to recognise that potential misuses of space assets have the potential to turn outer space into a battlefield, which would threaten Europe's security as well as compromising a range of civilian and security applications on which our daily lives now rely.

The concept of security developed in European Union policy is more nuanced and complex than the 20th century military-oriented defence policies pursued by the United States and some EU Member States. The EU's fundamental principles for security are enshrined in the Common Foreign and Security Policy (CFSP):

- Safeguard the common values, fundamental interests and independence of the Union;
- Strengthen the security of the Union and its Member States in all ways;

- Preserve peace and strengthen international security, in accordance with the principles of the United Nations Charter as well as the principles of the Helsinki Final Act and the objectives of the Paris Charter;
- Promote international cooperation; and
- Develop and consolidate democracy and the rule of law, and respect for human rights and fundamental freedoms.

The European Security and Defence Policy (ESDP) was intended to be the military-security component of CFSP, giving the Union the power to undertake autonomous military action for humanitarian or peacekeeping purposes and 'Petersberg' tasks, and to enable the EU to respond to international crises independently of decisions by NATO or the United States. There is a danger that in the rush to ensure that Europe's space assets are better geared to serve ESDP goals, not enough consideration is being given to the countervailing implications of an overly narrow and militarised concept both of ESDP and of space potential and uses. Europe's space policy needs to balance the requirements of ESDP with the overarching need to support European security objectives and CFSP. Much of the current debate appears to have lost sight of this fundamental obligation.

After several years of pressure from the European Parliament, industry and relevant bodies, including the Commission and the European Space Agency (ESA), efforts to develop a European Space Policy have yet to come to fruition. The draft Constitution for Europe referred explicitly to the need for a European Space Policy to "promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space".

The European Space Council was established in 2004, and has convened three meetings of Ministers from 27 EU and ESA member states. Although the Council has identified the general elements, principles and priorities for a space policy, it has proved difficult to resolve sensitive political issues, notably those arising from the dual use civilian-military applications of space technologies, the relationship between national and European programmes and security objectives, data policy questions relating to national, integrated or shared space assets, and how to interface with US space policy – an especially problematic question for NATO members.

If the Constitution had been adopted there would have been a specific Article covering Space, which would have clarified the shared competence of the Member States and the EU. In its absence, the space sector is likely to remain "user driven", unless other mechanisms can be developed to bring about agreement on the future of space collaboration and strategies.

After being a late developer because of the cold war, European industries and policy-makers are increasing their investments in space technologies and taking the lead in important areas, such as low-cost, flexible launches and small satellites, where European firms are at the cutting edge of innovation. Space-dependent applications and spin-offs now generate millions of Euros and the security dimension of space has become apparent. Much is now at stake, and it is vital that the EU agree soon on a coherent space policy in conformity with CFSP that will facilitate cooperation for security and peaceful purposes, and provide the guidance and strategic underpinnings to develop, resource and manage programmes to meet Europe's current and future security and development challenges.

One reason for Europe's lack of coherence in relation to outer space is the historical division of European space programmes between the 17-member ESA (with a remit limited to "peaceful

purposes" cooperation) and national space agencies, many of which focused more on military applications, though they also pursued or supported civilian programmes and industries.

With the adoption of CFSP and ESDP, efforts have been made to expand the interpretation of ESA's statute to enable the Agency to make more direct use of the military capabilities inherent in many of its programmes. While this would have important advantages for ESDP, there are dangers if 'creeping' reinterpretation is driven on an ad hoc basis. It would be preferable for open debate to be conducted into both the permissible parameters of security-related tasks and ESA's mandate. The intention would be to enable ESA expertise to play a more direct role in security debates and developments, and to enhance Europe's capabilities in supporting security, environmental and humanitarian policies without sliding into using collective resources for force-support, targeting or aggressive military roles.

In accordance with current practice, the EU is supposed to set policy direction and strategies, while ESA is responsible for implementing them, harnessing the skills of its member states and their space-related industries. ESA is currently tasked with developing space technologies and systems, supporting innovation and global competitiveness and preparation for the future, with activities that focus on space exploration, access to space, and space-based scientific research. More needs to be done to enable ESA expertise to be better integrated in decision-making relating to the dual use and security aspects of space activities.

Although the EU has not yet institutionalised a common space policy, two collaborative programmes are already pushing at the boundaries of the civilian-military nexus: Galileo and GMES, intended to provide Europe with its own network of positioning and Earth observation satellites respectively.

Benefiting from numerous expert studies on space and security, as well as the 2003 White Paper on Space, the European Space Council recognises that space assets such as Galileo and GMES, together with better coordination of national observation, meteorological and communication satellites, can play important roles in supporting the ESDP and Headline Goals, but there is as yet no consensus on the parameters and responsibilities for coordination and implementation of a joint European policy or for ensuring that EU doctrine, policy, strategy and practices are in conformity with CFSP and European security objectives as a whole.

In addition to the provision of information and intelligence for early warning, planning and operational purposes, the space capabilities most conducive to supporting ESDP and the European Security Strategies are those related to ensuring reliable access to information through observation and communication, space situation awareness, and satellite data interpretation for early warning, treaty compliance, verification and implementation of agreements.

In accordance with the current division of responsibilities, ESA carries out research and development, but the EU conducts overall policy. Without a coherent space policy, however, ESA's role is hamstrung and the EU is left ill-equipped to determine Europe's best interests in the face of determined efforts by some defence contractors and members of NATO to promote technologies and applications that would fulfil US predictions of space as the fourth medium of warfare.

Though Europe's analysis of the threats associated with terrorism and weapons of mass destruction (WMD) may be similar in many respects to the United States, the CFSP clearly demonstrates that Europe views security priorities differently from its transatlantic partner, and

that the EU favours a more diverse toolbox of solutions and responses to avert, manage or deal with potential threats.

EU policy treats the 'soft power' tools of diplomacy, cooperation, and economic and political action as no less valid and effective than the use of military force, especially for preventing security challenges from turning into actual threats. It is essential that these perspectives are not left out of space policy considerations, as appears to have already begun to happen.

Though some serious consideration has gone into developing a better infrastructure and a more collective, coherent industrial policy for space, taking into account the dual use character of much of the technology and capabilities, several salient issues of policy and principle appear to be missing from the current European debate.

The Space Council confirmed that a European Space Policy needed to contain four main elements:

- European space strategy, that would provide overall direction and objectives;
- European space programme, that would identify the priority activities and projects to achieve the strategy, including budget, costs and funding sources;
- Commitments from the major national and industrial participants and contributors; and
- Basic principles and framework for implementation.

The early meetings of the Space Council identified three priorities for implementation: independence in critical technologies; an industrial policy capable of maintaining and reinforcing European scientific and technological expertise and capacities; and encouragement for larger investment for maintaining Europe's independent space approach and expertise.

In agreeing with these objectives, it is necessary to point out that the scope of a European Space Policy needs to encompass not only the development and application of space assets and technologies for supporting security and defence goals and operations, but also the related issues of security *in* space and security *from* space. These may occur from debris and overcrowding of some of the most desirable orbital levels or from the national military policies of other states. These issues are as much questions of politics and international relations as of technological and industrial development and budget.

In incorporating these elements into the European Space Policy, attention will also need to be given to mediating US and European interests - military and civilian – and to managing potential rivalries. Europe's Space Policy will need to include some consideration of the terms and parameters of cooperation with other space faring nations - whether this is with our dominant ally, the United States, strategic competitors and collaborators like China and Russia, or developing states such as India or Brazil.

Several interconnected issues need to be addressed if the EU is to achieve a coherent and effective European space policy in harmony with EU security and foreign policy objectives:

- **First and foremost, in light of Europe's defined security objectives, the European Space Policy should clearly identify where the line needs to be drawn between 'acceptable' uses of space to support CFSP, ESDP and the European Security Strategy, and 'unacceptable' uses that would cut across Europe's wider security objectives and policies or jeopardise the peaceful and civilian uses of space on which our quality of life and security now rely.**

The same software and satellites may support security-enhancing applications, including disaster management, research into climate change, agricultural planning, rescue, arms control, verification, conflict prevention and confidence-building measures (CBMs), or military applications such as location, tracking and weapons targeting. In sweeping away the false and counterproductive 'firewall' between space activities deemed 'civilian' and 'military', the EU's cooperative and humanitarian approach to security and defence can be used constructively to help the international community to manage the interface to support 'peaceful', 'non-aggressive' uses of space. The aim should be to allow for the range of surveillance, positioning and communication tasks *et al* that can enhance human security while drawing clear boundaries to rule out aggressive deployments or uses that would not only jeopardise the sustainable uses of space, but could threaten the security of peoples on Earth.

- **The nexus between the national defence policies of European countries, which are oriented towards military as well as civilian purposes, ESA, with its 'peaceful purposes' mandate, and the EU's role and competence in security and defence needs to openly addressed, clarified and managed, taking into account the dual use character of much of the technology and capabilities.**

Without underestimating the political – especially transatlantic – sensitivities, Europe cannot afford to dodge these issues any longer. In particular:

  - to avoid confusion and duplication, efforts need to be made to clarify the responsibilities, roles and relationship between national space programmes, ESA and the EU;
  - the defence and commercial sensitivities of national aerospace industries and programmes need to be mediated, as Europe moves towards a more integrated and effective policy for using space for peace and security-enhancing purposes;
  - European policy-makers need to be alert and proactive to ensure that the space programmes of both ESA and EU Member States are fully consistent with European security goals and perspectives and CFSP.
  - Efforts are needed to maintain civilian authority over space programmes and to ensure that the US dominance in NATO and European fears about offending the United States do not conspire to promote or allow developments contrary to European security to be imposed by decision or default.

- **More needs to be done to manage the interfaces with NATO, with inauguration of an open, transparent, and rational analysis of the actual threats, prospects of and alternatives to missile defences, and implications of certain policy routes for European, international and space security.**

This will not be easy, as NATO is presently trying to paper over the transatlantic cracks by avoiding any in depth policy debate about the uses and abuses of space. US allies need to play an independent role and contribute fully to debate about the pros and cons of proposals that will affect terrestrial and space security. At the very least, NATO members should insist that a declassified version or substantive summary of the recent NATO Missile Defence Feasibility Study be published and subjected to open debate by industrial and civil society analysts and NATO parliamentarians.

- **There is a clear need to build a better infrastructure for supporting space activities, including a long-range plan to bring national and EU space manufacturers and users together in a more collective, coherent industrial policy for space.**

There has been a lack of a concerted needs assessment mechanism for aggregation of needs and requirements across the multiple agencies active in the communities related to space and security. As the EU Council has yet to issue a directive on industrial security, the EU is forced to pass classified contracts through individual member states. There is a need for better interaction between the space community and the agencies responsible for managing and implementing space programmes and for more coherent long term planning, not only in relation to Galileo and GMES, but across the board.

- **Reliable and adequate funding needs to be secured from EU budgets and commercial space users to support sustained research, development and programme operations.**

The allocation of some €1.4 billion for space activities in the 7th Framework Programme (2007-2013) represents a significant increase over the €235 million allocated to space activities in FP6. Since €1.2 billion has already been earmarked for GMES, however, that leaves only €200 million for launchers, exploration, technological developments, science projects and international cooperation. European space programmes have generally proved themselves to be more innovative, flexible and cost efficient than US programmes, in part to maximise what is possible on comparatively small budgets. However, if resources are too meagre, then policy either becomes hostage to industry's interests, or innovation ends in the ashes of failure because too many corners had to be cut. The crucial question that the EU and Space Council need to address is whether ESA and Europe's space programmes are adequately funded to meet the objectives and goals of space policy, both civilian and security, the ESDP and CFSP. At the moment planning and funding appear to be too hit-and-miss.

- **European space assets and access to space need to be proactively protected, through both technological and political initiatives, including space situation awareness and the coordination of policies and strategies to enable Europe to play a more significant and effective role in strengthening the international legal regime and developing rules of the road for space activities and uses.**

Harm or disruption to European assets could result in loss of amenity and function on a grand scale, thereby compromising dependent civilian and security activities. Protecting these assets will require both technological and political initiatives. The political initiatives need to include strengthening and implementing the legal regime for space, building a more effective space security regime, and preventing the weaponisation of outer space.

On the technological side, passive protection measures can be implemented, such as hardening and shielding satellites, shielding the telemetry, and providing enhanced space situation awareness, with both on-board technologies or remote monitoring. Reserve or 'redundant' satellites can also lessen the likelihood of losing security capabilities, eyes or ears even if one or a few assets are disabled by debris or aggression.

ESA and other space agencies have for some years pushed for a common European approach to space surveillance for the purposes of 'space situation awareness'. Though concerns not to pre-empt policy decisions and data protection are understandable, it would be possible to undertake the first step to enhance Europe's situation awareness capabilities by linking existing

surveillance assets and pooling data. Funding should be provided for this relatively low-cost first phase to be implemented. Further consideration then needs to be given to how to enable joint deployment and operation of further assets to plug any gaps and ensure effective monitoring where it is most needed, with due regard for making appropriate agreements on data policy and rules or guidelines to meet concerns about data sharing and military mission creep.

The EU should consider requesting observer status at the UN Committee for the Peaceful Uses of Outer Space. The space security regime would be strengthened if the EU threw its weight behind efforts by COPUOS and others to adopt new guidelines on space debris.

- **Europe needs to formulate a policy and strategy to prevent the weaponisation of space.**

Space security is pre-eminently an issue of global security and international relations. The EU should formulate a common position on crucial issues such as space security and preventing the deployment of weapons in space, as it did with regard to WMD or nuclear non-proliferation. With a common policy, the EU would be better placed to take the lead or seek partners within the multilateral framework to reinforce the outer space security regime and prohibit activities or deployments in space that threaten or risk the security of peaceful assets and operations in space or that risk destabilising international non-proliferation regimes and terrestrial security. Priority should be given to working multilaterally to develop rules of the road, guidelines and, where feasible, international legal instruments to increase transparency and confidence, minimise the risk of destabilising actions and activities, and to ensure that no weapons are tested or deployed for use in or from space.

- **Finally, the European Parliament has an important role to play in overseeing and ensuring that the development of the European Space Policy and the individual space policies and industrial strategies and practices are kept fully consistent with the CFSP and Europe's fundamental security objectives and interests.**

This paper, which should be regarded as preliminary since further research is still needed, contains a number of questions, suggestions and recommendations which could be taken up by individual Parliamentarians, within the context of national or EU political institutions, or by the European Parliament exercising its oversight role and drawing attention to space-related and security issues that need to be addressed by the Commission and Council. Questions also need to be raised about the reasons for (and implications of) the failure of the European Space Council to develop and agree the long-awaited European Space Policy, and Parliamentarians ought to engage more actively in identifying the appropriate elements for a security-enhancing policy that would take into account the civil-military-security nexus among space technologies and applications, but not ignore or accelerate aggressive military uses of space.

The issues are undeniably complex, but policy guidelines consistent with CFSP need to be promulgated so that EU Member States, ESA and related organisations can be confident in taking Europe's space programmes forward in the right direction. With each year that passes without a coherent policy, Europe risks losing ground and ceding our security future and space activities to be decided by military and industrial operators. While such actors have much to offer in expertise, advice and technological innovation to drive forward certain strategies and programmes, their goals may differ, and some may be motivated by short term, commercial or other objectives that can prove inconsistent with broader security needs. While the contributions of such stakeholders should be given due consideration, the guidelines of policy, resource allocation and objectives need to remain firmly and accountably in civilian hands.

Europe's Space Policies and their relevance to ESDP

1. Introduction

"Space is increasingly a key element for key EU policies, include transport, agriculture, environment, security and information society, integrated with terrestrial components in monitoring and communications networks and services."
European Commission, May 2005[1]

The commercial, economic and strategic importance of Outer Space has come to the fore worldwide. Interest in space exploration, observation and the commercial exploitation of space assets is growing. The international market for satellite navigation services and related products is currently growing by 25 percent a year and could reach €100 billion by 2010, and applications for space technology projects could be worth €350bn by 2010. Europe has been relatively slow to grasp the opportunities and challenges, and though many of Europe's industries are important innovators, as a whole it needs to develop a more competitive edge[2]. At the same time, space is the contested 'high ground' for some military strategists, particularly in the United States, who promote the argument that whoever controls space will obtain an unassailable military and commercial dominance on Earth (and that on this basis the United States needs to be first to establish space superiority and dominance)[3].

Divided between NATO and the Warsaw Pact, European countries allowed the United States and Soviet Union to dominate the space race during the Cold War. European space endeavours came to be divided between national agencies, which pursued military as well as commercial programmes, and the European Space Agency (ESA), whose remit was specifically limited to "peaceful purposes" cooperation among national space programmes.

In reality, these boundaries have been blurred for a long time, since so much of space technology, industrial development, and applications are of a dual use character. Though efforts have been made to push the edges of what 'peaceful' (subsequently interpreted as 'non-aggressive') purposes can cover, the legacy of the civilian-military divide and its effect on collective and national space objectives and programmes will need to be carefully mediated as Europe moves towards developing a coherent space policy for the 21st century.

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[1] Commission of the European Communities, 'Communication from the Commission to the Council and the European Parliament', Brussels, May 23, 2005, COM(2005) 208, p. 5.
http://europa.eu.int/comm/space/doc_pdf/pep.pdf

[2] Figures are courtesy of the European Commission, Simon Taylor, 'Could ground control lose command?', *European Voice*, vol. 12, no. 14, 13 April 2006.

[3] The drive towards developing weapons for use in or from space is related to missile defence and its proponents use two principal justifications: firstly, that space weapons are essential to protect space assets from a pre-emptive attack, dramatically called a 'Space Pearl Harbor' by the *Commission to Assess United States National Security Space Management and Organization* (known as the 2001 Space Commission); and secondly, that who controls space will obtain an unassailable military and commercial dominance on Earth (and that this space superiority and dominance is the destiny of the United States). In addition to the assumptions of vulnerability, control and space power projection, some argue from historical analogy that space weaponization is inevitable, and that whoever gets there first will enjoy an overwhelming advantage. From the mid-1990s on, all three types of argument could be found in US policy documents. See the 1996 *National Space Policy*; the 1999 *Department of Defense Space Policy*; US Space Command's *Vision for 2020* (1997) and *Long Range Plan* (1998); The US Air Force *Strategic Master Plan for FY02 and Beyond*; the Defense Department's 2001 *Transformation Study Report*; and the 2001 and 2006 *Quadrennial Defense Reviews*.

Dependence on space assets to support European industries and commerce in areas linked with banking, navigation, communications and entertainment steadily increased during the 1980s and 1990s. Unlike for the United States and Russia, whose space ambitions and policy developed out of their military and nuclear rivalry, many European space activities were developed under civilian auspices and, from the early 1960s, focussed on scientific and commercial developments.

In June 2003, key representatives from ESA, European industry and the EU met in Le Bourget to launch a 'European Space Technology Master Plan' (ESTMP). The impetus behind the ESTMP was to coordinate competition, so as to maximise cost-effectiveness, avoid duplication and address strategic lacunae. The plan is intended to consolidate the overall process for space research and development, highlighting some twenty priority areas for European harmonisation[4].

Europe's engagement in space currently occurs on two levels: collective endeavours coordinated through the 17-member European Space Agency (ESA)[5]; and the national programmes of a few key states, notably France, Germany, Italy, Spain and the UK (and to a lesser extent Belgium and the Netherlands)[6]. These states tend to take the lead in determining Europe's attitudes towards space, but there are tensions between those, like France, which seeks a more autonomous industrial and military role for Europe, and Britain, which would like to integrate more closely with US programmes. Some EU Members' interpretation of their commitments to NATO, where US space policy objectives predominate, have contributed to the difficulties over agreeing a progressive, coherent European Space Policy.

A further complicating factor is the asymmetries in investment, industrial and technological development and priority accorded to individual national space programmes. Most national programmes are under a mixture of commercial and government management and funding. Most of the national communications, positioning, observation and monitoring programmes have dual-use functions and many were designed primarily with military objectives in mind. Similarly, though Cold War politics restricted ESA's mandate to peaceful uses – essentially so that it could not step on NATO's toes – collaborative space programmes such as Galileo and the EU's Global Monitoring for Environment and Security (GMES) manifestly have dual-use functions, and the European Space Policy will need now to address these interfaces more openly and effectively.

During the 1990s, the European Union took steps to harmonise its security perspective, first through the Petersberg tasks relating to humanitarian, peacekeeping and emergency responses, and then through the Common Foreign and Security Policy (CFSP). In June 1999, the EU went further by adopting the European Security and Defence Policy (ESDP), which gave it the power to decide autonomous military action or respond to international crises independently of decisions by NATO or the United States.

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[4] Although industry sources report that the ESTMP is meant to be updated and published on an annual basis, the authors were regrettably unable to obtain a recent copy from ESA or national space sources before finalisation of this report.

[5] ESA comprises 17 Members: 15 are EU members – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom – and the other two are Norway and Switzerland. Canada is an associate member with a specific cooperation agreement. Hungary, the Czech Republic and Romania also participate as partners in a newly-established cooperation programme for central European states (the PECS programme).

[6] See Annex for a summary of the work of ESA and its related institutions, the EU's various programmes and the six major national programmes.

Political awareness of the military ramifications of space assets and applications quickened in 1999, when the US demonstrated its space-based precision capabilities in NATO's speedy military victory in Kosovo, and US plans for missile defence to provide "full spectrum dominance" began to be taken more seriously.

For conventional military planners, the main attraction of space technology is that it can enhance the planning and operation of ESDP-type operations. Through the 'real-time' acquisition, processing and diffusion of strategic, operative and tactical information space assets can offer the best means of understanding what is happening on the ground or in a theatre of operations. Such assets can assist in conflict prevention by remotely and relatively discreetly watching potential security threats. They can help the EU identify humanitarian crises at an early stage and focus responses and resources more effectively. The surveillance of borders, roads, control-points and sensitive facilities can also enhance efforts to combat the trafficking in people, sensitive goods (nuclear, biological, chemical or radiological materials, drugs, illicit cargoes) or weapons, contributing to efforts to reduce potential dangers from weapons of mass destruction.

At the same time, these capabilities should not be overestimated or treated as a military panacea. They can support European security objectives, but may also erode security in space and on the ground, unless European policy draws a clear line to ensure that security-enhancing applications are not misused or misdirected for the purposes of aggression or the surveillance of citizens in contravention of their privacy and human rights.

Under the auspices of the Commission, several studies have been conducted in recent years, culminating in three meetings of the Ministerial-level European Space Council. Though it is widely accepted that to support the ESDP and Petersberg tasks and enhance the competitiveness of Europe's space-related industries, the EU needs to needs to have greater independence and coherence in its space policy and programmes, the European Space Council has been struggling to identify the objectives and elements of a European space policy. This paper aims to inform Parliamentarians of the current state of play and identify some of the major elements that will need to be carefully considered in order that a space policy is adopted that truly contributes to European peace, security and foreign policy, and to equip policymakers to avoid the pitfalls that the over-militarisation of US space policy has become trapped in.

2. European Security Policy Developments and Needs

During the Cold War, the United States and Russia dominated and drove military developments for their European allies in both NATO and the Warsaw Pact, respectively. While European cooperation on scientific and civilian research and development in space technologies began in the early 1960s, the development of a more distinct and independent European approach on security and defence matters had to wait until the 1990s. In 1992, largely in response to the post-Cold War changes to Europe's geo-strategic and security environment (including the brutal Balkan wars on its doorstep), the EU adopted agreements for coordinating humanitarian action and rescue, peacekeeping, crisis management and peacemaking.

These 'Petersberg tasks' laid the groundwork for the CFSP, which was incorporated as Articles 11 to 28 of the 1993 'Maastricht' Treaty of the European Union. The Treaty mandated the

European Council to define the principles of, and general guidelines for, the CFSP, in consultation with the Parliament and Commission, and identified the basic objectives as to:

- Safeguard the common values, fundamental interests and independence of the Union;
- Strengthen the security of the Union and its Member States in all ways;
- Preserve peace and strengthen international security, in accordance with the principles of the United Nations Charter as well as the principles of the Helsinki Final Act and the objectives of the Paris Charter;
- Promote international cooperation; and
- Develop and consolidate democracy and the rule of law, and respect for human rights and fundamental freedoms[7].

ESDP, Space and Headline Goals 2008 and 2010

The ESDP developed out of the experiences of post-Cold War integration and enlargement and European failures with regard to the break-up of Yugoslavia, as well as lessons learned from NATO's action in Kosovo. European forces, most notably British and French troops, had demonstrated closer military cooperation than ever before in Bosnia, but that did not make up for the abject failure of EU policy in preventing the tragedy that unfolded there.

As the US demonstrated its high-tech, space-dependent military capabilities in Kosovo, some European defence ministries yearned to emulate the US, while others feared that NATO efforts to achieve 'interoperability' and 'transformation' would consolidate US military doctrine and industrial interests in ways that some European members of NATO found worrying. Some saw confirmation of Europe's military inadequacies, and consequently argued that EU countries needed to spend a far higher proportion of their GDP to bring their military capabilities closer to US standards and thereby also shoulder a greater burden of Europe's defence. Others highlighted differences between European and US approaches to national and international security, collective action and the rule of law[8].

At the same time, it became clear that, just as the Bush Administration has been reassessing the strategic importance of Europe, so European countries needed to re-evaluate their strategic dependence on the United States. Any such re-evaluation will need to take account both of NATO inter-state relations – including differences between the current US administration and certain NATO member states (including Britain, France and Germany), and of NATO's parallel (but not congruent) expansion to include certain Eastern European countries.

The post-Cold War changes in the transatlantic relationship, Europe's painful experiences in the Balkan wars and the post-9/11 perceptions that elevated the role of terrorism and terrorist access to nuclear, biological and chemical weapons all fed into the ESDP. The Bush Administration's decision to invade Iraq and its subsequent occupation of that country caused deep divisions in Europe. It also provided further impetus to efforts to develop more coherent and responsive security and defence policies consistent with Europe's broader security understandings and objectives.

In December 2003 the EU adopted two further significant documents: the European Security Strategy (ESS); and the EU Strategy against the Proliferation of Weapons of Mass Destruction (WMD). In his overview of ESDP, Jean-Yves Haine underlines that while these European

[7] Treaty on the European Union, adopted Maastricht, 1993.
[8] Jean-Yves Haine, 'ESDP: an overview', Institute for Security Studies, http://www.iss-eu.org/esdp/01-jyh.pdf.

strategies may share an analysis of the threats of terrorism and proliferation of weapons of mass destruction (WMD) similar to the US, *"the ways in which Europe addresses them are different. In its view, the fight against these threats cannot be limited to military force alone: while not excluding it, the Union intends to take a broader approach, combining the political and the economic"* [9]. In other words, where the Bush Administration has relied almost exclusively on expanding its military capabilities and options, the EU has sought to make more coherent use of a much more diverse toolbox of economic, diplomatic and political resources as well as the military.

Importantly, the ESS identifies three principles of policy and action:

- Effective multilateralism, with an emphasis on strengthening the international order, institutions and rule of law;
- Promoting a stable international and regional environment for Europe; and
- Cooperation with partners - directly or through multilateral institutions - with the intention of preventing conflict and confronting security challenges *before* they turn into threats.

Though the Strategies do not mention space as such, they continually emphasize the importance of sharing information and resources for European actions to become more capable, coherent and flexible – principles at the core of Europe's attempts to develop a space policy.

The ESDP has been described as the "operational arm" of the CFSP[10], and was intended to give the EU the means, capabilities and capacity for autonomous action "in order to respond to international crises without prejudice to actions by NATO". Since 24 of NATO's 26 members are European (though not all in the Union), this was a polite way of giving Europe the power to act without US approval or support[11].

While emphasising that "the transatlantic relationship is irreplaceable", Javier Solana, who was appointed the EU's High Representative for CFSP in 1999, has underlined that Europe has a more nuanced approach to security and needed to be able to act autonomously from the US and others[12]. In addition to Solana's appointment as High Representative, there are regular meetings of the Political and Security Committee (PSC); a European Military Committee (EMC) was established - comprising chiefs of defence staff or their alternates; and a European Military Staff was created, to provide technical and military expertise for the EU and to act as a conduit between the EU's political and military authorities. Attention was also given to providing more coherent capabilities across four related priority areas: policing; strengthening the rule and enforcement of law; civil administration and civil protection. The Treaty of Nice, which entered into force in February 2003, adapted Article 17 of the Maastricht Treaty to cover further CFSP provisions and enhanced the PSC's role in crisis management operations. It paved the way for the draft Constitution's 'enhanced and structured cooperation' provisions, in

[9] Jean-Yves Haine, op. cit., p.8.

[10] Permanent Representation of France to the European Union, 'Brief Guide to the ESDP', December 2005, p. 8. http://www.rpfrance-ue.org/IMG/0601%20Brief%20guide%20to%20ESDP.pdf. This emphasized the need for the EU to play "its full role on the international stage".

[11] After their respective enlargements, NATO has 26 members and the EU has 25 members. Nineteen states are members both of NATO and the EU. However, non-EU European states in NATO often attach themselves to EU positions.

[12] Javier Solana, 'A secure Europe in a better world', European Council, June 20, 2003, http://ue.eu.int/ueDocs/cms_Data/docs/pressdata/EN/reports/76255.pdf. A modified version of this became the European Security Strategy, adopted December 12, 2003. http://ue.eu.int/uedocs/cmsUpload/78367.pdf

accordance with which EU members may agree to undertake joint actions by qualified majority voting, providing there is unanimity among the nations providing forces to participate in the action.

The 2010 Headline Goal was endorsed by the European Council in June 2004, and the 2008 Civilian Headline Goal approved in December 2004. The 2010 Headline Goal set out Europe's security objectives and affirmed the role Europe seeks to play in the world: "supporting an international order based on effective multilateralism within the UN". The 2010 Headline Goal chimed with the concept of the 'Responsibility to Protect' that was being developed in UN circles at this time[13].

For the purposes of defence, crisis management and humanitarian intervention, the 2010 Headline Goal committed EU Member states to improve their capabilities and communication in order to be able "to respond with rapid and decisive action applying a fully coherent approach to the whole spectrum of crisis management operations covered by the Treaty on the European Union". In addition to the Petersberg tasks, "this might include joint disarmament operations... support for third countries in combating terrorism and security sector reform". Notably, "the EU must be able to act before a crisis occurs"[14]. The Headline Goal set out eight specific "milestones" that mainly dealt with establishing the European Defence Agency (EDA) in 2004-5 to facilitate cooperation on defence procurement, capabilities, research and development. EDA's role has so far been mainly to evaluate, manage and coordinate the implementation of ECAP, and to assist the Member States in enhancing their military capabilities, especially in relation to the rapid deployment of forces. However, some officials have expressed frustration that EDA's role is indistinct and inadequately conceived, and that not as much progress has been made as was originally envisaged.

NATO's concepts and approaches permeate the language of the 2010Headline Goal, which requires EU Member States "…to voluntarily transform their forces by progressively developing a high degree of interoperability, both at technical, procedural and conceptual levels...[to facilitate] a coordinated and coherent development of equipment compatibility, procedures, concepts, command arrangements and defence planning... commonality of security culture should be promoted." The aim was summarised as: "deployability, sustainability... force availability, information superiority, engagement effectiveness and survivability..."[15].

The seventh of the identified Headline Goal "milestones" explicitly referred to space: "to improve the performance of all levels of EU operations by developing appropriate compatibility and network linkage of all communications equipment and assets both terrestrial and space based by 2010[16]." Noting that the ability to plan and conduct operations would require EU information sharing, command and control, the 2010 Headline Goal further stated: that "the work of the Space Based Assets Project Group will contribute to the development of an EU space policy by 2006[17]."

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[13] See *The Responsibility to Protect*, Report of the International Commission on Intervention and State Sovereignty, ICISS, Canada, December 2001.

[14] Council of the European Union, Headline Goal 2010, June 2004, paragraphs 1 and 2. http://ue.eu.int/uedocs/cmsUpload/2010%20Headline%20Goal.pdf

[15] Ibid., paragraph 8.

[16] Ibid., paragraph 5g.

[17] Ibid. paragaph 15. This Group was formed as part of the European Capabilities Action Plan (ECAP), intended to tackle capabilities shortfalls, with specific reference to consideration of how to make space assets more effectively available for the planning and conduct of EU-led crisis-management operations. ECAP's proposals fed into the

The 2008 Civilian Headline Goal emphasised the crisis management tasks implicit in the 2010 Headline Goal, noting that civilian crisis management missions could be deployed autonomously or in joint or close cooperation with military operations. This goal requires the EU and its Member States to improve their capacity to act in a *"...whole spectrum of crisis management tasks such as conflict prevention, peacekeeping and tasks of combat forces in crisis management, including peacemaking and post-conflict stabilisation". Emphasis is placed on disarmament, demobilisation and reintegration (DDR), security sector reform, prevention and training, as well as "appropriate operational planning and mission support*[18]*."*

3. Development of European Space Policy

"To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space... European laws or framework laws shall establish the necessary measures which may take the form of a European space programme."
Draft EU Constitution, Article III-254.

The agreements to proceed with Galileo and GMES accelerated pressure for Europe to develop a more coherent space policy, amidst concerns also about the direction of US strategic policy, including ballistic missile defence and space policy. Following a resolution from the European Parliament in January 2002[19], the Commission held wide consultations on the basis of a Green Paper looking at the direction of European space activities and future policy. In close cooperation with ESA, and taking into account the objectives set out in the EU's developing security strategy and defence policies, the Commission subsequently published its first White Paper on Space in December 2003.

Although Europe still lacks a coherent overall space policy, some of the White Paper's recommendations have begun to be implemented. For instance, in accordance with the Framework Agreement between the EU and ESA, the European Space Council was established, comprising the relevant Ministers from 27 states (all the members of the EU plus the two additional non-EU members of ESA, Norway and Switzerland). In June 2004, the Commission established the Space and Security Panel of Experts (SPASEC), with participation from EU member states and relevant national and European agencies and bodies.

SPASEC concluded that there were a large number of legal and institutional questions relating to security cooperation and space that still need to be addressed, ranging from the conditions for intercepting communications through to special investigative methods in administration[20]. It

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Headline Goal 2010. See Document 6309/6/04 rev 6 dated 12 May 2004, approved by the Council on 17 May 2004 and noted by the European Council on 14 June 2004 as part of the Presidency ESDP report.
[18] Council of the European Union, Civilian Headline Goal 2008, December 7, 2004, doc. 15863/04 http://register.consilium.eu.int/pdf/en/04/st15/st15863.en04.pdf
[19] Europe and Space, European Parliament resolution on the Commission communication to the Council and the European Parliament on Europe and Space: Turning to a new chapter (COM (2000) 597 – C5-0146/2001 – 2001/2072(COS))
[20] *Report of the Panel of Experts on Space and Security*, European Commission, op. cit., p.28.

identified the need for protection of European space assets through an independent space surveillance system.

The purpose of 'space situation awareness' is to acquire and maintain a sufficient knowledge of the environment in space to be able safeguard the functional capabilities of satellites and their dependent applications. By minimising surprises and, where possible, taking action to avoid or mitigate threats to the functioning of Europe's space assets, space situation awareness can contribute to the defusing of conflict arising from accidents or miscalculations in space. In addition, it can identify and thus deter any potential aggressor, distinguishing between a technical and provoked 'failure', raising the possibility of retaliation for any discontinuance of service brought about by aggressive action.

The basic requirements include the ability to monitor European satellites in order to detect any damage or risk due to aggression, natural cause or collision with debris; characterise any threat to these satellites; observe and possibly forecast solar activities and other kinds of space 'weather'; verify the application of international treaties in outer space; and participate in the strategic evaluation of technological and operational capabilities of other countries/organisations. The aim is to provide decision makers with pertinent information about the environment, safety and operations of European satellites so that remedial action or appropriate policy responses can be considered[21].

Due to the political sensitivities of two member states, however, the final version of the SPASEC report failed to include the experts' recommendation for a first step to be taken to link up the existing facilities of Member States, notably the French (GRAVES and ARMOR), German (FGAN-TIRA), Italian (Sicral) and British (TOPSAT and Skynet) radar and surveillance systems. Enabling this integration of data from various national assets is technically feasible and would provide a low cost step, while substantially enhancing European space surveillance and intelligence capabilities. Opposition reportedly centred on the political implications, including the lack of a European data policy and concerns that this could become a slippery slope towards development of joint intelligence and overt military capabilities, including missile defences.

A third element underpins the work of the European Space Council and SPASEC: the proposed Treaty establishing a Constitution for Europe broke new ground in instituting space as a shared competency for the EU and its Member States. Although the Treaty has encountered serious difficulties with regard to ratification by certain member states, some of its constituent parts are moving ahead nonetheless.

2003 White Paper on Space

Entitled 'Space: a new European Frontier for an Expanding Union', the White Paper described itself as "an action plan for implementing the European space policy". More accurately, it was a call for the EU to develop such a policy. Warning that Europe would "decline as a 'space power' because of an inability to develop new technologies and sustain applications with serious consequent damage to its overall competitiveness", the White Paper argued for *"an extended space policy, driven by demand, able to exploit the special benefits space technologies can deliver in support of the Union's policies and objectives: faster economic growth, job creation*

[21] Ibid., para 6.5.6.

and industrial competitiveness, enlargement and cohesion, sustainable development and security and defence[22]*."*

The White Paper made a strong case for the ability of shared, coordinated space programmes to provide important tools to help the EU meet five core policy challenges and goals:

- Building up the knowledge economy to strengthen economic growth, job creation and competitiveness (the Lisbon strategy)
- Promoting sustainable development
- Strengthening industrial performance through enhanced research, development and technological innovation
- Fighting poverty and aiding world development; and
- Fulfilling the security objectives represented by the CFSP and ESDP, particularly with respect to anticipating, monitoring and preventing humanitarian crises.[23]

These sections of the White Paper are particularly important, as they demonstrate how the EU understands a much broader concept of security than the traditional military approaches that still dominate US thinking (and therefore NATO). As noted above in relation to the ESDP, "from a similar analysis of the threats associated with terrorism stems a more diversified strategy, one that better reflects the European identity[24]."

Though Europe's analysis of the threats associated with terrorism and WMD may be similar to that of the United States, it is clear from the ESS that Europe views the priorities rather differently from America, and that the EU is more willing to rely on a much more diverse toolbox of solutions. Although ESDP represents a move towards collective military action in certain circumstances, mainly for humanitarian missions, EU policy treats the 'soft power' tools of diplomacy, cooperation, and economic and political action as no less valid and effective than the use of military force, especially for preventing security challenges from turning into actual threats[25].

The space capabilities most conducive to meeting the goals of the ESS are those related to ensuring reliable access to information through observation and communication, with specialised expertise in satellite data interpretation for treaty verification and early warning. To meet the Headline Goals of rapid response to humanitarian crises and emergencies, the EU will also require a level of operational capability and information to enable early and appropriate decisions to be taken. In addition, the security of space assets, and therefore the reliability of their applications, will require 'passive' protection, such as hardening and shielding and enhanced space situation awareness, which may be provided by on-board technologies or remote monitoring. Reserve or 'redundant' satellites can also lessen the likelihood of losing security capabilities, eyes or ears if one or a few assets are disabled by debris or aggression. The surge of interest in small and micro-satellites, such as those provided by Surrey Satellite Technology Limited, among others, makes the concept of financially feasible 'swarms' or constellations providing flexible monitoring with built-in redundancy and space situation awareness protection. Even a single, low cost microsat 'companion' to a vital high cost asset could help to detect and providing warning of imminent threats.

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[22] European Commission, 'Space: a new European Frontier for an Expanding Union', Luxembourg, Office for Official Publications of the European Community, November 17, 2003. COM (2003) 673, doc 14886/03 available from http://europa.eu.int. Executive Summary, pp.1-3.
[23] Ibid. pp.11-12, and p.19-20.
[24] Jean-Yves Haine, op. cit., p.8.
[25] See Council of the European Union, 'ESDP and Space', November 16, 2004, 11616/3/04 REV3.

Although bilateral and joint arrangements for sharing assets or information exist between some of the major national space authorities, the EU could consider ways to make such resources more directly available to meet EU security strategies, recognising that where resources are under national military control they may be treated as highly sensitive. In addition, new developments and demands in space-related technologies are fast-moving, so the EU needs to develop policies to ensure that planning and investment in future capabilities is timely, coherent and appropriate.

The Commission urged "a change of the governance paradigm so as to give the Union new responsibilities for driving, funding and co-ordinating activities within an extended Space Policy" and recommended:
"(i) putting additional efforts into a variety of space infrastructures and applications, which will make unique contributions to satisfy the needs of the citizens and to respond to the Union's political objectives
(ii) consolidating the existing scientific and technical basis of space activities[26]*."*

The White Paper also called on the EU to give itself the necessary financial resources to implement the European Space Programme in an appropriate manner, with the declared objective of doubling public investment on space in Europe by 2010. At present this is far from being implemented.

European Space Council
The European Space Council was established to coordinate and facilitate space-related activities in accordance with the 2003 Framework Agreement between the EU and ESA. This agreement established two principal aims: development of space policy to ensure that EU industrial and space policies are harnessed so that space-based services and infrastructures meet users' demands and benefit all European citizens; and the facilitation of cooperation and joint initiatives to identify and implement European objectives and priorities in space. The Space Council held its first meeting in November 2004, and subsequent meetings in June 2005 and November 2005.

The Space Council confirmed that a European Space Policy needed to contain four main elements:

- European space strategy, that would provide overall direction and objectives;
- European space programme, that would identify the priority activities and projects to achieve the strategy, including budget, costs and funding sources;
- Commitments from the major national and industrial participants and contributors; and
- Basic principles and framework for implementation[27].

It built on the following priorities:

- The EU would focus on space-based applications to achieve its policies, with particular reference to Galileo and GMES;
- ESA would focus on securing guaranteed and competitive access to space through its own launch capabilities and technologies;

[26] White Paper, Foreword, p.4.
[27] 'Further Steps towards a European space policy: Orientations from the second Space Council', June 7, 2005, from ESA Portal, http://www.esa.int/esaCP/SEMJ0Z0DU8E_index_0.html JUNE 2005

- Individual EU or ESA members would be responsible for putting their own national contributions on the table at a further meeting of the Space Council.

It set "principles of implementation" that included:

- Independence in critical technologies;
- An industrial policy capable of maintaining and reinforcing European scientific and technological expertise and capacities; and
- Encouragement for larger investment for maintaining Europe's independent space approach and expertise.

Aware that space programmes do not come cheap, the Space Council invited *"the Joint Secretariat in close consultation with the High-level space policy group to identify possible cost-efficient scenarios for optimising the organisation of space activities in Europe in the future and to initiate a wide-ranging appraisal of these in comparison to present processes."* [28] The Council concluded that the EU would take the lead in "identifying and bringing together user needs" and pull together collective political and economic will to support Europe's space and security policy objectives, "subject to the requirements of strict budgetary discipline and to objective evaluation". The EU would also *"pursue an optimum regulatory environment to facilitate innovation, access to international markets and the effective coordination with ESA of the European position in international fora"*[29].

Due to political differences among Member States, particularly regarding the Atlantic Alliance and US sensitivities over European space engagement, the Space Council has disappointingly failed to make progress in developing a space policy appropriate to Europe's needs and in conformity with the parameters of CFSP. As noted in the Annex, the later meetings have focussed on GMES and the European contribution to GEOSS, but they have failed to get to grips with the underlying political complexities of what an effective and appropriate European Space Policy would need to address.

4. Financial and Institutional Implications

The European Space Programme is primarily driven by civilian interests. Most public financing for space comes from civil agencies such as France's Centre National d'Études Spatiales (CNES), the British National Space Centre (BNSC), Italy's space agency (ASI) and Germany's Aerospace Research Center and Space Agency (DLR)[30]. National space agencies have a separate budget for scientific research and joint projects with other countries or with the ESA alongside their direct financial contribution to the ESA budget. It would thus be wrong to compare directly the ESA's budget with NASA's budget. The Commission also contributes to European spending on space mainly through its Framework Programme for Research and Development and the Trans-European Network. Altogether it is estimated that the government-funded European civilian space budget is worth €5.5 billion annually[31].

The EU contributes to space-related activities through different financial resources, principally from the Commission, ESA and national space programmes in partnership with the private

[28] Ibid.
[29] Ibid.
[30] For more information on these and other national agencies, see Annex.
[31] D. Whittle and T. Filtness. Meeting Europe's Space-Based Security Needs. September 2005

sector. Most of the EU's financial expenditures on space are invested in research and development (R&D) under the Framework Programmes (FP) for Research and Technology or from the Trans-European transport networks (TEN-T) - Transport budget line.

The European Security Research Programme (ESRP), which seeks to bring together the necessary know-how and investment for the development of critical technologies, is an example of the Commission's attempts to bridge the gap between civil research and national and intergovernmental defence programmes[32]. However, in the absence of a 'horizontal' policy, it is difficult to determine how much is spent on specific space activities.

The Barroso Commission decided to move the Space Dossier from 'Research and Development' (DG RTD) to 'Enterprise and Industry' (DG ENTR). This appears to have been decided partly on the basis that it is preferable to 'decentralise' space research work to its 'active' DG rather than leave it in a centralised research DG. Another factor in the decision may have been the recognition that as space grows in economic and security importance, it also increases in institutional possibilities and thus institutional interest.

The European Space and Policy Institute (ESPI) estimates that the Framework Programme for Research and Technology FP5 (1998-2002) and FP6 (2002-2006) have each allocated an amount of €350 million[33]. However, space-related expenditures differ within each framework programme, depending on its thematic priorities. Within FP6, funding estimations vary from €235 million cited under "aeronautics & space" up to a figure of €475 million quoted in the White Paper (2003). The discrepancy is explained by the fact that the White Paper also includes space-related activities from other thematic priorities including "information and society", "sustainable environment, transport and energy", Joint Research Centre space-related activities, "nanotechnologies and materials" or "research infrastructures".[34]

The Galileo programme, described in more detail in the Annex, is divided into four phases. The Fifth Framework Programme (FP5) provided €76 million to finance the first phase of the project: the definition phase, which ran from 1999 to 2001, during which the architecture of the system was designed and its planned services decided upon. The Commission (TEN-T budget line) and ESA are financing the second - development and validation - phase equally (2001-2008) to the extent of €1.5 billion, with some financing from the private sector[35]. This second phase encompasses design work and development of the satellites and the system's ground components, as well as the launch and testing in orbit of the four initial satellites. FP6 also contributed €110 million to the development of application links to satellite navigation. The deployment phase (2008-2010) involves the building and launching of the satellites and the establishment of the entire ground-based component. The private sector will finance at least two-thirds of this phase (estimated at €2.1 billion), with the remainder coming from the Community budget[36].

Finally, the commercial operating phase is due to begin in 2010-11. This will cover the management of the system as well as its maintenance and updating, at a cost estimated at some

[32] See Anna Burzykowska, op. cit.
[33] Plattard, Serge, 'Propositions to Build Up a European Space Policy', *EuroFuture*, Summer 2005
[34] These thematic priorities finance some space-related activities but it is not always made clear how much and on what.
[35] There appears to be some confusion among experts over costs, with the financing of the development and validation phase also cited at €1.1 billion, with some €200 million coming from the private sector.
[36] For the first time ever a specific budget line of €900 million for 'spatial infrastructure' for Galileo has been created.

€220 million per year, including satellite replacements. Though this financing is envisaged as coming from the private sector, some industry experts are sceptical whether the private sector will be able to cover the full costs. Taking into account the opportunities for marketing satellite navigation services, therefore, as well as the guarantee of provision of these services in the interest of the public sector, representatives from the public and private sectors are currently negotiating the amount of public financing[37].

FP7 (2007-2013) created a single thematic priority for "Security and Space", to which it allocated €2.8 billion[38]. It was decided to divide this sum equally between each component, providing around €1.4 billion for space. This represents a significant increase over the €235 million allocated to space activities in FP6. Moreover, this figure does not include space-related activities funded by other thematic priorities within the FP. Around €1.2 billion, however, has been earmarked for GMES[39]. The remaining funds will be spent on science projects, launchers, exploration, technology and international cooperation. Other investment may be derived on an individual project basis from the Structural Funds, TACIS, FED, MEDA, etc., although there is no pre-determined allocation for space-related activities[40].

The Preparatory Action on Security Research (PASR) was launched in 2004 for a period of three years to lay the basis for a comprehensive European Security Research Programme (ESRP) starting in 2007. The objective is to reconcile civilian research conducted by the EC Framework Programmes and national and intergovernmental defence programmes[41]. The PASR has a total budget of €45 million for the period 2004-2006, out of which only €2.2 million will be used for space. ASTRO+ (Advanced Space Technologies to support Security Operations) is one of seven PASR-funded projects and the only one relating to space security. It aims to demonstrate the benefits that would derive from the use of space resources – telecommunications, earth observation, navigation.

If the Constitution had been adopted there would have been a specific article on Space, which would have clarified the shared competence of the Member States and the EU. In its absence, there is no agreement on the future of space collaboration and European activities in this area will continue to fall within Article 171 of the Treaty, allowing the Commission to call upon space as relevant technology to support its policies. That would mean that the space sector will remain "user driven" and no dedicated budget line can be envisaged for its necessary financial support[42]. It is clear that in the future a clarification of ways and means is needed.

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[37] European Commission. "Proposal for a Regulation of the European Parliament and the Council on the implementation of the deployment and commercial operating phases of the European programme of satellite radio-navigation." Com(2004)477 final. 14 July 2004.

[38] European Commission. "Building the European research area of knowledge for growth" 6 April 2005. The Commission's original proposal totalled €7.27 billion, of which €3.9 billion was allocated to security and space, but these figures were reduced by the Member States to €4.8 billion and €2.8 billion respectively.

[39] In its Communication 'GMES from concept to reality' in November 2005, the Commission envisaged "that GMES will be allocated a substantial majority of the funding available for Space" under the FP7. Overall, the cost of the joint EU Commission and ESA project will run to approximately €2.3 billion. The remaining costs will be covered by the ESA from optional programmes. http://www.eu2006.at/en/News/Press_Releases/April/2004GMES.html

[40] White Paper, op. cit.

[41] http://europa.eu.int/comm/entreprise/security/index_en.htm. See also Commission Communication (COM(2004)72 "Towards a programme to advance European Security through Research and Technology"

[42] Anna Burzykowska, ESDP and the Space Sector – defining the architecture and mechanisms for effective cooperation, Space Policy 22 (2006) 35-41.

5. Current and Future Threats to Space Assets and Uses

"... if the systems such as ... Galileo were hit by terrorists then not only would the defence related traffic have problems but there would be serious implications for our commercial and economic well being [43]."

The importance of space for European security and defence is not just a question of aggregating the funding, technology and assets to support the ESS, ESDP and the headline goals. The objectives and scope of a European Space Policy pre-eminently need to relate to the objectives of the CFSP; they therefore need to address issues of security *in* space and security *from* space. Dependency on space-based eyes, ears, positioning and communication carries associated vulnerabilities. As outer space grows in commercial and military importance, there are real and present vulnerabilities and threats to the security of European assets, policies and user-needs and objectives in space.

The major foreseeable threats comprise two kinds: 'inadvertent' risks to satellites and their applications arising from the space environment; and threats emanating from military activities in space. Environmental threats include space debris, discussed below, overcrowded orbits or space 'weather', like solar activity. Military threats may in turn be deliberate, for example if an adversary sought to eliminate or disable European satellites or their data-links or deny access to space assets or data; or collateral, as a consequence of misguided defence policies and practices undertaken by the United States, Russia, China, European or other governments, such as weapons deployment and use in or from space, attacks with anti-satellite weapons or a nuclear detonation generating a disabling electro-magnetic pulse (EMP).

Space Debris

Space in low earth orbit is teeming with human generated debris, defined by NASA as "any man-made object in orbit about the Earth which no longer serves a useful purpose". There are some 13,000 objects larger than 10 cm and over 100,000 smaller objects. As orbiting debris may be travelling at very high velocities, even tiny fragments can pose a significant risk to satellites or spacecraft.

The dangers and problems associated with space debris have been recognised since the 1980s, when the Inter-Agency Debris Committee (IADC) was set up to facilitate the exchange of information on debris issues at the international level. In October 2002, the IADC approved a set of guidelines, which now form the basis for draft space debris mitigation guidelines proposed by the Scientific and Technical Sub-Committee of the UN Committee on the Peaceful Uses of Outer Space (COPUOS)[44] in February 2005. Providing these guidelines are approved by the Sub-Committee they will be put before the COPUOS plenary meeting for approval in June

[43] *Report of the Panel of Experts on Space and Security*, European Commission, op. cit., p.16.

[44] The Committee on the Peaceful Uses of Outer Space was set up by the General Assembly in 1959 to review the scope of international cooperation in peaceful uses of outer space, to devise programmes in this field to be undertaken under United Nations auspices, to encourage continued research and the dissemination of information on outer space matters, and to study legal problems arising from the exploration of outer space. It has 67 Member States, and two subcommittees – the Scientific and Technical and Lgeal Subcommitees.

2007, following which they are likely to be submitted as part of a UN General Assembly resolution on the peaceful uses of Outer Space in late 2007.[45]

Any destruction or fragmentation of satellites would exacerbate the risks from space debris. Not only would the weaponisation of space make the debris problem much worse, but multiple attacks on space objects - as might arise from testing weapons or in the event of an exchange of firepower - could also potentially "entomb" the earth and jeopardise the possibility of further space exploration and uses. If weapons were used in space, it has been calculated that a relatively small number of hits might create sufficient debris to cause a cascade of further fragmentation (a kind of chain reaction). This, in turn, could potentially damage the Earth's environment and, as the Sun's rays reflect off the dust, cause permanent light pollution, condemning us to a "lingering twilight"[46]. Such scenarios are not inevitable, but preventing them will require collective, cooperative action.

Because of the bar on addressing issues relating to military space, the IADC/COPUOS guidelines on debris mitigation were able only indirectly to address debris that might be caused by anti-satellite attacks[47]. Clearly, there would likely be increased threats to European commercial and intelligence assets in space, arms control verification and other cooperative uses of space if the United States or any other space faring nation were to proceed towards the testing or deployment of weapons in, from and into space. Moreover, as the tensions with the Pentagon over Galileo have already demonstrated, the United States might seek to constrain commercial, scientific and educational collaboration that the Pentagon deemed to be contrary to its national security interests.

While Europe is able to detect and catalogue some space debris using the facilities of the Member States, most of the data is still provided by the United States. The lack of integrated European space surveillance resources for situation awareness is a serious capability gap[48].

Anti-Satellite Warfare

The so-called 'revolution in military affairs' (RMA), including US developments in 'network-centric warfare', have increased the Pentagon's dependency on satellites for communications, command, control, intelligence, tracking and targeting of conventional land, sea and air forces. US military policies, which a growing number of states view as overly aggressive, may have increased the motivations of potential adversaries to develop ways of neutralising or offsetting the overwhelming American military advantage.

The 2001 the Rumsfeld Commission on Space made much of the ensuing vulnerability of US military forces and plans if space assets were subjected to a pre-emptive attack. Focussing mainly on the risks from anti-satellite weapons (ASATs), the Commission argued that the US government should pursue the relevant capabilities "to ensure that the President will have the option to deploy weapons in space to deter threats to and, if necessary, defend against attacks on US interests"[49].

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[45] Brachet, op. cit. The documents referred to by Brachet are: IADC Space Debris Mitigation Guidelines, 15 October 2002, IADC-02-01; and document A/AC.105/C.1/L.284

[46] Primack, op. cit. pp. 24-25.

[47] Guideline 4 states: "the intentional destruction and other harmful activities which would lead to the creation of long-lived debris should be avoided". IADC Space Debris Mitigation Guidelines op. cit.

[48] Report of the Panel of Experts on Space and Security, European Commission, op. cit., p.30.

[49] Report of the Commission to Assess United States National Security Space Management and Organisation, Washington D.C. (Public Law 106-65), January 11, 2001, p. 12. This Commission is usually referred to as the Rumsfeld Commission on Space, after its Chair Donald Rumsfeld, now US Secretary of Defense.

Much has been made of the threat of a 'Space Pearl Harbour' as coined by the Rumsfeld Commission. Undoubtedly, any state with the capabilities to launch long-range ballistic missiles or put satellites in space would also be capable of launching an ASAT attack. However, the investment and infrastructure requirements make it highly improbable that a direct attack on satellite assets could be conducted by anyone other than a developed state or group of states. At present, though a handful of states aspire to these capabilities, only five such contenders exist – the United States, Russia, China, France and the United Kingdom.

Although the Pearl Harbour scenario of a crippling, pre-emptive ASAT attack on US military assets in space cannot be wholly discounted, it should not be exaggerated either. An attack on the ground stations or telemetry linking the satellites with the data processing and interpretation facilities is far more likely, and easier to accomplish. Space assets are thus far more vulnerable to asymmetric warfare techniques than a direct ASAT attack[50]. The relatively few states with both the means and intention to threaten space assets directly with an ASAT attack would also be likely to have space assets of their own in orbit, which such an attack could well put at risk as well.

Missile Defence

The Bush administration has already determined its approach to security in relation to space: it views space as the fourth medium of warfare and intends to deploy weapons for use in and from space[51]. Initially, this would occur as part of its multi-tiered concept of missile defence. Indeed, this policy of space weaponisation is at the heart of the neoconservative project, reflected in Rumsfeld's decision to integrate US Space Command into the core of US Strategic Command. As Paul Wolfowitz, then US Deputy Secretary of Defense, noted in 2002: *"while we have demonstrated that hit-to-kill works, as we look ahead we need to think about areas that would provide higher leverage. Nowhere is that more true than in space. Space offers attractive options not only for missile defense but for a broad range of interrelated civil and military missions. It truly is the ultimate high ground. We are exploring concepts and technologies for space-based intercepts*[52]*."*

Despite considerable scepticism about the need for, risks related to, and technological feasibility associated with, missile defence, since 2001 the United States has managed to place the issue on the agenda for European states (most notably, the 24 of which that are members of NATO). In

[50] This point was chillingly made at a conference in the United Kingdom in early 2001, when an American discussant quipped that the US's real early warning system would be when its stations at Thule and Fylingdales were attacked and destroyed. From author's notes and 'Missile Defence, Deterrence and Arms Control: Contradictory Aims or Compatible Goals', Wilton Park/UNIDIR, 2002.

[51] Equating space with the fourth medium of warfare appeared earlier in United States Space Command, Vision for 2020, February 1997, which declared: "the medium of space is the fourth medium of warfare – along with land, sea and air."

[52] Speech by Paul Wolfowitz, US Deputy Secretary of Defense, to the Frontiers of Freedom organisation, *Transcript – Wolfowitz Outlines Missile Defense Successes, Way Ahead,* US State Department (Washington File), October 25, 2002. Questioned about the space component in relation to airborne lasers, Lt. General Ronald T. Kadish, USAF, Director, Missile Defense Agency, told a Hearing of the Senate Armed Services Committee that "space solves your geography problem… because you can use those weapons more effectively from the high ground of space." March 18, 2003. Under the previous administration, the Commander-in-Chief of US Space Command (CINCSPACE) and of NORAD, General Joseph W. Ashy, declared in 1996:"We're going to fight a war in space. We're going to fight from space and we're going to fight into space…" August 5, 1996. Some of the Bush administration's more ambitious plans and timetables have been derailed, mainly due to the budgetary and military overstretch in Iraq, which caused concern to Members of the US Congress, who have put a brake on some of the funding for space weapons-related research and development.

March 2005, the NATO Council agreed to cooperate on an "Active Layered Theatre Ballistic Missile Defence" (ALTBMD) capability, portrayed in terms of protecting troops on the battlefield from shorter-range ballistic missiles. The target date for deploying this capability is 2012. The decision follows from the Missile Defence Feasibility Study, launched by the Prague Summit of 2002 and subsequent agreements made at the Istanbul Summit in June 2004.

NATO underlines that ALTBMD is intended to be separate from other initiatives to develop defences against longer-range missiles, and that it will integrate different Theatre Missile Defence (TMD) systems, such as PATRIOT, MEADS (NATO's Medium Extended Air Defence) and the Surface-to-Air medium-range air defence system (SAMP/T), into a single, coherent and deployable system capable of giving layered protection against incoming missiles.

Although NATO may have modest intentions, the Bush Administration does not: proponents of ballistic missile defences make clear that they see the multi-layered system as offering a way of mitigating the limitations of the individual systems. At the same time, the multi-tiered, layered concept blurs the distinction between TMD - some systems of which, like Patriot, have been deployed for years - and 'national' missile defence (NMD), which though the name is no longer in use, is still part of US policy, and continues to make Russia, China and many US allies very nervous[53].

The Bush architecture holds out the prospect of "seamless" defence cover, whether of lower-tier threats from cruise missiles, unmanned aerial vehicles (UAVs) and even bombers, or from ballistic missiles (ranging from those of the shortest range (60 km) right up to those of intercontinental range). Theoretically, the concept is an attractive and powerful one – promising total protection (at least for the intended targets)[54].

Such a blanket approach may shorten the odds of actually hitting an incoming missile, but it would also carry a huge financial, environmental and - Europeans fear - security cost. Some European experts doubt that such a multi-layered architecture is actually economically or technically feasible, even if it were fully backed politically. They also fear the possibility that warheads or fallout from intercepted missiles may land upon unprotected European populations. In other words, depending on the trajectory and intercept phase, the promise of protection for some could turn into a deadly rain of nuclear, chemical or biological agents on unfortunately-located towns, cities and crops en route. Similarly, if the US were to target nuclear or suspected WMD sites in the Middle East, parts of Europe could be put at risk from contamination plumes, with consequences that could prove more devastating than the original threat that missile defence is supposed to protect against[55]. Risks such as these fly in the face of NATO's commitment to the indivisibility of alliance defences and the promise to defend allies as well as the US homeland[56].

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[53] In addition, choosing a vague, multi-layered concept also renders BMD less susceptible to detailed rational analysis, and makes it easier for missile defence proponents to avoid discussing the counter-measures dilemmas or other well-aimed criticisms of the technology, testing, military appropriateness, feasibility and cost that bedeviled both the specific NMD concept and Reagan's grandiose Star Wars projection. Hence it serves to de-politicise the debate.

[54] See General Sir Hugh Beach, 'Negotiating New Controls on Missile Defences', *ISIS Policy Paper on Ballistic Missile Defence,* No. 9 (London: October 2002), p. 7. See also Rebecca Johnson, 'Missile Defence and the Weaponisation of Space', *ISIS Policy Paper*, No. 11 (January 2003).

[55] See, for example, Geoffrey Forden, "Laser Defenses: What if they work?", *Bulletin of the Atomic Scientists* (September/October 2002) pp 49-53.

[56] See Prague Summit Declaration Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Prague on 21 November 2002. Paragraph 4 g particularly states that Alliance efforts to

Privately many European Governments appear to be concerned about three broad aspects of the Bush Administration's plans for a multi-layered BMD system extending to weapons in space:

- It is driven by ideology rather than sober threat assessments;
- It fails to address, and in fact diverts attention from, more real and immediate security challenges relating to terrorism and WMD; and
- The unintended consequences of deploying such defences would be likely to create far greater risks than currently posed by the potentially threatening missiles themselves, both physically and politically.

European countries that participated in the 2003 Report of the UN Secretary General on "The issue of missiles in all its aspects" agreed with the concerns that the Group of Governmental Experts raised about the strategic and security consequences of missile defences, especially: *"the implications of missile defences for arms control and disarmament; the effects of missile defences as well as of missile defence cooperation on the further spread and refinement of missiles; the effects of missile defences on the weaponisation of space; and the effects of missile defences in addressing growing vulnerabilities to missile threats and attacks* [57]*."*

On 10 May 2006, NATO's Assistant Secretary General for Defence Investment and the Permanent Chair of the Alliance Conference of National Armaments Directors (CNAD), Marshall Billingslea, signed the final report of the NATO Missile Defence Feasibility Study and delivered it to the North Atlantic Council. As described in NATO's press release *"The Feasibility Study signed today marks nearly four years of detailed technical analysis by NATO's armaments community. It is a detailed assessment of how to defend NATO population centres, forces and territory from all types of ballistic missile threat. The 100,000-page study was developed by an international consortium of industries, led by [the US-based] Science Applications International Corporation (SAIC). In response to a series of threat scenarios, developed by NATO military authorities, detailed defence architectures were designed and modelling conducted to ensure that incoming ballistic missiles could be intercepted successfully*[58]*."*

Though NATO officials acknowledge that the issue has broad and important implications for European security and defence, the study is classified. There is currently no intention to publish a summary or declassified version. Because of US sensitivities, it is privately admitted that within NATO it is virtually impossible to discuss the issue of space security. Other NATO members are being constrained from having a policy debate about the wider implications of missile defence, let alone conduct a debate about European and transatlantic space policy, despite the obvious controversies and potential contradictions between US and European perspectives and objectives.

By insisting on an open, transparent, and rational analysis of the actual threats, and the prospects of and alternatives to missile defences, US allies need to play an independent role to help Washington to target its considerable resources more effectively towards dealing with the real

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study the feasibility of missile defence cooperation for NATO would need to be "consistent with the indivisibility of Allied security".

[57] Report of the UN Secretary General on "The issue of missiles in all its aspects", The United Nations, 2003, (A/57/229).

[58] 'NATO Missile Defence Feasibility study results delivered', NATO press release, May 10 2006, http://www.nato.int/docu/pr/2006/p06-048e.htm. See also, http://www.nato.int/issues/missile_defence/index.html.

and likely security threats, rather than to pursue what a former US Navy Rear Admiral characterised as "illusory defences against non-existent threats"[59].

EMP from nuclear detonation at high altitude or in space

In addition to concerns about inadvertent fallout from semi-destroyed warheads harming civilians on the ground, a further threat that needs to be taken into account is the damage that could be done to space assets and communications by the detonation of a nuclear weapon in space or even at high altitude. Although US policy has ruled out nuclear interceptors for years, some Pentagon advocates of missile defence have renewed pressure for this to be reconsidered. Moreover, Russia deploys – and has recently updated – the 51T6 nuclear-armed ABM system around Moscow[60]. Many Russian and American scientists maintain that if ballistic missile defence is to be pursued in earnest, nuclear interceptors are technically more reliable and efficient at destroying a missile target. In addition to the possibility of EMP being generated by a state carrying out an anti-ballistic missile or ASAT attack, there is the very remote possibility – cited by US analysts – that a terrorist might seek to disable and disrupt developed countries' commercial and military assets by exploding a high altitude nuclear bomb.

A single nuclear detonation at very high altitude is capable of disabling all satellites in low earth orbit (LEO) that had not been previously hardened against the effect of EMP. Nuclear explosions in space are currently banned under the 1963 Partial Test Ban Treaty, a prohibition reinforced by the 1967 Outer Space Treaty and, more recently, by the 1996 Comprehensive Test Ban Treaty (CTBT)[61]. Though Russia continues to deploy nuclear-tipped interceptors around Moscow, the United States abandoned the option because of the harmful consequences i.e. the resultant electro-magnetic pulse (EMP), environmental and collateral damage that arose was likely to cause greater harm to US interests than to any putative adversary. Although the US has hardened and shielded most of its key military satellites to withstand sudden shocks such as EMP, small collisions and solar activity, such passive defences add to the weight and therefore cost of space assets. Assets that have not been hardened and shielded, which include many commercial assets and some European military satellites, would be disabled by EMP.

It must be recognised that although the technology to prevent a high-altitude nuclear detonation does not exist, it would be extremely difficult for the perpetrator to evade detection. Consequently, there would be high political costs involved in crossing the nuclear threshold and in damaging space assets that are beneficial to millions of people around the world. Although, in an age of asymmetric warfare, a high-altitude nuclear detonation cannot be completely ruled out, it is unlikely for many technological and political reasons.

Weaponisation of Space: Creating new threats through bad policy

The development and deployment of missile defences is likely to increase the vulnerability of various components supporting the system, including tracking satellites and their ground stations. Countries that feel threatened by nuclear or conventional forces using space assets to observe, locate and direct armaments towards targets, are already seeking ways to neutralise those targeting components. Viewed from their side as 'defensive' measures to prevent an attack

[59] Rear Admiral Eugene J. Carroll Jr, USN (ret.), *National Missile Defense: What Does It All Mean* (CDI, Washington DC: September 2000), p 1.

[60] Formerly 'Galosh', this updated Russian ABM system has reportedly been code-named 'Gorgon' by the United States.

[61] Opposition from the Bush Administration, India and a handful of others has prevented the CTBT from entering into force. See, for example, Daryl Kimball, 'Keeping Test Ban Hopes Alive: the 2005 CTBT Entry-into-Force Conference', *Disarmament Diplomacy 81* (Winter 2005), pp 41-49.

against them, they may consider undertaking a pre-emptive neutralising attack on ground stations, telemetry or even seek to black out satellite support systems. Such neutralising attacks could be electronic (hacking or jamming, for example) or optical (high powered ground or air-based lasers), and need not necessarily be physical. Nevertheless, they could seriously undermine a space-dependent military force.

While it is extremely unlikely that China or any other potential US adversary would seek to emulate the Soviet Union's Cold War mistakes and try to pursue an arms race with Washington, it is likely to be pursuing alternative means to counter US dominance and perceived or potential US threats. Therefore, as the US pursues missile defences, as well as its current policies of net-centric warfare, space control and dominance, the spectre of a destabilising asymmetric offence-defence spiral cannot be discounted. As the history of weapons innovations has demonstrated many times, there is the risk that missile defence programmes may actually become the provocation that causes adversaries to consider risking all to inflict the 'Space Pearl Harbour' threat that the Rumsfeld Commission used in order to justify space weaponisation[62].

The pursuit of missile defences could also increase nuclear threats by creating a destabilising, offence-defence spiral, not only in production of weaponry, but also in operational situations – particularly in crises. For example, in computer wargame trials conducted by the Pentagon a few years ago, the use of weapons in space (including anti-satellite weapons) led inexorably to the use of nuclear weapons and nuclear war on the ground. Losing one's space-based eyes and ears appeared to cause miscalculations and led to rushed, panicky 'use them or lose them' decisions being made, with devastating consequences.

To protect against asymmetric threats, the US may insist on further military secrecy and draconian policing near facilities that support the US missile defence programme, including Fylingdales and Thule, and, potentially at any NATO sites that might become involved. Moreover, they may close down or limit cooperative research and educational exchange programmes involving space-related technologies or missions, or they may choose to make it more difficult for US-based industries to work closely with space-related industries in other countries.

6. Towards a coherent, security-enhancing European Space Policy

"Space is strategic for Europe, a tool to serve the policies of the Union, European governments and European citizens. Many European and national policies already benefit from operational space systems, integrated with related terrestrial systems...The European Space Policy will seek to ensure continuity of these benefits and that they are shared by all."
Second meeting of the European Space Council, June 7, 2005.

Efforts are being made to address space and security challenges internationally. However, with a few individual exceptions, such as France, the EU has failed to play the kind of significant political and diplomatic role that would be needed in order to strengthen the international legal regime and instruments or to further the space-related security objectives contained in the CFSP. Moreover, though NATO appears bent on avoiding an internal debate on space policy because of transatlantic sensitivities, NATO's policies are being increasingly determined by US

[62] See, for example, Rebecca Johnson, 'Security without weapons in space: challenges and options', UN Institute for Disarmament Research (*Disarmament Forum,* March 2003).

priorities, particularly with regard to missile defence and the commercial and military exploitation of space.

The ESDP was developed to be the military-security component of CFSP, but with regard to space policy, it appears to be in the driving seat. The risk is that under the umbrella of ESDP, Europe may find itself driven towards military space developments that would be incompatible with the broader security interests of Europeans or the perspectives and objectives contained in CFSP. The lack of a coherent, thought-through European Space Policy makes this drift into military cul-de-sacs more likely, not necessarily because of malign intention, but because some key policy-makers may lack expertise or confidence with regard to space technologies. The lack of clear European objectives and space policy leaves decision-makers vulnerable to the influence of industry and military experts whose assumptions and recommendations may be unduly influenced by the dominant commercial and military considerations of the United States, by far the largest investor and user of space assets.

Despite determining some basic elements, principles and priorities the European Space Council has disappointingly failed to work through the political and technical complexities and sensitivities and has not, therefore, made concrete progress towards agreement on a European Space Policy. As noted above, there was agreement on four main elements: a European space strategy that would provide overall direction and objectives; a European space programme, that would identify the priority activities and projects to achieve the strategy, including budget, costs and funding sources; commitments from the major national and industrial participants and contributors; and the need for a framework and for implementation.[63]

There is clear understanding that space assets such as Galileo, GMES, and the range of national observation, meteorological and communication satellites will be central to fulfilling the ESDP and Headline Goals, by providing information and intelligence for early warning, planning and operational purposes. But progress towards achieving a coherent and appropriate space policy is reportedly dogged by turf competition regarding the sharing of resources and benefits, and political disagreements over the civilian-military nexus and how to interface with US space and defence policies.

Most importantly, space policy must not be seen solely in terms of ESDP. The security implications are far wider, and Europe's space policy has to placed firmly under CFSP. As implied in the statements of Javier Solana and others, the concept of security developed in European policy is more nuanced and complex than the outdated military-oriented defence policies of the United States and many EU member states. Space can provide unparalleled opportunities for enhancing Europe's security in relation to humanitarian, environmental, WMD and criminal threats, but some uses of outer space also have the potential to turn the space environment into a military battlefield, which would threaten Europe's security as well as compromising a range of civilian and security applications on which we now rely.

The early meetings of the Space Council identified three priorities for implementation: independence in critical technologies; an industrial policy capable of maintaining and reinforcing European scientific and technological expertise and capacities; and encouragement for larger investment for maintaining Europe's independent space approach and expertise.

[63] 'Further Steps towards a European space policy: Orientations from the second Space Council', June 7, 2005, from ESA Portal, http://www.esa.int/esaCP/SEMJ0Z0DU8E_index_0.html JUNE 2005

In agreeing with these objectives, it is necessary to point out that the scope of a European Space Policy needs to encompass not only the development and application of space assets and technologies for supporting security and defence goals and operations, but also the related issues of security *in* space and security *from* space. These are as much questions of politics and international relations as of technological and industrial development and budget.

Several interconnected issues need to be addressed if the EU is to achieve a coherent and effective European space policy in harmony with EU security and foreign policy objectives:

- First and foremost, in light of Europe's defined security objectives, the European Space Policy should clearly identify where the line needs to be drawn between 'acceptable' uses of space to support CFSP, ESDP and the European Security and WMD Strategies, and 'unacceptable' uses that would cut across Europe's wider security objectives and policies or jeopardise the peaceful and civilian uses of space on which our quality of life and security now rely.
- The nexus between national defence policies, which are oriented towards military as well as civilian purposes; ESA, with its 'peaceful purposes' mandate; and the EU's role and competence in security and defence. These three strands all need to be openly addressed and managed, taking into account the dual-use character of much of the technology and capabilities. Without underestimating the political – especially transatlantic – sensitivities, Europe cannot afford to dodge these issues any longer. In particular:
    - to avoid confusion and duplication, efforts need to be made to clarify the responsibilities, roles and relationship between national space programmes, ESA and the EU;
    - more needs to be done to manage the interfaces with NATO, which will not be easy, as NATO is presently trying to paper over the transatlantic cracks by avoiding any in depth policy debate about the uses and abuses of space; and
    - the defence and commercial sensitivities of national aerospace industries and programmes need to be mediated, as Europe moves towards a more integrated and effective policy for using space for peace and security-enhancing purposes.
- The preceding point draws attention to the need to build a better infrastructure and a long-range plan to bring national and EU space manufacturers and users together in a more collective, coherent industrial policy for space.
- Reliable and adequate funding needs to be secured from EU budgets and commercial space users to support sustained research, development and programme operations.
- European space assets and access to space need to be proactively protected, through both technological and political initiatives. Useful approaches would include
    - passive defences such as hardening and shielding, and enhancing Europe's space situation awareness capabilities; and
    - the development and coordination of policies and strategies to enable Europe to play a more significant and effective role in strengthening the international legal regime and developing rules of the road for space activities and uses.
- Europe needs to formulate a policy and strategy to prevent the weaponisation of space, prioritising international legal instruments and agreements to ensure that no weapons are tested or deployed for use in or from space.
- The European Parliament has an important role to play in overseeing and ensuring that the development of the European Space Policy and the individual policies and industrial strategies and practices are made consistent with the CFSP and Europe's fundamental security objectives and interests.

In incorporating these elements into the European Space Policy, attention will also need to be given to mediating US and European interests – military and civilian – and to managing potential rivalries. Europe's Space Policy will need to include some consideration of the terms and parameters of cooperation with other space faring nations - whether this is with our dominant ally, the United States, strategic competitors and collaborators like China and Russia, or developing states such as India or Brazil.

6.1 Defining 'acceptable' and 'unacceptable' uses of space

The same software and satellites may support security-enhancing applications, including disaster management, research into climate change, agricultural planning, rescue, arms control, verification, conflict prevention and confidence-building measures (CBMs), or military applications such as location, tracking and weapons targeting.

In sweeping away the false and counterproductive 'firewall' between space activities deemed 'civilian' and 'military', the EU's cooperative and humanitarian approach to security and defence can be used constructively to help the international community manage the interface between 'peaceful' and 'aggressive' deployments and uses of space. The aim should be to allow for the range of surveillance, positioning and communication tasks *et al* that can enhance human security while drawing clear boundaries around weapons targeting and aggressive deployments or uses that would not only jeopardise the sustainable uses of space, but could threaten the security of peoples on Earth.

While it is clear that EU Member States already deploy many military capabilities in space, these must legally be in conformity with the Outer Space Treaty, to which all EU members have acceded. The Outer Space Treaty requires that: *"States Party to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding."*[64] The treaty directly prohibited also "objects carrying nuclear weapons or any other kinds of weapons of mass destruction".

In addition to the Outer Space Treaty's requirement that space activities be in conformity with the maintainance of international peace and security and should promote international cooperation and understanding, ESA's charter, which governs cooperation among Europe's civilian programmes, refers explicitly to peaceful purposes. Over the years, taking into account dual-use technologies and capabilities, ESA's mandate has come to be interpreted as non-aggressive rather than non-military purposes.

Unquestionably, the CFSP is consistent with widely accepted interpretations of the peaceful uses of space enshrined in the Outer Space Treaty. With a nuanced understanding of human security and the responsibility to provide humanitarian protection, the majority of roles envisaged for providing space support for the ESDP and European Security Strategy can be fulfilled within this peace-supporting, security-enhancing, non-aggressive rubric.

The language of the 2010 Headline Goal, however, illustrates the grey area that needs to be clarified, for there is a risk of taking EU space policy beyond peace-supporting roles and into force-application roles and weapons deployment. Though the purpose of operations is defined in

[64] Article III, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967 Outer Space Treaty).

terms of mutual defence, crisis management and humanitarian intervention, the 2010 Headline Goal adopts language straight out of US and NATO handbooks, with references to force transformation, interoperability, compatibility of equipment, procedures, concepts, command arrangements and defence planning and "commonality of security culture". To make this consistent with CFSP and the principles in the ESS, it is essential to ensure that the intention really is crisis prevention and enabling the EU "to respond with rapid and decisive action... to the whole spectrum of crisis management operations covered by the Treaty on the European Union... [including] joint disarmament operations... support for third countries in combating terrorism and security sector reform".[65] Even so, unless real vigilance is exercised, the dominant military assumptions of many space industry experts may lead the EU and space policy down a very slippery slope.

The issues are complex. Traditional assumptions of a separation between civil and military assets and uses in space are a fiction, and may be maintained for narrow political reasons, not borne out by either the technology or commercial practices and developments. A rigid adherence to the traditional assumptions of a civil-military divide in relation to space assets does not reflect reality and may actually impede coherent approaches to promote space security. Although ESA practitioners have found ways to skirt the problem, a failure to address and adapt the definitions more openly make it unduly difficult for ESA to participate effectively in policy development and programmes with overt military applications, even for peace supporting missions under ESDP.

In advocating that ESA's mandate needs to be reconsidered in the context of dual-use reality, it is essential not to fall into the opposite trap of assuming an inevitable progression from peace-supporting military or dual-use technologies and activities – surveillance and monitoring, tracking, communication and positioning and navigation – to aggressive uses of space, including weaponisation.

US policy does not make these distinctions, which poses a dilemma for the European members of NATO. Propelled by NATO, which tends to reflect US defence priorities and assumptions, some European states are already beginning to accept and plan for space to be the fourth medium of warfare. Such an approach, reflected in 'MilSpace' Industrial planning, equates security with defence and defence with force, notably weapon capabilities and applications. In the absence of an appropriate European space policy and the avoidance of politically sensitive debate within NATO, space policy is being decided on the hoof and decision-making is already being dominated – and to a significant degree determined – by specialist national, defence and commercial interests.

6.2 Clarifying the responsibilities, roles and relationship between national space programmes, ESA and the EU, and managing the interfaces with NATO and national aerospace industries and programmes

There are large discrepancies between the capabilities and interests of different EU Member States, particularly with regard to space. These need to be mediated by EU policy on behalf of all Europeans.

In working out a European space policy, the Space Council needs to identify the overall goals and direction of a security-enhancing European space policy, which should be consistent with

[65] Council of the European Union, Headline Goal 2010, June 2004, paragraphs 1 and 2. This also stated that "the EU must be able to act before a crisis occurs". http://ue.eu.int/uedocs/cmsUpload/2010%20Headline%20Goal.pdf

CFSP. It would be democratically important for there to be debate and support within and from the European Parliament and Commission. In conjunction with ESA, the Council ought then to coordinate leading representatives from major stakeholders, such as national agencies, civilian and military experts and users, to decide strategy and identify the resources and timelines for implementing the policy. Under Council and Parliamentary oversight, ESA is probably the appropriate agency to coordinate and facilitate implementation of the strategy, working with national agencies, manufacturers, users and other EU and international bodies, though consideration needs also to be given to the role that might be played by the European Defence Agency, which has only recently been established and is yet to demonstrate its potential.

Although NATO has been pulled towards a first layer of BMD collaboration, with agreements in 2005 on developing and deploying the ALTBMD theatre defence system, many NATO officials are as sceptical of the space component of the Bush administration's proposed BMD architecture as their EU counterparts. Like the EU, NATO has done its best to avoid debating the implications of BMD and MilSpace developments. For some, the aim is to avoid division within NATO and a potential rift with the United States. Others are happily (and in some cases at least, knowingly) being led by the United States, with the active collaboration of the major aerospace industries, towards accepting assumptions about the inevitability and 'high ground' desirability of space weaponisation.

NATO's current attempts to paper over the transatlantic cracks by avoiding any in depth policy debate about the uses and abuses of space are mistaken and counterproductive. By insisting on an open, transparent, and rational analysis of the actual threats, and the prospects of and alternatives to missile defences, US allies need to play an independent role and contribute fully to debate about the pros and cons of proposals that will affect terrestrial and space security. It is profoundly worrying that NATO has chosen not to publish in unclassified form the recently-completed Missile Defence Feasibility Study. At the very least, NATO members should insist that the main arguments and findings – preferably, a declassified version or substantive summary – of the recent NATO Missile Defence Feasibility Study be published and subjected to open debate by industrial and civil society analysts and NATO parliamentarians, and that it should not just be kept behind the hot-house doors of military group-think.

Unless European policy-makers get engaged in these NATO and industrial developments more actively, the assumptions and definitions of these actors will become the norm by default, thereby closing off or limiting European consideration of alternative security concepts and space-user interests that are more fundamental than the short-term military-industrial interests of those that currently dominate the field.

Europe would benefit from a collaborative study involving the EU, NATO and ESA, to look at the future of space uses and space security. This would need honestly and openly to address the conflicts and challenges for military, political, commercial and development uses of space. There may, however, be drawbacks to undertaking a joint study with NATO before the EU had itself finalised its space policy, including policy on space security and the weaponisation of space. Concerns were aired when this proposal was raised at a previous meeting of parliamentarians that if such a study were initiated before the EU had agreed a space policy, it might be easy for NATO or others to dominate the debate and push through less nuanced military or industrial assumptions.

It should also be noted that some sectors of the aerospace industry are now talking about building a 'deterrence' capability into commercial satellites. This appears to combine the threat-

detection, tracking capabilities of space situation awareness with a 'minimum capability' to neutralise or hit an adversary's satellite if your own satellite's monitoring system interpreted the closeness or trajectory of another as an attack.[66] Though such individualised, perhaps only localised, on-board weapons are not yet a reality for commercial satellites, they raise some very worrying questions for space security.

European policy-makers need to be alert and proactive to ensure that the space programmes of both ESA and EU Member States are fully consistent with European security goals and perspectives. In the absence of a European space policy, too many decisions are already being taken that could irrevocably determine the direction of European space developments. Efforts are needed to maintain civilian authority over space programmes and to ensure that US dominance over NATO and European fears about offending the United States do not allow developments contrary to European security to be imposed by decision or default.

The first step requires that the EU promotes a more democratic debate about the objectives and strategies for achieving space security and harmonising space technology and uses with European peace and security objectives and policies. The EU members of NATO will then need to initiate a substantive debate with their NATO partners about the role and direction of NATO with regard to European and international security, space use and missile defences[67]. This debate needs to be conducted openly, under democratic oversight and control, with participation from all European space stake-holders, including informed civil society.

While it is desirable that the EU should enter such a debate with NATO with a fuller understanding of how space policy relates to CFSP and ESDP, this may not be possible, in view of the Space Council's inability to articulate an appropriate, coherent space policy to date and the fact that NATO is already proceeding towards developments that relate to these questions of space security and doctrine. In that case, European countries may need to enter the debate individually; if so, they must ensure that their representatives advocate approaches consisent with EU policy, particularly the CFSP, and are not bounced into accepting contradictory positions because of intimidation by technological experts wielding military jargon or US representatives pushing expert analyses designed to bolster US interests.

6.3 Need to build a better infrastructure and a long-range plan to bring national and EU space manufacturers and users together in a more collective, coherent industrial policy for space

EU industrial policy still favours free market principles. Nevertheless, products such as "aircraft, space technologies, electronics, engineering systems and subsystems"[68] have been recognised as being crucial for domestic security and not, therefore, subject to EU regulations[69]. As the EU Council has yet to issue a directive on industrial security – thereby keeping national

[66] See, for example, presentation by Dr Stephen J. Stott, 'The Private Sector and the Security of Outer Space', Palais des Nations, March 30, 2006.

[67] It should be noted that the Prague Summit Declaration Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Prague on 21 November 2002 stated (in paragraph 4 g) that Alliance efforts to study the feasibility of missile defence cooperation for NATO would need to be "consistent with the indivisibility of Allied security".

[68] European Commission, 'Creating coherent market and policy framework for a vital European industry', Star 21 Strategic Aerospace Review at the 21st Century, July 2002, p.14, cited in Anna Burzykowska, op. cit.

[69] Anna Burzykowska, op. cit.

industrial security constraints high for the manufacturing of space equipment – the EU is forced to pass classified contracts through individual member states[70].

The Panel of Experts on Space and Security (SPASEC) noted that: *"... industrial capacity currently exists in European Member States to meet the perceived needs of the European Union for space systems for security missions."* [71] The European space industry has reached a significant level of excellence and knowledge due to the previous investments of some member states into ESA and through their national programmes. This enables it to provide a complete range of capabilities, including launchers, satellites and payloads for all kinds of applications. But there has been a lack of a concerted needs assessment mechanism for aggregation of needs and requirements across the multiple agencies active in the security communities of interest.[72] As SPASEC concluded, *"there is a real need for interaction between the space community and the public sector agencies responsible for management of the operational requirements and those charged with implementation of the resultant programmes."* [73]

The second systemic issue is the poor level of institutional – and in some cases, technological – interoperability, stemming from different organisational structures and concepts of operation for the same service in each member state.[74] This has come about largely because of the practice of using systems developed in the national programmes of member states as a contribution to pan-European efforts. Consequently, there is now an urgent need: *"... to take stock of the security related projects which will be undertaken in the coming years and ensure that an appropriate set of standards, procedures and concepts of operation are built into the programme development stages at the outset."*[75]

A Franco-German-Italian initiative to define Common Operational Requirements for a potential European reconnaissance satellite system – known as the 'BOC', for *Besoins Opérationnels Communs* – is one useful step towards a possible autonomous European capacity in strategic imagery to support ESDP. As such it is an example of an instrument for pooling national space-based assets into a European capability, from which the EU can gain experience in the shared utilisation and exploitation of dual use technologies[76].

6.4 The need for reliable and adequate funding

The allocation of some €1.4 billion for space activities in the 7th Framework Programme (2007-2013) represents a significant increase over the €235 million allocated to space activities in FP6. Since €1.2 billion has already been earmarked for GMES, however, that leaves only €200 million for launchers, exploration, technological developments, science projects and international cooperation.

By contrast, the US space agency, NASA, had a budget in 2005 of about $16 billion (€13 billion)[77]. As the annexes on 'Defence and Space Expenditure in the US and EU' and 'Estimated

[70] Ibid.
[71] Report of the Panel of Experts on Space and Security, European Commission, op. cit., p.12.
[72] Ibid. pp. 29-30.
[73] Ibid. p. 28.
[74] Ibid. p. 30.
[75] Ibid. pp. 26-27.
[76] Anna Burzykowska, op. cit.
[77] More than half of NASA's publicly declared budget was devoted to exploration capabilities (53%), one quarter to space science (25%) and the rest to earth science (9%), biological and physical research (6%), aeronautics (6%) and

annual public funding for space in Europe in 2004' illustrate, however, the figures can be misleading, because European countries' defence expenditure on space assets are covered out of national defence budgets. If compared with US defence budgets, these may appear paltry. Accounting for some 95% of world expenditure on military space, the US Department of Defense had a budget of $22.5 billion (€18.28 billion) for military space applications in 2006[78].

The key point here is not a comparison with the United States, where defence spending is often bloated and inefficient. European space programmes have generally proved themselves to be more innovative, flexible and cost efficient, in part to maximise what is possible on comparatively small budgets. However, if resources are too meagre, then policy either becomes hostage to industry's interests, or innovation ends in failure because too many corners have to be cut. The crucial question that the EU and Space Council need to address is whether ESA and Europe's space programmes are adequately funded to meet the objectives and goals of space policy, both civilian and security. The prior question of course concerns the need for elaboration of a comprehensive European space security doctrine. Despite its controversies, the United States has such a doctrine, which can therefore be considered when Congress oversees the budget. Neither the EU nor any of its member states has a space security doctrine and policy, and the lack is increasingly problematic.

According to a report from the EU-ISS,[79] it may not be desirable to seek to finance European Space activities with a unified community budget. Today those activities (including ESA multilateral initiatives) are financed through individual national budgets based on national demand. As these can vary appreciably from one state to the next, it may be difficult to get agreement on common space budget at EU level. Enhanced cooperation, on the other hand, may meet with success if a 'coalition of the willing' can be established in which participating countries have a clear financial interest. Trying for a complete rationalisation and unification of European space budgets in the short term may be futile and could prove counterproductive. Most analysts would therefore argue that national government logic and choices should continue to be the financial determinant.[80]

6.5 Protecting space assets, access and uses

Harm or disruption to European assets could result in loss of amenity on a grand scale. This could seriously compromise industrial and military operations, communication, surveillance, disaster management, navigation and air traffic control, as well as a host of conveniences such as ATM cash, booking and travelling facilities, entertainment, and so on. Protecting these assets will require both technological and political initiatives. The political initiatives include strengthening and implementing the legal regime for space, building a more effective space security regime, and preventing the weaponisation of outer space. The legal and diplomatic initiatives are addressed in the following sub-sections, but it is worth considering some technological options that could be instituted in the near term.

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education (1%). See, for the purposes of comparison, the annexes on 'Defence and Space Expenditure in the US and EU' and 'Estimated annual public funding for space in Europe in 2004'.

[78] This estimate does not include the 'black' budgets, in which some classified military or intelligence items may be concealed.

[79] Stefano Silvestri (Rapporteur), *Space and Security Policy in Europe*, EU-ISS, Occasional Papers, No.48, December 2003.

[80] Ibid.

Passive protection measures can be implemented, such as hardening and shielding satellites, shielding the telemetry, and providing enhanced space situation awareness, with both on-board technologies and remote monitoring. Reserve or 'redundant' satellites can also lessen the likelihood of losing security capabilities – "eyes or ears" - even if one or a few assets are disabled by debris or aggression. As noted earlier, small, efficient, low cost satellites increase the financial feasibility of instituting redundancy to diminish loss of continuity or function, as 'swarms' or constellations can provide flexible surveillance and communication at lower risk.

For some years ESA and other space agencies have pushed for a common European approach to space surveillance for the purposes of 'space situation awareness'. The aim is to protect space assets by monitoring their physical and spatial environment and condition. By minimising unpleasant surprises and, where possible, gaining advance warning of problems, the goal is to avoid or mitigate threats to the functioning of Europe's space assets.

SPASEC originally proposed a two-step plan of action to enhance Europe's situation awareness capabilities: a first phase, in which existing surveillance assets would be linked and data pooled; and, in the second phase, committing to joint deployment and operation of further assets to plug any gaps and ensure effective monitoring where it is most needed. The first phase could have been implemented rather quickly, at low cost, since the technology already existed. Reportedly, opposition from two EU Members torpedoed SPASEC's proposal, though the report contained an outline of the initiative (without a budget). The plan would certainly require the coordination of links between national surveillance systems developed for primarily military purposes, and development and agreement of an appropriate data policy to govern how information gained from such systems should be collated, disseminated and used, with due protection for sensitive intelligence data. These aspects may have been at the root of the concerns.

Though concerns not to pre-empt policy decisions and data protection are understandable, it is unfortunate that even the first phase has been delayed. This should be revisited, with a view to putting in place as soon as possible at least a first tier coordinated situation awareness capability for European space assets by linking existing resources and pooling data. Efforts should be made to enable this first, relatively low-cost stage of the plan to go ahead as soon as possible, with agreement on data policy and rules or guidelines to meet concerns about data sharing and military mission creep.

6.6 Strengthening the international legal regime to regulate and protect non-aggressive space uses

There are already a number of international treaties and instruments with jurisdiction over space activities, but they do not adequately cover the challenges posed by space debris, overcrowding or space-based weapons and BMD. In particular, though some prohibit or restrict the deployment of weapons or use of force in outer space, the provisions appear to be limited in scope and coverage. None of the existing legal instruments unequivocally cover the use of force or threat of use of force against a country's assets in outer space.

The 1932 International Telecommunication Union (ITU) Convention, as amended in 1992 and 1994**,** protects civilian satellites from interference. The 1963 Partial Test Ban Treaty (PTBT) bans nuclear testing in outer space. The Outer Space Treaty provides a basic framework with the principles of free exploration, use and benefit of space for all. It prohibits the stationing of weapons of mass destruction, including nuclear weapons, in space, but does not cover the transit of nuclear weapons (on ballistic missiles) through space or nuclear weapons launched from

earth into space for the purposes of destroying incoming missiles. It also says nothing about ASAT or the placement of conventional weapons in space.

In the 1960s and 1970s, the US and Soviet Union negotiated further agreements, including the Astronauts Rescue Agreement (1968). Important prohibitions on interfering with national technical means operated for verification purposes were enshrined in the 1972 Anti-Ballistic Missile (ABM) Treaty - now deemed void following US withdrawal in June 2002. The principle of non-interference with national technical means and verification satellites was also enshrined in the 1987 Intermediate-Range Nuclear Forces (INF) Treaty and the 1991 Strategic Arms Reduction Treaty (START I).[81]

One way in which Europe could contribute towards strengthening the space security regime is by throwing the EU's weight behind efforts by COPUOS and others to adopt the IADC's guidelines on space debris. For this it would be useful – as a first step – for the EU to apply for observer status at COPUOS. Although ESA already has observer status, and has been encouraging coordination of European member states' positions at COPUOS, it would be worth the EU sending representation in its own right as well, thereby facilitating coordination of European positions, especially on wider policy questions.

Further issues, including space traffic control and orbital slot management, confidence building measures, rescue, and pre- and post-launch notification, are also ripe for negotiations, perhaps as steps towards developing a more comprehensive code of conduct (rules of the road) for space security.[82] Though opposition from the United States and the impasse in the Conference on Disarmament in Geneva provide little room for optimism that negotiations could be productively undertaken there in the near future, there is a growing need for multilateral talks on space security, perhaps leading to the elaboration of rules, guidelines, elements of a stand-alone agreement or even a framework treaty for space security.[83]

6.7 Preventing the weaponisation of space

The pursuit of missile defences could increase nuclear threats by creating an escalating offence-defence spiral, not only in production of weaponry, but also in operational situations, which could be particularly destabilising and dangerous in times of crisis. The use of space for

[81] The 1972 Convention on International Liability for Damage Caused by Space Objects, and the 1975 Convention on Registration of Objects Launched into Outer Space (the Registration Convention), which entered into force in 1976 were also worthy confidence-building measures, though neither agreement has received much attention. In addition, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the Moon Agreement) was signed in December 1979 and entered into force in 1984. It confirms many of the provisions of the Outer Space Treaty, with specific reference to the Moon. It also prohibits the threat or use of force on the Moon or the use of the Moon to commit hostile acts in relation to the Earth or space assets, although the placing of conventional weapons in orbit around the Moon is not prohibited.

[82] See Rebecca Johnson, 'Security without weapons in space: challenges and options', UN Institute for Disarmament Research, *Disarmament Forum,* Geneva, March 2003; Michael Krepon with Christopher Clary, 'Space Assurance or Space Dominance: the case against Weaponising Space', Henry L Stimson Center, Washington DC 2004; or 'Security or Space Weapons: a Guide to the Issues', Henry L Stimson Center, Washington DC 2005.

[83] For the first consideration of some necessary elements for a space security regime, see Rebecca Johnson, "Multilateral Approaches to Prevent the Weaponisation of Space", *Disarmament Diplomacy 56* (April 2001), as presented at the International Conference on 'Space Without Weapons – Arena of Peaceful Cooperation in the 21st Century', Moscow, April 11-14, 2001. See also 'Working Paper on Prevention of an Arms Race in Outer Space', submitted by the delegations of Russia and China to the Conference on Disarmament, June 2002 (CD/1679); and 'Compilation of Comments and Suggestions to the CD Paros Working Paper CD/1679', February 14, 2006, CD/1769.

targeting conventional forces may already provoke asymmetric threats, particularly through hacking, jamming or attacks to disable ground stations.

A number of adverse security consequences are foreseeable if space were to be weaponised. It could exacerbate the threats from space debris and EMP and provoke other space-faring nations to deploy weapons in space. Even if weaponising space did not lead directly to war, with likely catastrophic consequences for human security, it would create a situation of distrust and could impede international cooperation and educational and information exchanges in areas related to space technology and developments, including commercial enterprises and exploration.

Despite its obvious relevance for European interests, hardly any EU policy or discussion documents make reference to the threat to European assets, objectives and security posed by US plans for extending missile defence to encompass the deployment and use of weapons in and from space.

In the consultation process over the Green Paper, the Commission received a number of analyses warning about the dangers of missile defence leading to the weaponisation of space, as well as considerable information about US plans for extending its military applications in space to include weapons. This makes it all the more remarkable that the White Paper does not once mention either 'missile defence' or the word 'weapon'.

Yet disquiet with US plans did seep into one telling paragraph: *"The long-standing space partnership with the United States is a valuable one. Although the US space policy aims at establishing US space dominance, this partnership could be further deepened in a number of areas including space science, human spaceflight, and sustainable developments. However, the possibilities may well be altered by the ongoing revision of US space policy involving fundamental questions to do with the future of space access systems and human space flight."* [84]

Two aspects of this brief reference to the US are particularly noteworthy. First, the assumptions and apparent resignation implied in the bald statement that "US space policy aims at establishing US space dominance"[85]. Secondly, the omission of US military policy as a factor that might affect European space policy or alter the possibilities for EU-US partnership, despite the clashes that have already occurred over Galileo. The omission of any questioning or discussion of these assumptions, however, appears to be for political reasons: as with the determined lack of debate on space security in NATO, transatlantic politics have dictated that the White Paper should ignore the impact of missile defence and US military policy on European space cooperation and developments.

One problem for Europeans is that the transatlantic relationship is far from equal in terms of perceptions and military capabilities. Already, to appease US anxieties, Europe has had to compromise its space ambitions by settling for a lower capability for Galileo than technologically desirable (and feasible). The United States seldom feels a need to make similar

[84] White Paper, op. cit. p. 21.

[85] It may be argued that the White Paper was merely acknowledging reality, since US objectives for space dominance and control have been articulated in numerous policy papers. See, for example, the 1997 "Vision for 2020" brochure issued by US Space Command, which noted that: "As space systems become lucrative military targets, there will be a critical need to control the space medium to ensure US dominance on future battlefields… to ensure space superiority." It went on to push for US forces to be configured to provide "full spectrum dominance". US Space Command foresaw a role for itself in "dominating the space dimension of military operations to protect US national interests and investment…[and] integrating space forces into war-fighting capabilities across the full spectrum of conflict."

concessions to European anxieties or interests. As noted by the Washington-based Center for Strategic and International Studies (CSIS): *"While today top US officials do not see transatlantic relations as being primarily about Europe, which is no longer at the heart of US global strategy, Europeans still believe that the Atlantic relationship is mainly about the United States."* [86]

With regard to an issue like the weaponisation of space, therefore, Europe will continually find itself outmanoeuvred or pre-empted if the debate is left solely to its defence officials or to a context in which NATO drives the debate. Space security is pre-eminently an issue of global security and international relations. The EU should formulate a common position, as it did with regard to WMD or Nuclear Non-Proliferation and either take the lead or seek partners within the multilateral framework to reinforce the outer space security regime and prohibit the weaponisation of space[87].

Instead of turning to the sledgehammer of space weaponisation to deal with the potential vulnerabilities of space assets, a more sensible approach would combine arms control efforts with the technical hardening and shielding of as many satellites as possible, plus space situation awareness, redundancy and other 'passive' defence means. Progress in nuclear disarmament, strengthening the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), negotiating a nuclear weapons convention, further efforts to restrict missile proliferation, building on the Missile Technology Control Regime (MTCR) and the Hague Code of Conduct Against Ballistic Missile Proliferation (HCoC) would also contribute to security and reduce the chances of space becoming a battleground.

Several opportunities are now coming to the fore to promote the strengthening and universalisation of the existing space security regime. For example, since 2007 will be the 40th anniversary of the Outer Space Treaty, its states parties could consider holding a review conference to review how the Treaty has operated these forty years and perhaps consider ways to strengthen implementation and progress towards universality. Such a conference could consider the challenges to space security and, without going down the path of formal amendments, could discuss the current and future space security environment. The term 'weapons of mass destruction' has never been defined, although it is taken to encompass nuclear, chemical and biological weapons, even though there has never been any suggestion of biological or chemical weapons being used or usable in space. Perhaps a broader, more space-relevant interpretation could be considered: that in view of the particular circumstances of outer space, any weapon used in or from outer space would result in unpredictable and potentially mass destructive effects. This might be one approach to bringing the OST up to date without opening it for amendment, which would not be wise.

7. Conclusion – a Role for Europe's Parliamentarians

[86] Reginald Dale and Robin Niblett, '2006 will provide clues to Europe's future', Center for Strategic and International Studies (CSIS), Washington DC, April 5, 2006.

[87] All EU countries have consistently voted in favour of the annual UN Resolution entitled Prevention of an Arms Race in Outer Space (PAROS), which traditionally used to receive consensus. Changes in US policy destroyed the consensus, but the resolution is still overwhelmingly adopted. In December 2005, for example, the PAROS resolution (UNGA 60/54) received 180 votes in favour. Only the United States and Israel voted against, and there were no abstentions. A second space-security resolution calling for 'Transparency and confidence-building measures in outer space' (UNGA 60/66) received 158 votes in December 2005; only the United States voted against, and Israel abstained.

"The European Parliament... takes the view that the European Union should have a policy and a strategy addressing the effective use of space-based systems for monitoring of the environment and for security, in order to protect citizens lives and natural resources... that space policy must not be wholly dominated by the market and that account must be taken of long-term assessments of the benefits and risks of exploiting space, not only from the point of view of the interests of industry, but also in terms of the welfare of mankind..."
European Parliament resolution, May, 2000[88]

A brief consideration of European Parliament resolutions and documents since 2000 shows intermittent interest in space issues and policy development, but little consistency. Between the May 2000 resolution quoted above, and a resolution adopted on January 29, 2004 with regard to the 2003 White Paper on Space, there is, however, a significant change of tone. Omitting the earlier references to humanity, security and citizens lives, the second resolution *"considers, in view of the strategic significance of the conquest of space, its many technological and domestic repercussions and the emergence of new space powers, that the European Union must make a supreme financial effort, including in particular the development of space applications relating to global security."*[89]

This shift in emphasis indicates the influence of a greater number of military-industrial interest groups as space has become a vital – and therefore more competitive – commercial and military arena. Undeniably the views of such stake-holders should be taken seriously, but they should not necessarily dominate the debate, as more far-reaching questions of European security and civilian operations and access to space need to be taken into account. In this regard, the European Parliament has an important role to play in overseeing decisions, promoting transparency and accountability, and ensuring that the European Space Policy and the individual policies and industrial strategies and practices of the relevant companies, agencies and organisations are consistent with the CFSP and Europe's fundamental security objectives and interests.

This paper, which has sought to provide a preliminary overview, contains a number of questions, suggestions and recommendations which could be taken up by individual Parliamentarians, within the context of national or EU political institutions, or by the European Parliament exercising its oversight role and drawing attention to space-related and security issues that need to be addressed by the Commission and Council. In particular, the Parliament should raise serious questions about the implications of the failure of the European Space Council to develop and agree the long-awaited European Space Policy.

The issues are undeniably complex, but policy guidelines consistent with CFSP need to be promulgated so that Member States, ESA and other relevant organisations can be confident in taking Europe's space programmes forward in the right direction. With each year that passes without a coherent policy, Europe risks losing ground and ceding our security future and space activities to be decided by military and industrial planners. While such actors have much to offer in expertise, advice and technological innovation to drive forward certain strategies and programmes, their goals may differ, and some may be motivated by short term, commercial or

[88] European Parliament resolution, on the communication of the Commission on the Commission working document 'Towards a coherent European approach for space' May 18, 2000 (SEC(1999) 789 - C5-0336/1999 - 1999/2213(COS)). This resolution followed from a report by the same name, issued by the Committee on Industry, External Trade, Research and Energy (Rapporteur, Konstantinos Alyssandrakis), April 19, 2000, A-5-0119/2000.
[89] European Parliament resolution, on the 'action plan for implementing the European space policy', February 3, 2004, P5_TA-PROV(2004)0054.

other objectives that can prove inconsistent with broader or longer-term security needs. While the contributions of such stakeholders must be respected and given due consideration, the essential guidelines of policy, resource allocation and objectives need to remain firmly and accountably in civilian hands.

Annexes

European Space Institutions, Assets and National Space Programmes

European Space Agency

ESA was established during 1973-75, integrating the European Space Research Organisation (ESRO) and the European Launcher Development Organisation (ELDO). The founding Convention hence stipulated: *"... the purpose of the Agency shall be to provide for and to promote, for exclusively peaceful purposes, cooperation among European states in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space application systems."*

There is specific reference to a long-term European Space Policy, coordinating and integrating national space programmes into a "European space programme" and developing a "coherent industrial policy" and joint activities and programmes[90]. However, little progress towards this was made.

ESA's stated objectives are to promote: a new European frontier for an expanding space; independent access to space; a strong and competitive space industry; new applications meeting real needs; a strong space science programme; and strong international partnerships. With its headquarters in Paris, ESA has a staff of around 1,900 and runs additional facilities in Noordwijk, the Netherlands (space research and technology); Darmstadt and Cologne, Germany (satellite operations and astronaut training, respectively); and Frascati, Rome (earth observation and data collection)[91]. Together with the EU, ESA also shares responsibility for EUMETSAT, Galileo and GMES, which are described in more detail below.

1.

ESA's budget of about €3 billion per year comes from national contributions. ESA Member States contribute to ESA's mandatory activities (about 20 per cent of the ESA yearly budget) calculated on the basis of their gross national product (GNP). In addition, each state decides whether to participate in 'optional' programmes and at what level. In 2005, the three largest contributors - France (29.3 per cent), Germany (22.7 per cent) and Italy (22.7 per cent) - provided three-quarters of ESA's funding. In return, countries receive contracts for their industry in roughly the same percentage as they contribute.

The largest part of ESA funds is invested in launch vehicles (€663.5m – 22.28 per cent), followed by human space flight (€514.9 m – 17.3 per cent), earth observation (€356.8 m – 11.9 per cent), space science (€349.3m – 11.73 per cent) and navigation (€314.4 m – 10.56 per cent). Smaller expenses include the general budget (€189.8 m – 6.38 per cent), telecommunications (€163.2 m – 5.48 per cent), associated to general budget (€135.1 m – 4.54 per cent), technology (€92.18 m – 3.10 per cent) micro gravity (3 per cent) and others (7 per cent)[92].

Translated into activity, over the years ESA's budget has funded the development of five launchers and 60 different satellites, and 162 launches have been carried out, most successfully.

[90] Article II, Convention for the establishment of a European Space Agency & ESA Council, CSE/CS(73)19 rev.7, approved by the Conference of Plenipotentiaries, Paris, May 30, 1975 (entered into force October 30, 1980).
[91] For up to date information on ESA, view its web portal at: http://www.esa.int/esaCP/index.html
[92] ESA website: http://www.esa.int/esaCP/index.html

On 5 and 6 December 2005, Ministers in charge of space activities of the 17 ESA Member States plus Canada[93] met to decide on future programmes and spending. They agreed that the budget would stay at about the 2005 level until 2010. The ESA budget for 2005 is estimated at €2.997 and €2.904 billion for 2006. In a meeting on 2 May 2006, ESA members expressed some concerns about the feasibility of the European Space Policy within that budget, and raised the prospect of reopening the budget debate in 2008-2009 during the mid-term review.

Galileo

Galileo was planned to provide a European and civilian-run alternative to the military satellite and navigation systems developed and controlled by the United States and Russia respectively. Jointly funded and managed by ESA and the European Commission through the Brussels-based Galileo Joint Undertaking, the system is planned around a constellation of 30 satellites. Galileo will provide five services: the Open Service (OS), similar to the standard civilian GPS signal; the Commercial Service (CS); which will provide additional information such as increased positioning accuracy; the Safety of Life Service (SOL) which will contain an integrity signal, essential for all applications where knowledge of (and confidence in) the integrity of the navigation system is essential; the Public Regulated Service (PRS), encrypted and dedicated to government-controlled applications; and finally, the Search and Rescue Service (SAR), able to relay distress signals transmitted at 406 Mhz by air, sea or land bound distress beacons. Intended to provide users with greater precision, improved coverage (95 per cent of the world's towns and cities - compared with Global Positioning System's (GPS's) current coverage of around 50 per cent), Galileo also receives funding from international partners. These partners will expect to benefit from a range of services - both open and encrypted - for commercial, policing, air traffic control, shipping, and search and rescue purposes[94].

After five years of bitter arguments, the US finally lifted its objections to Galileo: objections that centred on concerns that not only would Galileo provide commercially attractive rival capabilities but that it might also provide information that, unlike GPS, would not be under the control of the US military. The dispute was resolved (at least for the present) in June 2004 with an agreement to harmonise Galileo and GPS with lower signal robustness than originally planned for Galileo[95]. One possible option, favoured by many in the industrial sector, will be to

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[93] ESA's 17 Member States are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. As noted in footnote 5, Canada is an associate member with a specific cooperation agreement, while Hungary, the Czech Republic and Romania participate under the the PECS programme.

[94] The PRS signals are designed to withstand localised jamming and will be used by civil protection, rescue forces, border patrols, drug enforcement, police and military services in European Union countries. See Will Knight, 'China to help Europe develop GPS rival', *New Scientist*, September 19, 2003, http://www.newscientist.com/article.ns?id=dn4185. Current partners include China, India, Israel, Morocco, Saudi Arabia and Ukraine, with potential partnerships under discussion with Argentina, Australia, Brazil, Canada, Chile, Malaysia, Mexico, Norway and South Korea. See See Theresa Hitchens and Tomas Valasek, 'European Military Space Capabilities: a Primer', World Security Institute's Center for Defence Information, March 2006, pp 9-17.

[95] The compromise sealed with the United States required Europe to settle for less than its desired technological capability, using Binary Offset Carrier (BOC) 1.1, 1.1, rather than BOC 1.5, 1.5. This compromise, which many viewed as detrimental to European interests, potentially enables the US to deny Galileo signals in times of crisis. The second test-bed satellite will fly by late 2006 to validate critical technologies. The contract for the first four pre-operational Galileo satellites was eventually signed between ESA and the manufacturers. The In-Orbit Validation (IOV) satellites are tentatively planned for launch in 2008 and will provide the first full-scale demonstration of the system's architecture. See http://www.newscientist.com/article.ns?id=dn4641. See also Will Knight, 'NATO claims Galileo could jeopardize operations', New Scientist, June 21, 2002 at: http://www.newscientist.com/article.ns?id=dn2447; and Celeste Biever, 'US and Europe to combine satellite navigation', New Scientist, June 24, 2004 http://www.newscientist.com/article.ns?id=dn6068

develop dual GPS III/Galileo terminals able to fully leverage the combined availability, accuracy and enhanced integrity of the positioning services.

Although Galileo is now well on its way towards completion, there are still numerous hurdles to overcome. In addition to the concerns raised by the United States and its NATO representatives, Galileo has been delayed by disputes among some of the main participant governments (France, Germany, Italy, Spain and the UK) over the system's industrial and political benefits, including the location of ground facilities and sharing of activities and data. In addition, the UK remains concerned that it could endanger the 'special relationship' with the United States[96].

Though Galileo is presented as a civilian system, and is currently planned to remain under civilian authority, it has important security implications and will also have major civilian and military applications[97]. Together with GMES, Galileo hence pushes at the boundaries of the civilian-military nexus and represent the direction in which the major European space players wish to move. To enable these programmes to play an effective role in European security (and to avoid muddle in the future), it is necessary to examine the assumptions built into the programme specifications and to integrate their coordination more directly with EU objectives. Galileo as a technical tool may be politically neutral, but it is vital that EU policymakers think very carefully about political control and responsibility: in particular, where to draw the lines between acceptable security applications i.e. those consistent with fulfilling ESDP missions, and unacceptable security applications, such as might support overtly aggressive military doctrines, for example.

GMES

Originally conceived for monitoring environmental changes, the concept of GMES was explicitly expanded to include security and thereby contribute to the ESDP under the auspices of the CFSP[98]. An EU-led initiative, GMES is intended to bring together all the relevant European Earth observation activities, making the use of European assets more effective by forming a "system of systems", which would enable a better flow of information[99]. In addition to its original purpose of monitoring climate change and providing early warning of environmental dangers, therefore, GMES has been rethought as a tool to be used to monitor borders and population centres and movements, support conflict prevention and crisis management, and help verify international arms control and environmental treaties[100].

The space component of GMES relies on five concepts of space missions or 'Sentinels', with access to complementary missions by ESA Member States, EUMETSAT, Canada and other third parties. Implementation will involve the rapid deployment of a first satellite (GMES-1),

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[96] See Stefan Barensky, 'The challenges facing the Galileo project', European Voice, *European Voice*, vol. 12, no. 14, 13 April 2006. He noted that the stumbling block was "a requirement for guarantees from public finances as the return from investments may take several years to materialise" and also commented that "the global navigation satellite system supervisory authority, which will own Galileo, will have to define the actual role of third parties who decided to join and contribute to the project. China, for instance, gave €65m for the development and validation phase and another €130m for the deployment phase. But its role in the operational phase remains unclear, as is also the case with India, Israel and Ukraine."

[97] Ibid.

[98] Gerard Brachet, 'From initial ideas to a European Plan: GMES as an exemplar of European Space Strategy', *Space Policy*, No.20 (2004). The author is grateful to Mr Brachet for his helpful comments on sections of an earlier draft.

[99] Mr Gubert (Rapporteur), 'The Space Dimension of ESDP', WEU Report submitted on behalf of the Defence Committee, November 2004, para. 55.

[100] European Space Agency and European Union, 'Global Monitoring for Environment and Security, Final Report for the GMES Initial Period 2001-2003, February 18, 2004.

combining a C-band interferometric radar mission (Sentinel 1) with Sentinel-3, an ocean-land mission comprising altmimeter, multispectral imager and sea surface temperature sensor. Sentinel-2 will be a multispectral optical imagining mission providing continuity for the Landsat data. Sentinel-4 and Sentinel-5 will be placed in geostationary and low-Earth orbits respectively, mainly for atmospheric chemistry monitoring missions[101].

It will also feed into the US-initiated 'Global Earth Observation System of Systems' (GEOSS) and contribute to data sharing for land monitoring, climate research, marine research and disaster (emergency) planning[102]. Managed through the GMES Advisory Council and the GMES Programme Office, the system is in the early stages of development, and will use existing national and multinational satellites, as well as adding new satellites jointly funded by ESA and the European Union[103]. GMES will require enhanced data collection and management systems on the ground, and again points to the need for Europe to develop an appropriate data policy to cover the acquisition, transmission, sharing and dissemination of data, to European partners and potential clients outside Europe.

The third meeting of the European Space Council noted that operational deployment of three 'fast-track services' for emergency response, land monitoring and marine services was due by 2008, with other services scheduled to follow in 2009-13. To avoid duplication and enhance cost-effectiveness, GMES will start by incorporating planned national and EU satellite and in situ systems. Though it set up a group of experts to assess the structural needs and longer term issues of implementation and governance of GMES, the Council was unable itself to go much further[104].

EUMETSAT

The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) was founded in 1986 as an intergovernmental organisation to provide "forecasting and mitigation of severe weather to protect human life and property[105]." Now with 18 Member states, EUMETSAT is located in Darmstadt, Germany. Its Constitution lists its primary objective as "to establish, maintain and exploit European systems of operational meteorological satellites", with a further objective of contributing to monitoring the climate the "the detection of global climatic changes". The preamble makes clear that the purpose is to enhance the safety and security of populations and human activities[106]. EUMETSAT is intended to contribute to GEOSS and GMES, when the latter is operational.

The European Union Satellite Centre (EUSC)

On 1 January 2002 - taking over from the WEU - the EU established a dedicated satellite data centre at Torréjon, Spain "to support the decision-making of the Union in the context of the CFSP, in particular of the ESDP, by providing material resulting from the analysis of satellite

[101] 'Global Monitoring for Environment and Security is main issue for Third Space Council, press release, 28 November 2005, http://ec.europa.eu/comm/space/news/article_2291_en.html

[102] Commission of the European Communities, 'Communication from the Commission to the Council and the European Parliament', Brussels, May 23, 2005, COM(2005) 208, http://europa.eu.int/comm/space/doc_pdf/pep.pdf. The GEOSS secretariat is in Geneva.

[103] Hitchens and Valasek, op. cit., p 13-17.

[104] See http://ec.europa.eu/comm/space/news/article_2291_en.html; http://www.esa.int/esaCP/SEMBARULWFE_Benefits_0.html; http://www.spaceref.ca/news/viewpr.html?pid=18405

[105] http://www.eumetsat.int/idcplg?IdcService=SS_GET_PAGE&nodeId=31&l=en

[106] EUMETSAT Convention, http://www.eumetsat.int/groups/cps/documents/document/pdf_leg_convention.pdf

imagery and collateral data, including aerial imagery as appropriate[107]." EUSC exploits raw observation data, mainly from commercially available sources. It has served as a 'developer' of the usefulness of space observation data, especially for smaller EU countries, and sees its primary roles as: general monitoring of areas of EU interest, including maritime surveillance; support for arms control, non-proliferation and treaty verification; environmental monitoring and support for security, policing or military exercises under EU or NATO auspices[108]. In specific terms, three Petersberg missions have been highlighted: humanitarian and rescue; peacekeeping; support for combat forces in crisis management, including peacemaking.

Envisat

The Envisat satellite was launched by ESA in 2002 at a cost of around €2 billion. Described on its website as "the most powerful Earth Observation satellite ever built", Envisat carries ten sophisticated optical and radar instruments to provide continuous observation and monitoring of the Earth's land, atmosphere, oceans and ice caps. Envisat data is processed at the ESA/ESRIN centre in Frascati, Italy, and provides a wealth of information on the Earth's land masses, oceans and atmosphere, including the state of the icecaps and rainforests and changes due to global warming. No follow on to Envisat is envisaged, but continuity of some of the measurements that it performs is included in plans for future ESA and non-ESA European satellites.

Europe's Six Leading National Space Programmes

While recognising that other countries also contribute to relevant space and security programmes, the European countries with the more significant national space programmes are: Belgium, France, Germany, Italy, Spain and the UK[109]. This annex provides a brief overview of the publicly available information available on the security-related (not necessarily military) programmes of these six main European space-faring nations, which play a leading role in determining Europe's space policy.

Belgium

From ESA's founding meeting in Brussels in 1973 to the present, Belgium has played a small but notable role in space developments, with four key objectives: scientific; public; industrial; and commercial. Belgium was an early supporter of the Ariane launch programme and Spacelab. It has entered into bilateral cooperation with France for the Earth observation system SPOT-Image, with Russia in relation to MIRAS and SPICAM, and also with Argentina, the United States and Japan. The Belgian government has promoted diversity in space markets, backing national and commercial projects and the creation of orbital infrastructures and means for space access, as well as a range of space applications and services.

[107] European Council Joint Action, July 20, 2001. 2001/555/CFSP. The European Commission has been a member of the Steering Board of the EU Satellite Centre for the past five years.

[108] Fernando Devara, Director EUSC, 'Geographic information in the EUSC: use and trends', Brussels, 2004 http://www.ec-gis.org/ginie/final_conference/davara.pdf.

[109] This annex draws on personal interviews, information publicly available on the websites of the national space agencies, and comments provided by several experts and officials, as well as recent research by Theresa Hitchens and Tomas Valasek, in Hitchens and Valasek, 'European Military Space Capabilities: a Primer', World Security Institute's Center for Defence Information, March 2006. Though care has been taken to provide as accurate an overview as possible, consistent with brevity, this is a changing field, and apologies are made in advance if errors have occurred due to contradictory information or sources.

Some 40 Belgian enterprises are identified as having investment in space activities, with around 36 scientific teams participating in the 75 Belgian projects selected in PRODEX[110]. The Liège Space Centre (Centre Spatiale de Liège – CSL) conducts testing, calibration and inspection for ESA, and the Redu Centre forms part of ESA's ground station infrastructure, with responsibility especially in monitoring communications satellites. The von Karman Institute in Rhode-Saint-Genèse researches spacecraft reentry and plasmotronics; and the Cyclotron Research Centre in Louvain-la-Neuve designs microelectronic components for space systems and conducts research into the effects of cosmic radiation on electronic components. Belgium coordinates telescience projects in a number of universities, research centres and laboratories, and regards itself to be at the forefront of experiments in the fields of solar physics, atmospheric studies and microgravity, as well as supporting the exploitation and marketing of European satellite data.

France

With a current annual budget of €1.7 billion (of which some €685 million is disbursed to ESA), France spends more than any other European country on its national space programmes, channelled through the Centre National d'Études Spatiales (CNES). Founded in 1961, CNES has played a major role in developing the French and European space industries. With a mission that encompasses security, communication, environmental management and space exploration, CNES carries out research, development and deployment of assets with a range of applications: access to space; earth observation and telecommunications; study and exploration of the Universe; manned space flights and experiments in micro-gravity; and security and defence. Nearly 2,400 staff are dispersed between CNES headquarters in Paris, and three other facilities, at Toulouse, Evry and Kourou, French Guyana (Centre Spatial Guyanais), which is the European launch base.

Unlike many EU countries, France has a specific budget line dedicated to military space. The French Ministry of Defence plans to spend €3.6 billion for space programmes in the period 2005-2010. €631 million was allocated in 2005, with the biggest contribution going to the Syracuse 3 programme (€366 million)[111]. The most important of France's programmes with military application are: Hélios (an optical imaging system for surveillance and reconnaissance), the Syracuse communications system, and the GRAVES radar system, giving the Ministry of Defence an independent capability to detect and track objects in space. Hélios IA and IB were launched in 1995 and 1999 respectively, with EADS-Astrium as the prime contractor for the satellites. Hélios IIA was launched in 2004 and the launch of Hélios IIB is scheduled for 2008. Belgium and Spain have shares in the Hélios II programme, and France has bilateral agreements with Italy and Germany for information exchange.

Constructed by Alcatel Alenia Space but under the control of the French Ministry of Defence, the Syracuse satellite system links France's dual-use civil-military communications network. It is expected to integrate with the UK's Skynet and Italy's Sicral I to provide support for NATO. Syracuse IIIA was launched in October 2005 and the launch of Syracuse IIIB is expected in 2007.

France is the only EU Member to have a dedicated electronic intelligence (ELINT) programme, the 'Essaim' network of four micro-satellites. Launched in December 2004, Essaim was built by the French-German space system manufacturer, EADS-Astrium with an initial budget of €80 million from the Délégation Générale pour l'Armement (DGA), Ministry of Defence. There are

[110] http://www.belspo.be/belspo/res/rech/spatres/policy/index_en.stm
[111] France in Space #289. http://www.spaceref.ca/news/viewsr.html?pid=16161

now plans to double this expenditure and expand with a further three ELINT satellites in 2008-9[112].

France is in the early stages of developing a missile warning system, called 'SPIRALE', with two satellites scheduled for launch in 2008. Though designed for early warning, these could potentially be included in any possible future ballistic missile defence system, though little information is in the public domain[113]. France is also developing the new generation Pleiades two-satellite optical dual-use (military-civilian) system. Pleiades is conceived as part of the Franco-Italian ORFEO (Optical and Radar Federated Earth Observation) programme, and due for launch around 2008-10. The Pleiades satellites are being manufactured by EADS-Astrium, with several innovative features, including new measuring instruments, fast data-transmission rates and an agile guidance and control system.

Though the system is designed to enable fast and detailed mapping of urban environments and will provide wide coverage of the Earth for a range of policing and civil-security applications – for example, it is intended that the military should have priority access to Pleiades data. Pleiades is intended to succeed France's pioneering SPOT system (Satellite Pour l'Observation de la Terre), in service since 1986, of which only Spot 2, 4 and 5 remain in operation. Primarily intended for civilian and commercial use, SPOT's sun-synchronous Earth observation coverage has long provided images to military as well as civilian customers around the world[114].

In addition to its participation in Galileo and GMES, France is the major player in the ESA Ariane and VEGA launch programmes, the Argos and COSPAS-SARSET surveillance systems for environmental monitoring, search and rescue, and participates in a number of exploration and scientific research projects including Mars and Venus Express, Cassini-Huygens and the International Space Station (ISS), as well as running various national and multinational communications and monitoring programmes, from Topex Poseidon, Jason 1 and 2 and Calipso (in cooperation with the United States) to Rosace, SPOC and TAROT for space surveillance[115]. Of 23 shareholders in Arianespace from 10 European countries, CNES is the major protagonist, with over 32 per cent, while the Franco-German space industry leader EADS-Space has a further 15 per cent. Based at Courcouronne, near Evry, Arianespace has signed more than 250 launch contracts since its creation in 1980[116].

It is unsurprising that France, with its nuclear missiles and launch resources, has a substantial military space programme, including missile warning, tracking and targeting capabilities. At the same time, it supports negotiations to prevent the weaponisation of space and has a strategic plan that emphasizes cooperation and free access to space for peaceful purposes, security and European autonomy. France envisages that a growing CNES will remain at the centre of European as well as French space policy[117].

Germany

[112] Hitchens and Valasek, op. cit., pp. 33-34, 38 and 40-41.
[113] Ibid., p. 38. See also Bildt et al, p. 26.
[114] Smaller partners for Pleiades include Austria, Belgium, Spain and Sweden. See Hitchens and Valasek, op. cit., p 27-29.
[115] Ibid., pp 25-26 and 42-44.
[116] Arianespace website, http://www.arianespace.com/site/about/about_index.html
[117] Most of the information on the French programme is taken from the CNES website, at http://www.cnes.fr/ See also European Commission press release, 'French government aims to redefine CNES' role in European space activities', January 29, 2003.

Germany views its space policy within the European framework, with the "hallmark of international cooperation" within Europe and further afield. Its space budget totals about €750 million out of which two thirds goes to ESA programmes. For 2006, the German contribution to ESA is expected to be about €550 million. Its aim is:

"To secure significant, worthwhile investment in the future of our community", safeguarding and improving the quality of life for present and future generations. Space is regarded as "an indispensable tool for the protection of life on Earth [118]*."*

Germany's space activities are largely coordinated through DLR, the German Aerospace Research Center and Space Agency, which employs some 5,000 people, with a budget of over €450 million[119]. A member of the Helmholtz association, DLR has 30 institutes at eight locations, the most improtant of which is Oberpfaffenhofen, near Munich. DLR plans space activities, carries out German space flight programmes (including coordinating the launch of over 40 satellites) and manages research, development, educational outreach and commercial innovations.

Germany's principal military reconnaissance programme, comprising a constellation of satellites, is SAR-Lupe, planned for 2006-08. Germany's development of this programme was directly related to its experiences during the NATO action in Kosovo, particularly to difficulties in getting the US to share satellite intelligence of direct relevance to the protection and security of non-US allied forces. These experiences convinced Germany of the need for its own space-based intelligence-gathering assets.

SAR-Lupe is planned as a constellation of five synthetic-aperture X-band radar (SAR) satellites that would be distributed over three polar orbits at an altitude of 500 km. A bilateral agreement with the French government provides for data from SAR-Lupe to be provided in exchange for data from Hélios. Germany's first dedicated military satellite communications system, Satcom Bw, is under construction and planned for 2008. It covers IT voice, fax, data, and video networks, and will provide communications for Germany's armed forces, including data transmission between fixed and mobile terminals, such as ships, vehicles and aircraft.

Germany is also part-funding two public-private dual-use Earth observation system known respectively as TerraSAR-X (with EADS-Astrium), an X-band synthetic aperture radar imager due for launch in late 2006, and Rapid Eye, a constellation of five optical mini-satellites aimed at mapping and agricultural imaging. The German Research Establishment for Applied Science (FGAN) operates the experimental Tracking and Imaging Radar (TIRA) for early warning, detection and tracking of missiles and satellites in orbit[120].

In addition to dedicated or dual-use security and defence applications, German policy identifies seven space programme objectives: telecommunications; navigation; earth observation; space exploration; micro-gravity research; space station; space transportation; and space technology. Specifically, Germany contributes 70 per cent of its space investment to the ESA, and has become a leading supplier in a number of areas, including: scientific satellites, components and sub-systems for space vehicles and communications satellites, notably temperature-resistant

[118] Federal Ministry of Education and Research, German Space Programme.
[119] According to DLR's website, it is responsible for administering the total space budget of the German government, some €760 million. See http://www.muenchen.de/Stadtleben/Education_Employment/Research/82999/04adlr.html
[120] Hitchens and Valasek, op. cit., pp 26, 30, 36 and 42.

materials and structures; integration of orbital systems for manned spaceflight; space robotics; X-ray astronomy; sensor technology (especially SAR); and meteorological and ocean monitoring and climate research[121].

Italy

An early participant in space development projects, the Italian Space Agency (Agenzia Spaziale Italiana, ASI) was established in 1988 under the auspices of the Italian Ministry of Higher Education and Research. With its headquarters in Rome, it is a small-scale agency by comparison with the space agencies of France and Germany. ASI has facilities near Matera (the ASI-CGS space observation centre) and Trapani (Milo Base for launching balloons for climate observation) in southern Italy. Between them, these facilities provide data analysis and scientific research, space observation and geodynamics, remote sensing, and space automation and robotics. ASI also has a small research and tracking base - the Broglio Space Centre in Malindi, Kenya, formerly the University of Rome's Satellite Tracking and Launching Centre - which ASI took over in 2004[122].

The ASI total budget for 2005 was around €700 million, out of which Italy contributes 50 per cent of its investment in space programmes to ESA. The rest of the budget is dedicated to national, bilateral and various European and multinational programmes. It holds a 14 per cent share in Hélios II. In addition to Italy's participation in Galileo and GMES, it is the leading investor in the VEGA programme, contributing 65 per cent[123]. FiatAvio (70 per cent) and ASI (30 per cent) are the main investors in ELV, the prime contractor for the VEGA and P80 launch programmes, to be commercially operated by Arianespace.

ASI's principal programmes are COSMO-SkyMed (Constellation of small Satellites for Mediterranean basin Observation), and the Sicral 1 military telecommunication satellite, for national defence, intelligence and to provide support for NATO forces. Italy's Ministry of Defence has also invested in the French Hélios I reconnaissance satellite programme, with a share of 14 percent.

COSMO-SkyMed, a constellation of four[124] SAR observation satellites to be launched from 2007 onwards, is Italy's contribution to the Franco-Italian ORFEO project. A low-orbit, dual-use (civil and military) Earth observation satellite system operating in the X-band, COSMO-SkyMed is managed by ASI but funded by both Italy's Ministry of Research (MIUR) and Ministry of Defence. Though it was intended first and foremost to cover the Mediterranean region, ASI's overall objective is for COSMO-SkyMed to provide global Earth observation to meet the needs of the military as well as for the civil (institutional, commercial) community.

COSMO-SkyMed data is envisaged as contributing to: defence and security applications - surveillance, intelligence, mapping, damage assessment, vulnerability assessment, target detection/localization; risk management applications - floods, droughts, landslides, volcanic and seismic events, forest fires, industrial hazards, water pollution; and environmental applications - marine and coastal, sea ice, agriculture, forestry, cartography, meteorology, geology and

[121] Federal Ministry of Education and Research, German Space Programme.

[122] Report of the Italian Space Agency, 2004, http://www.ioag.org/ioag7_asi_report.pdf. Note, the Broglio Space Centre has recently had some local difficulties. See Paul Gitou, 'Kenya: Scientists denied food in standoff', *East African Standard*, April 3, 2006. http://allafrica.com/stories/200604030355.html.

[123] The other participants in VEGA are: France (12.4 per cent), Belgium (5.6 per cent), Spain (5 per cent) the Netherlands (3.5 per cent), Switzerland (1.3 per cent) and Sweden (0.8 per cent).

[124] Some sources suggest that five may be planned.

exploration, telecommunication, utilities and planning; provision of commercial imaging services[125].

Launched in 2001, Sicral 1 is Italy's first dedicated military telecommunications satellite and is the product of the SITAB industrial consortium comprising Alenia Spazio, FiatAvio and Telespazio. With a design life of around 10 years, it downloads to fixed and mobile terminals operated by Italy's military, and is intended to provide flexibility of use, low management costs and the ability to adapt to changing operational conditions, especially in emergencies. Europe's first venture into Extremely High Frequency (EHF) broadcast frequencies, Sicral also has capacity in the Super High Frequency and Ultra High Frequency bands, permitting interoperability with US and other European satellite systems[126].

In addition to participation in Galileo, GMES and VEGA, Italy has been closely involved with the Ariane 5 launcher programme and is heavily investing in the VEGA small launcher programme as well as other ESA projects such as the ISS, ARTEMIS (the Advanced Relay and Technology Mission satellite) and ARTES-3. Italy is involved with AGILE (launch date due 2006), and is also providing the FUCINO ESA ESOC gateway. Together with NASA and other countries, ASI has worked on Cassini, the Tether Satellite System (TSS), the LAGEOS observation satellite and the SAX X-ray astronomical satellite[127].

Spain

Spain has been involved in space programmes since the 1970s, and from 1983 has managed its ESA participation through the Centre for Industrial Technology Development (Centro para el Desarrollo Tecnológico Industrial - CDTI)[128]. Spain's contribution is relatively small, with less than 3,000 professional staff and a budgetary contribution of around 4 per cent of Europe's total. The latest figures available (dating from May 2003) estimate that 80 per cent of the €150 million space budget goes to ESA. Industrial and commercial input into space programmes is coordinated through ProEspacio, which supplies a wide array of services, including: operation of satellite systems and ground tracking infrastructures and engineering and components for space systems and their ground facilities. Spain contributes to the Galileo, GMES, Ariane, VEGA and reusable launcher programmes and has called for national and joint European space technology programmes to be better integrated. It also supports better coordination of European research and development programmes and new regulations to protect small and medium space industrial actors.

Spain is a strong advocate of a European Space Policy, which it considers should be "to preserve European independence in such sensitive fields as access to space, advanced telecommunications, security and safety, navigation and defence and environmental surveillance and monitoring". In ProEspacio's view, if Europe fails to maintain and expand institutional support to the European national and multilanational space endeavours, it could "lead to a panorama characterised by an American industrial monopoly". Three priorities are identified: development of a regulatory framework that would minimise administrative barriers to national and Europe-wide industrial and space developments; promotion of industrial objectives that are

[125] POLinSAR, Cosmo-SkyMed powerpoint presentation, January 2003, http://earth.esa.int/workshops/polinsar2003/participants/rum74/skymed.pdf. See also http://directory.eoportal.org/pres_COSMOSkyMedConstellationof4SARSatellites.html

[126] SITAB comprises Alenia Spazio (70 per cent), FiatAvio (20 per cent) and Telespazio (10 per cent). See Report of the Italian Space Agency, 2004, http://www.ioag.org/ioag7_asi_report.pdf.

[127] Ibid.

[128] CDTI website, http://www.taftie.org/Members/Members/CDTI_-_Spain.html

consistent with European aspirations regarding space; and active collaboration between industry and the scientific community to maximise the social benefits associated with space activities.[129]

On the military side, Spain is a partner in the French Hélios I and Hélios II reconnaissance satellites and co-owns with the US the dual-use XTAR-EUR communication satellite. Launched in Feburary 2005, XTAR-EUR provides both commercial and military coverage over a wide swathe of the Earth from Brazil to the Middle East and parts of Africa and Asia. Together with the SPAINSAT (XTAR-LANT) satellite, the system provides data for the Spanish Ministry of Defence and the Pentagon, and is able to supply allied governments with a variety of X-band services.

United Kingdom

The UK space industry is relatively large and diverse, with a total turnover in 2004-5 estimated at £4.5 billion (€6.7 billion). Civilian space endeavours are coordinated through the British National Space Centre (BNSC). Public sector expenditure is around £200 million, with priority on astronomy, planetary exploration and observation. The UK is also a significant partner in ESA, including Galileo and GMES, and has considerable involvement in space based navigation and telecommunications and defence-related activities[130].

Through BNSC, the UK has expertise in the areas of: satellite platforms, payloads and operations; instrumentation; software; components; testing facilities; remote sensing applications; antennas and signal simulators; digital processing; radio-frequency (RF) technology; and system validation. With some 16,000 employees involved in space programmes, the BNSC coordinated expenditure of some £198 million (about €290 million) in 2005 on space programmes. In 2004-5, the UK contributed around £129 million to ESA (about 65-70 per cent of the space budget) . Non-ESA expenditure are spent on domestic projects and collaboration with international agencies. In response to concerns that the large number of autonomous industries coordinated by BNSC risked a lack of coherence for UK space strategy, the BNSC has made recent changes to its governance, including establishment of a Space and Advisory Council with representatives from 11 partners and the wider space community[131].

In 2003, the UK published a new (civilian) Space Strategy, subtitled "Space for science, enterprise and environment", with a long-range plan extending to 2015. This demonstrates a policy that prioritises scientific and commercial objectives for which space activities "are the most effective tool", rather than "considering space exploration as an end in itself". The ambition for the UK Space Strategy is "to secure world-beating science and the technologies needed to deliver it, and to achieve greater use and market acceptance of all types of space services, addressing regulatory, technical or market issues as appropriate". The UK policy focuses on "user-driven research", with emphasis on investing "selectively in space-related technologies and services... [and focusing] on achieving its objectives cost-effectively, usually through international partnerships[132]."

Three key objectives for the UK were identified:

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[129] Juan Nebrera, Asociación Española de Empresas del Sector Espacial (proEspacio), 'Space – the Industrial Vision', Madrid Workshop 2003. www.proespacio.org.

[130] See Parliamentary Office of Science and Technology (POST), 'UK Civil Space Activities'. POST note number 262, March 2006. A similar parliamentary research note was due to be written on UK military space activities but has reportedly been delayed.

[131] Ibid, p 4; and British National Space Centre, 'UK Space Strategy: 2003-2006 and beyond', http://www.bnsc.gov.uk/assets/channels/about/5818%20BNSC%20Brochure.pdf.

[132] Ibid.

"enhance the UK's standing in astronomy, planetary and environmental sciences; stimulate increased productivity through promoting the use of space in government, science and commerce; and develop innovative space technologies and systems to deliver sustainable improvement in quality of life [133]."

While investment in national programmes is largely designed to bring the benefits of international programmes to UK science, commercial and other user communities, around 70 per cent of UK Government expenditure on space is invested directly in European programmes, through ESA and EUMETSAT. The UK also has bilateral agreements with other space nations (including the US, Russia and Japan). At the third European Space Council Meeting in November 2005, Britain committed to paying just over 4 per cent of the first phase costs of GMES. Though the UK space industry has expressed concerns that this relatively low contribution (just over the minimum required to secure UK involvement in the programme) will result in fewer contracts, it reflects government concerns about GMES' objectives and orientation. Concerns have also been expressed about lack of strategic planning.[134]

The UK participates in national and international projects, including the Cassini-Huygens mission to Saturn, the Aurora-Mars exploration, the Hubble space telescope, CRYOSAT-2 and others. The civilian space programme is billed as contributing to public safety and security through: monitoring impacts of climate change; monitoring natural habitats; crop health research and monitoring for food security assessments; crop monitoring and surveillance to improve implementation of EU agri-environmental schemes; humanitarian relief and crisis management; monitoring illegal cropping practices; monitoring wave state and energy for offshore exploration; monitoring pollution incidents; and also satellite communications and navigation systems for safer railway signaling[135].

Britain also invests in military space applications, mostly in conjunction with the United States (as with the Fylingdales space surveillance and tracking facility) and also with European and other partners. Most recently, TOPSAT, an earth observation satellite – described as a 'technology demonstrator' – with military applications, was launched from the Plesetsk launch site in Northern Russia in October 2005. TOPSAT also has security and civilian remote sensing applications including disaster relief, environmental monitoring, crop management, land use and border control.

Funded jointly by the UK Ministry of Defence (MoD) and Department of Trade and Industry (DTI), the TOPSAT project is run by a consortium of four organisations, led by QinetiQ[136]. Surrey Satellite Technology Ltd, a pioneer in smaller, low-cost, high performance satellites and commercial-off-the-shelf (COTS) technologies, developed the platform, satellite integration and the telecommand and control system; the Rutherford Appleton Laboratory provided the high performance camera and Infoterra Ltd is developing the market for TopSat data products. TOPSAT is one of three satellite projects funded under the MOSAIC programme (the BNSC Small Satellite Programme).

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[133] Ibid. p. 2.
[134] POST note 262, op. cit., p. 3.
[135] Ibid.
[136] QinetiQ has recently acquired a majority share in the Belgian small satellite manufacturer Verhaert Design and Development, now renamed Verhaert Space, to boost the company's capability to provide this type of spacecraft. This section on TopSat was largely taken from Qinetiq's website, at http://www.qinetiq.com/home/commercial/space/space_missions_and/development_projects/topsat.html.

Although nothing has reportedly been decided, plans for the future may include a constellation of three or four TOPSAT satellites that could image almost any point on the Earth at least once a day (subject to cloud conditions), opening up the potential for very low latency imagery, which is extremely cost effective to deliver.

From 1988, the UK MoD ran a military-operational communication system SKYNET IV, which comprised three satellites and four X-band channels feeding into Royal Air Force ground stations. As part of a deal to upgrade to will be SKYNET V, the MoD has 'sold' its SKYNET IV satellites and ground sector infrastructure to Paradigm Secure Communications (a subsidiary of EADS-Space) as part of a 'private finance initiative' contract worth £2.5 billion (€3.6 billion) in 2003. This deal will allow Paradigm to sell services to third-party users, including governments, though only with MoD approval. EADS-Astrium, a French-German space system manufacturer, with facilities also in the UK and Spain, is responsible for the production of two SKYNET V satellites and the upgrading of the UK's ground control systems[137].

[137] Hitchens and Valasek, op. cit., p 33.

Communities of Interest (COI)

The communities of interest (COI) active in the security area considered by the Panel of Experts that could benefit from a range of satellite services.

[Taken from *Report of Panel of Experts on Space and Security*, European Commission, March 2005, (pp.12-13)]

COMMUNITIES OF INTEREST		MAJOR SECURITY ISSUES
COI1: Law enforcement services	• Customs • Policing • Justice	Cross border control and border surveillance Fight against illegal immigration, Fight against humans/drugs Trafficking Fight against organised crime and fraud Schengen Information System (SIS) Fight against illicit trafficking of small arms and light weapons and proliferation sensitive goods (e.g. WMD) Anti-terrorism, Surveillance of criminals on parole or probation.
COI2: Civil crisis management operators & search and rescue teams	• Medical services • Fire services • Humanitarian aid teams • Civil protection and other emergency teams	Management of natural, technological or epidemiological risks, in a predictive, preventive or response mode. Authorities exist at local/national/regional level and includes a growing community of decision makers at the European level. Examples of benefits to be brought by space capabilities : • Mapping with information on the disasters, health structures, access routes, travels plans; critical infra-structures, epidemiological mapping; tracking and tracing of refugees flows • Low cost and easily deployable telecommunication services for exchange and capitalisation of data • Navigation services for redefining geography of disaster struck areas • Telemedicine applications
COI3: Services operators	COI3A: Services operators already make extensive use of space capabilities: • Transport operators and associated agencies for traffic control (road, rail, aviation, maritime) • Telecommunications • Environmental information systems (environmental observatories; weather forecast; including space systems themselves)	***The major issue is to ensure the security and availability of critical infrastructures and services, with the objective to make them less vulnerable and more efficient.*** ***This concerns all structures or organisations which are very critical to society life cohesion, including (but not only) those for which SPACE is already a core component of their process.*** A few examples of benefits to be brought by space capabilities • Ensuring the security of all modes of transport with security related specification for access to GNSS information • Undertaking a review of Pan European assets tracking for road, rail, air • Monitoring status of critical industrial infrastructures • Anticipating major meteorological events • Tracking and tracing of food safety • Use of observation space based systems to survey ground energy supply infrastructure • Providing with weather and sea state data for energy consumption and production prevision; • Using GNSS timing capabilities to implement a more reliable management of telecoms or power networks over continental areas. GALILEO will

	COI3B: Service operators with potential benefits from use of space based capabilities: • Energy production and distribution • Water supply • Food Safety • Health Agencies • Economic networks (Banks, Insurance)	provide additional performance in this respect.
COI4: Political and Military users	• Decision making authorities (national and EU bodies) • Intelligence community • Headquarters (including civil and military planners) • Forces (including Rapid Reaction Battlegroups) • Other international organisations such as UN or NATO	Covering the overlap with military needs where the synergy between both civil and military activities may be provided. This includes crisis management teams

European Milsatcom Capabilities

[Taken from *Report of Panel of Experts on Space and Security*, European Commission, March 2005 (p.30)]

There is a range of both civil and military satcom services available for security applications. This table provides an overview of the most well known ones.

Name	*Owner*	*Characteristics*	*Remarks*
SKYNET IV	UK,	5 Satellites, UHF SHF X-Band, Paradigm took over operations in 2004	Military/Operational
SKYNET V	Paradigm Secure Communication	2 Satellites, UHF, SHF X-Band, EHF	Military/Private Financed Initiative Launch 2006/2007
SICRAL	Italy	1 Satellite, S-Band, UHF, SHF X-Band, EHF	Military/Operational
SYRACUSE III	France	1 Satellite, SHF X-Band SHF, EHF	Military/Operational
SYRACUSE II	France	1 Satellite, SHF X-Band	Military/Operational
SPAINSAT	Spain	1Satellite SHF X-Band, Ka Band	Military Launch 2005/2006
XTAR-EUR	US/Spain	1 Satellite SHF X-Band	Military Launch 2005
SATCOMBw Stufe 2	Germany	2 Satellites, UHF, SHF X-Band, C-Band, Ku-or Ka-Band	Military Launch 2008
NATO IV	NATO	2 Satellites UHF, SHF X-Band	Military/Operational
NATO SATCOM Post 2000	NATO	UHF, SHF X-Band, EHF UHF, SHF X-Band Service Provider: FR, IT, UK EHF Service Provider: TBD	Military SHF X-Band, UHF Operational: 2005 EHF operational: 2008
HELLAS SAT	Greece	Ku-Band	Commercial/Operational
ARTEMIS	ESA	1 Satellite, S-and Ka-Band, optical data relay, navigation and L-Band mobile	Operational
SeSat	EUTELSAT	2 Satellites, Ku-Band	Commercial/Operational
e-bird	EUTELSAT	1 Satellite, Ku-Band	Commercial/Operational
W-Series	EUTELSAT	6 Satellites, Ku-Band	Commercial/Operational
HOTBIRD	EUTELSAT	6 Satellites, Ku- and some Ka-Band	Commercial/Operational
EUROBIRD	EUTELSAT	2 Satellites, Ku-Band	Commercial/Operational
ATLANTICBIRD	EUTELSAT	3 Satellites, Ku- and some C-Band	Commercial/Operational
ASTRA	SES GLOBAL	36 Satellites, mix of C-, Ku, and C/Ku-Band Satellites	Commercial/Operational
I-2, I-3, I-4	INMARSAT	Mobile communications 10 Satellites, C- and L-Band	Commercial/Operational

European Earth Observation Capabilities

[Taken from *Report of Panel of Experts on Space and Security*, European Commission, March 2005 (p.32) and updated in June 2006[138]]

The EU Satellite Centre operates in the security domain (both civil and military) but uses predominately civil imagery. This Table provides an overview of the main services available today from European satellites.

Name	*Owner*	*Characteristics*	*Remarks*
HELIOS I	France/Italy/Spain	2 optical satellites .	Next upgrade is Helios II
HELIOS II	France/Belgium/Spain	2 optical satellites and IR,	Operational 2005
Pleiades	France/Austria/Beglium/Spain/Sweden	2 optical (res 70cm)	Operational after 2008
SAR LUPE	Germany	5 satellites SAR X-band, res.<1m	Operational after 2006
COSMO-Skymed	Italy	4 sat. SAR X-band	Operational after 2007
Envisat	ESA	Imagers ASAR and MERIS	Operational
Topex-POSEIDON	France/US	Ocean topography	Terminated late 2005
CRYOSAT	ESA	Icecaps thickness monitoring: 3 SAR Radar altimeters	First launch in 2005 failed; new lanuch planned for 2008.
JASON 1	France/US	Ocean topography	Operational
JASON 2	France/US	Oceans topography	Launch 2008
ERS-2	ESA	SAR	Operational
SPANISH EO System	Spain	optical/radar satellite	In definition
SPOT 2, 4 and 5	France/Belgium/Sweden	Panchromatic and multispectral	Operational
PROBA	ESA	High Resolution Imaging Spectrometer /Hyperspectral	Operational
MSG-1 and 2	EUMETSAT	Second generation European geostationary meteorological satellites: visible and infrared images/search and rescue transponder	Operational
EPS/METOP-1	EUMETSAT	First European polar meteorological satellite: advanced very high resolution radiometer and advanced scatterometer	Launch July 2006
TerraSAR-X	Germany	1 sat. SAR X-band, res. from 16 m to 1 m	Launch end of 2006 Public Private Partnership
Rapid Eye	Germany	5 optical satellites, res. 6,5 m	Launch 2007 Public Private Partnership
Disaster Monitoring Constellation (DMC)	Algeria, Nigeria, Turkey, Thailand, UK	Micro-satellites (optical imager payloads, 32m multispectral + 12m pan)	Launched 2003/4
DMC Phase 2	China, Vietnam	Micro-satellites, 32m M/S, 4m pan	Launch 2005

[138] The authors especially wish to thank Gerard Brachet for assistance in updating this table.

Relative national contributions to European Space Agency

The resulting total contributions from Member and Cooperating States for the three-year period 2003-2005 for the ESA's Mandatory Activities and for the Optional Programmes in 2004

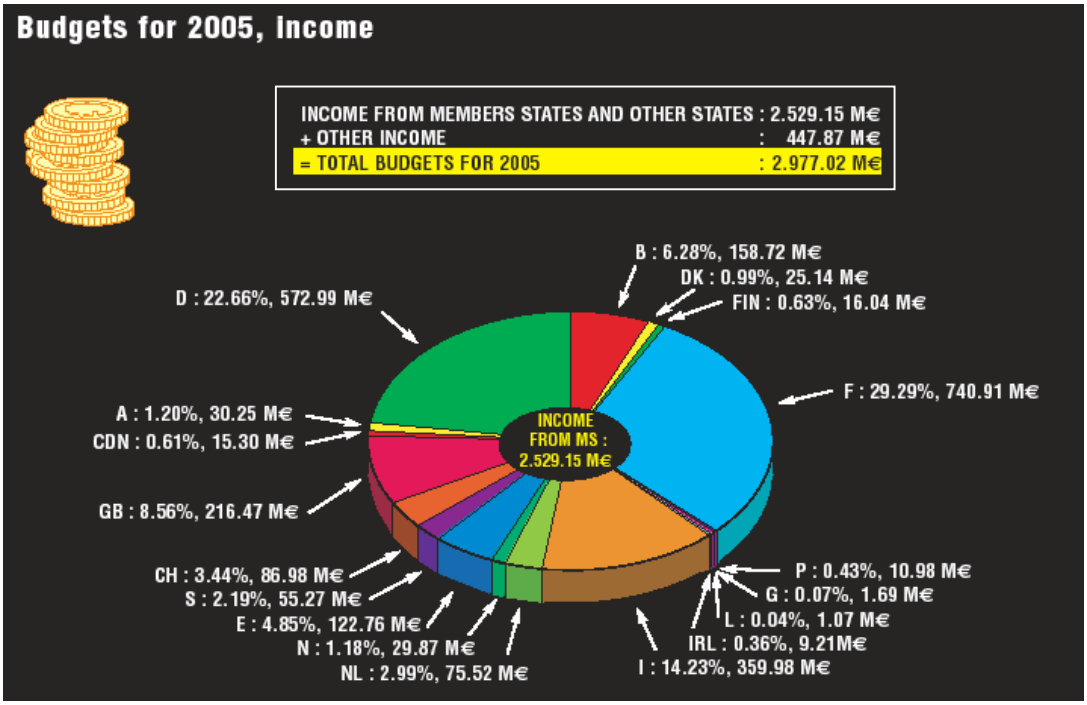
ESA Annual Report 2004

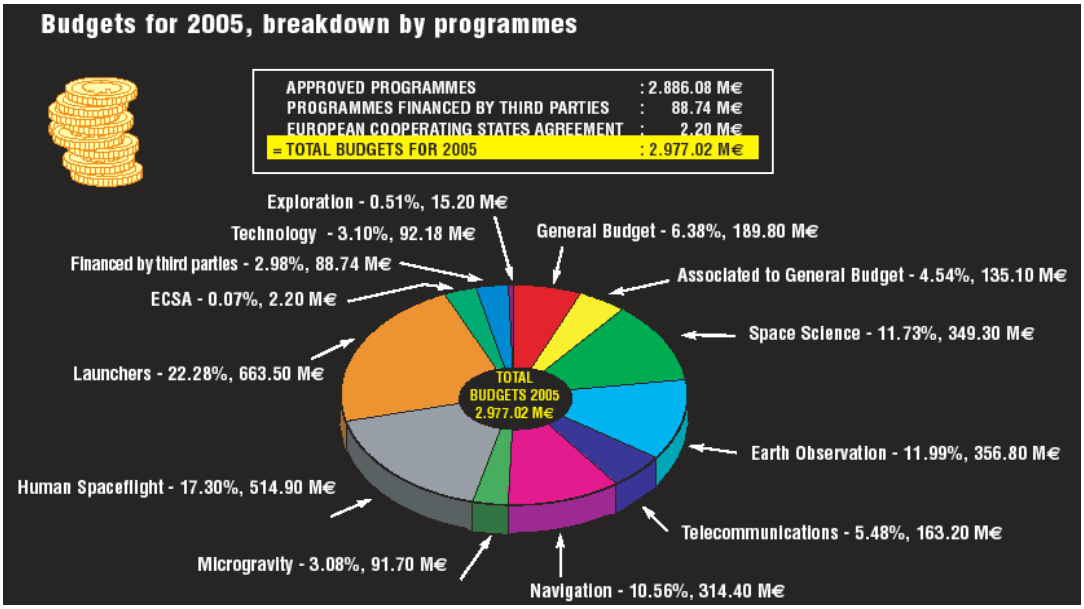
Contributions to Mandatory Activities (%)		Contributions to Optional Programmes* (%)	
AUSTRIA	2.30	AUSTRIA	1.09
BELGIUM	2.68	BELGIUM	8.27
DENMARK	1.85	DENMARK	0.78
FINLAND	1.40	FINLAND	0.56
FRANCE	15.90	FRANCE	32.24
GERMANY	23.82	GERMANY	21.46
IRLAND	0.96	IRELAND	0.29
ITALY	13.10	ITALY	11.56
NETHERLANDS	4.51	NETHERLANDS	2.99
NORWAY	1.73	NORWAY	1.13
PORTUGAL	1.22	PORTUGAL	0.25
SPAIN	6.99	SPAIN	5.90
SWEDEN	2.66	SWEDEN	2.34
SWITZERLAND	3.46	SWITZERLAND	4.20
UNITED KINGDOM	17.22	UNITED KINGDOM	5.70
TOTAL MEMBER STATES	100.00	TOTAL MEMBER STATES	98.76
CANADA	3.43	CANADA	1.00
CZECH REPUBLIC	-	CZECH REPUBLIC	0.06
HUNGARY	-	HUNGARY	0.01
LUXEMBOURG	-	LUXEMBOURG	0.08
GREECE	-	GREECE	0.08
TOTAL Cooperating States *	3.43	TOTAL Cooperating States (**)	1.24
TOTAL ESA	-	TOTAL ESA	100.0

** Including contributions of National Aviation Agencies to ARTES-9 GNSS IP (ATMSP)*
*** Participating non-Member States linked to ESA by a Cooperation Agreement*

European Space Agency: Income and Breakdown by programmes

Tork Hillar. Ülevaade ESA tegevusest. Teine Eesti Kaugseire Seminar. Tartu Observatoorium. 11 October 2005. http://www.aai.ee/kaugseireweb/ettekanded/tork.ppt





Defence and Space Expenditure in the United States and EU

In the United States, NASA's budget in 2005 was about $16 billion (€13 billion). More than half of the budget was devoted to exploration capabilities (53 per cent), one quarter to space science (25 per cent) and the rest to earth science (9 per cent), biological and physical research (6 per cent), aeronautics (6 per cent) and education (1 per cent).

The US Department of Defence (DoD) has also substantial spending in military space applications, with a space budget of $19.8 billion (€16 billion) in 2005 and a request of $22.5 billion (€18.28 billion) in 2006. The US DoD has no equivalent worldwide – it accounts for 95 per cent of world expenditure on military space[139].

In contrast, European military expenditure lags well behind its overall investment in space over the last ten years. On average 13 per cent of all space spending has been for military applications compared to a 50:50 civilian/military split in the US[140]. Only France and the UK have committed to significant military allocations, while other countries spent a few dozen millions. In addition, though several European countries decided to acquire satellite capabilities on a national basis, their implementation leads to some duplication in terms of R&D and procurement[141]. At present, there are eight different satellite systems for communications or surveillance/reconnaissance satellites in Europe[142].

Table I: EU/US Ratios[143]

In 2004, the ratio of US and European budgetary allocations for military space was calculated to be 1:20. By contrast, the United States spends around three times the combined defence budgets for EU countries.

In billions of € for the year 2004

	United States	Europe	US to Europe ratio
Defence budget estimated	354	146	<3
Military Space	15.1	0.75	>20
Military Space/total defence	4%	0.5%	

[139] Ibid.
[140] S. Bochinger. Europe and Space: the Economic Dimension, Euroconsult, 2005.
[141] Ibid.
[142] France has Helios for optical imagery, Syracuse for telecommunications and demonstrators in other application areas. The United Kingdom has Skynet for telecommunications. Italy has Sicral for telecommunications and Cosmo-Skymed for radar imagery. Germany has SAR-Lupe for radar imagery and Satcom Bw for telecommunications. Spain has Spainsat for telecommunications. For further information see S. Bochinger. 'OPED: What Agenda for Military Space in Europe?' 4 April 2005. http://www.space.com/spacenews/archive05/Bochinger_040405.html
[143] S. Bochinger, 'Europe and Space: the Economic Dimension', Euroconsult, 2005

2. *Estimated annual public funding on space in Europe in 2004*

Table 2: Estimated public expenditure in space in Europe (M€) (2004)

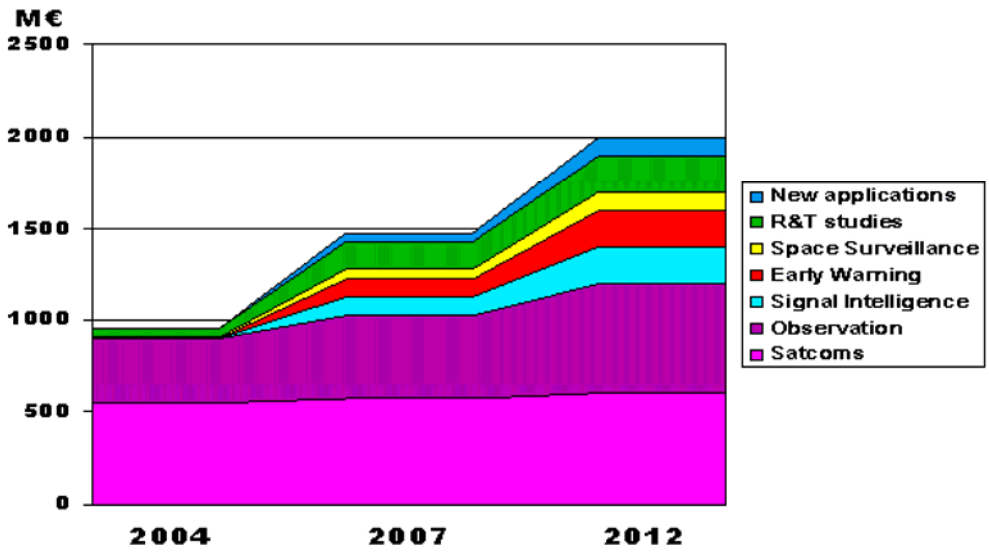
European Space Agency	2,700**	
Member States	1600	(national civil activities)
	550	(national military activities)
Eumetsat	300	
EC*	230	
TOTAL	5,380	

** corresponding figures only include earmarked budgetary resources*
*** ESA expenditure in recent years: 1999 (2400); 2000 (2299); 2001 (2522); 2002 (2812)*

Cost estimates of European Space System for ESDP

[taken from *Report of Panel of Experts on Space and Security*, European Commission, March 2005 (pp.52-53)]

The chart provided by EUROSPACE shows that a progression from a current budget of just under 1B€ in 2004 to around 2B€ which appears to be necessary from 2012 onwards.



The 2004 costs contain the programmes financed by the different national Ministries of Defence for governmental applications:

- Satcoms: Skynet, Syracuse, Sicral

- Observation : Helios, SAR Lupe, Cosmo-Skymed
- R&D Studies/Demonstrators ; EHF, Essaim (Comint), Spirale (Early warning), Lola (laser link), Grave (space surveillance).

The estimated 2012 costs are a projection to maintain and increase the actual capacities towards a coherent European space system for ESDP:

- Satcoms: secure systems/services including EHF and data relay capacity
- Observation: new generation of optical and radar observation systems including Extremely High Resolution (EHR), Very High Resolution/wide view, Infra-Red and hyperspectral capacity
- Signal Intelligence: European Sigint system including Elint and Comint)
- Early Warning: First step of a European system
- Space Surveillance: space component of a global system (radar and optical)
- R&D Studies: studies and technology R&D necessary for the above programmes together with new advanced applications studies e.g. Geostationary observation and sigint, high resolution micro-sats etc.
- New Applications: provision for new applications using existing technology Eg. Geo-mobile, mobile receiving stations, space MTI.

Remarks:

1. These estimates concern only the programmes mentioned above and include launch costs, ground segments and operations.
2. Europe has attained the technical capability to develop such programmes due to efforts at national or European level developing programmes such as SPOT, ERS, Artemis, Silex, Envisat, Jason and Launcher developments (Ariane, Véga). In the future, similar civil oriented efforts in terms of R&D and demonstration will be necessary to sustain the fundamental technical capability.
3. Other civil space applications that will be also used for security and defence (mulitple use) – such as GMES, meteorology or oceanography systems - shall still need to be financed through separate civil budgets that could be allocated at national or European level (not included in the above chart).
4. According to EUROSPACE, an independent access to space is essential for a European space system for ESDP and must continue to be maintained through ESA budgets.
5. Special attention should be paid to ground segments taking into account the necessary level of federation of sensors and fusion of data.
6. The approximate doubling of the budget on space systems for ESDP is consistent with other forecasts for a doubling of the overall space budget in the same timescale yet] will leave the expenditure in Europe on space systems for security and defence at one tenth of that in the US.