11. The security dimension of European collective efforts in space

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I. Introduction

Europe, both collectively and nationally, has long been a major power in outer space, with countries maintaining an array of facilities for satellite launches, satellite production and research. Like many other elements of European power, however, space capability is not a fully unified project, but rather arises through the accumulation of a confused mixture of national and multinational entities and efforts. As might be expected, the major national players in space are the four European states with the largest economies: France, Germany, Italy and the United Kingdom. At the collective level, there are two premier organizations: the 25-state European Union (EU) and the 17-state European Space Agency (ESA). In addition, other joint European projects involve sets and subsets of national governments and multinational organizations.

While European space activities have focused on civil and commercial applications, over the past several years European countries and Europe collectively have recognized the need to add a security dimension to their space programmes. This has been a slow and halting process. Even today, European states jealously guard their military space capabilities; they are often wary of inter-European cooperation and more so of collective endeavours. That mindset is beginning to change, spurred in large part by the revolution in military space power in the United States, where the increased exploitation of space assets for both tactical and strategic purposes has provided the country with an undisputed edge on the battlefield.

The pressures for more cooperation in military space activities also stem from the general evolution of European military thinking: primarily, the trend towards collectivism in foreign affairs and defence policy that began with the articulation of the EU Common Foreign and Security Policy (CFSP), established in 1992 and expanded in 1997, and its subordinate European Security and Defence Policy (ESDP), established in 1999. European militaries cooperate ever more closely on the ground, on the seas and in the air. The creation of joint units such as EU battle groups,[1] in turn, drives member states to integrate their space policies and assets, without which much of modern warfare would be impossible.

[1] See chapter 1 in this volume.

Another, but no less important, driver has been Europe's desire to build capabilities that are independent of the USA—a trend that has its roots in the end of the cold war but which has hastened in recent years as European views about US unilateralism have hardened and US restrictions on space technology transfer have tightened. A March 2005 report to the European Commission by a panel of space experts concluded that 'Europe can no longer assume a fortuitous coincidence of interest with the USA'.[2] While European states have a growing desire for information about a wide range of issues from sources other than the USA, no European country could itself hope to finance a space programme that could deliver such information. The EU is therefore increasingly becoming a locus for new space efforts.

All this said, some important factors limit Europe's current collective ambitions in space. First, European countries have different types of cooperation arrangements with the USA as regards space in general and its security dimension in particular. Second, EU policy makers have never contemplated a collective missile defence project of the sort that has driven a number of developments of systems based in and using space in the US military technology programme—although the subject of a theatre missile shield for Europe remains under discussion in the North Atlantic Treaty Organization (NATO).[3] On a related point, the policies of EU members on the use of space generally oppose such aspects of the 'militarization' of space as the development of anti-satellite (ASAT) systems and technologies. Last, and more broadly, EU policy on the development of space assets for the Union's own collective military purposes is constrained by the important formal limits that exist on those purposes: operations under the ESDP are still limited to various tasks of crisis management (and various kinds of military support for civilian needs, e.g., in emergency response), rather than being fully engaged with the defence of Europe's own territory and the high-intensity operations that would involve.

Section II of this chapter examines the emerging EU space policy from the perspective of its potential security implications. Section III surveys the main collective organizations engaged in space policy, and section IV gives an overview of national space programmes that have a security dimension.[4] Section V presents the conclusions.

II. The emerging security dimension in EU space policy

While the collective engagement of European countries in space programmes pre-dates the creation of the European Union, the EU is now increasingly the

[2] European Commission, 'Report of the Panel of Experts on Space and Security', Brussels, Mar. 2005, URL <http://europa.eu.int/comm/space/news/article_2262.pdf>, p. 38.

[3] The limited evidence of purely national programmes in Europe for missile defence that involve space assets, and British, Norwegian and Danish (Greenland) involvement in the USA's own ballistic missile defence programme, are referred to below in section IV.

[4] For comprehensive, up-to-date information on developments in space programmes in Europe and worldwide see GlobalSecurity.org's 'World Space Guide' at URL <http://www.globalsecurity.org/space/world>.

focal point for a rapidly developing security policy in which space-based and associated terrestrial infrastructure already play a substantial role.[5]

Given Europe's multi-dimensional approach to security, differentiation between a purely military space infrastructure for traditional military purposes and a wider space infrastructure and systems relevant to security is becoming more and more difficult. As noted by the European Commission, 'The Council of the EU has recognized that space assets could contribute both to making the EU more capable in the field of crisis management and to fighting other security threats. It has therefore approved the idea that identified and agreed upon ESDP requirements should be reflected in the global EU space policy and European space programme.'[6]

The 'militarization' of European space programmes has come slowly, but over the past several years the EU has quietly breached a number of taboos by fully embracing the use of space for security purposes. The change has been more psychological than substantive: extant space assets, which often take decades to move from drawing boards to orbits, have naturally changed very little. However, the new course of discussions in Europe points to potentially significant changes in the future. EU member states are now openly talking about using common civilian assets for military purposes, and about managing the next generation of military space assets at a European, rather than national, level. A November 2004 EU Council document on European Space Policy discusses the possibility in the long term of launching military space programmes 'supported or possibly managed by the [European Defence Agency (EDA)] on behalf of member states'.[7] Already, the new emphasis on exploring the use of EU space assets for security has translated into the establishment of a Space Assets Group within the European Capabilities Action Plan (ECAP) process,[8] aimed at identifying and filling gaps in military software and hardware programmes.

The driving forces behind the growing EU role in space are both military and political. As for the first category, space itself is becoming indispensable for modern security and military operations. European member states have been pooling their military assets on a number of levels, and a move towards cooperation in space grew out of these efforts. In one example, space will play a role in sourcing and relaying data in real time at virtually every step of the deployment of the EU's new battle groups: from identification of a threat (surveillance/early warning) to operational planning (observation/surveillance) to deployment (communication/satellite navigation) to operation (satellite navi-

[5] For a broad introduction to satellite terminology, technology and applications see the chapter 'Military satellites', *SIPRI Yearbook 1977* (Almqvist &Wessell: Stockholm, 1977); and Jasani, B. (ed.), *Outer Space: A New Dimension of the Arms Race* (Taylor & Francis: London, 1982). For a comprehensive history of the development of military space technology see the relevant chapters in the *SIPRI Yearbooks 1973–92*.

[6] European Commission, 'European space policy', Brussels, 2005, URL <http://europa.eu.int/comm/space/themes/intro_space_en.html>.

[7] Council of the European Union, 'European space policy: ESDP and space', document 11616/3/04 REV3, Brussels, 16 Nov. 2004.

[8] European Commission (note 2).

gation/communication/observation). The associated work overseen by the EU Military Committee and the EDA to identify military needs and coordinate the development of capabilities has naturally included a closer look at how existing and future space assets can help support EU military efforts.[9]

The use of satellite technology for civilian purposes, such as earth imaging, meteorology and communications, also feeds into military operations. These and other applications of space-based data are also relevant for the EU's development of non-military policies, for example, civil emergency response, border management, and safety of transport and communications. At the same time, moves towards developing EU space assets for military purposes must not be viewed in a purely technical light. Space, while important for modern warfare, is not at the top of the list of EU capability priorities, which is dominated by more immediate needs such as airlift, sealift and transport helicopters. Of the 64 categories listed in the Council's May 2005 Capability Improvement Chart,[10] only five directly involve space; and even in those categories (such as imagery and early warning), non-space alternatives exist.

Interest in the EU's use of space for military purposes is driven in equal measure by political imperatives set by member states. Common technological projects, of which space is just one example, have become a symbol of collective European achievement and, as such, a driver for further policy development. Projects like Galileo and Global Monitoring for Environment and Security (GMES) continue the tradition of European technology projects such as the CERN particle accelerator:[11] they help generate support for further and deeper cooperation among member states. When space and security are used as symbols of integration, commonality of approach is just as important as the substance of the project itself. At the same time, the growing military need for space helps build the case for stronger EU involvement. Thus, the political and military imperatives are inseparable.

Last but not least, use of space by the EU for security is heavily influenced by the desire in Europe for strategic autonomy. The EU today has become both more active in foreign and security policy and more likely to act independently of the USA. The EU's civilian and military planning activities as well as its growing range of operations require extensive use of information gleaned from space. However, a declining proportion of EU missions abroad now involve day-to-day cooperation with NATO and the USA, which have provided the lion's share of intelligence and other space support needed in the past. Current EU needs are met by national European and non-European assets, but the limitations of these are increasingly at odds with the Union's

[9] European Commission (note 2).

[10] The Capability Improvement Chart is a twice-yearly report prepared by the Council of the European Union in order to monitor member states' progress in fulfilling EU military readiness goals. Council of the European Union, 'European Security and Defence Policy—Capability Improvement Chart I/2005', 23 May 2005, URL <http://www.eu2005.lu/en/actualites/documents_travail/2005/05/23pesd>.

[11] Pasco, X., 'Space for security: a European perspective', Paper presented at the conference Space: Key to Europe's Security and Defence Capabilities?, Wilton Park, 7 Sep. 2005.

foreign policy ambitions. This realization, too, is fuelling the drive to shift more responsibility for the use of space for security purposes to the EU.

Transatlantic relations

The evolution of EU plans for space brings both benefits and difficulties to the relationship with the USA. For example, since capabilities such as imagery are in high demand, more European assets generate more options to which the USA—either directly or through NATO—has a measure of access. However, Europe's ability to independently verify US satellite intelligence potentially reduces US influence over European foreign policy choices. Given the fallout from the faulty intelligence on Iraqi weapons of mass destruction, this is not a secondary consideration for either Europe or the USA.

More immediately, the plans for the European Galileo satellite navigation system (discussed below) have already proved contentious. The USA raised two issues in particular. First, the original frequency planned for Galileo's highest-quality signal, the Public Regulated Service (PRS), overlapped with the new M-signal of the US military's Global Positioning System (GPS). This posed a difficulty for the US Department of Defense (DOD): if Galileo were used against the USA in a future conflict, the overlap would impede its ability to jam all signals except its own encrypted GPS code.[12] After years of sometimes tense negotiations, in June 2004 the EU agreed to move the encrypted PRS signal from the original frequency band.

The second US concern focused on preventing Galileo technology from falling into the wrong hands. The participation of China, the largest non-European country involved in the Galileo project, raised particular concerns in the USA. The EU vowed to scrutinize the security implications of Galileo contracts with the greatest care. It is now proceeding on two levels: limiting non-EU member states' access to Galileo's most sensitive signals, and creating mechanisms for interrupting those signals if they are used against EU interests. A July 2004 regulation by the Council of the European Union created a supervisory authority including a special Safety and Security Committee with a mandate 'to ensure the safety and reliability of the system against attacks (malicious or otherwise) and to prevent its use for purposes that run counter to the interests of the EU and its member states'.[13] The supervisory authority scrutinizes each of Galileo's features (such as its range of signals) and communicates with outside countries regarding the security implications. EU officials have repeatedly said that China will not gain access to PRS technology.

A separate Joint Action of the European Council also gave the Secretary-General of the Council, Javier Solana, the right to disable Galileo 'in exceptional cases, where the urgency of the situation is such that it requires immedi-

[12] Biever, C., 'US and Europe to combine satellite navigation', *New Scientist*, 24 June 2004, URL <http://www.newscientist.com/article.ns?id=dn6068>.

[13] Council Regulation (EC) no. 1321/2004, *Official Journal of the European Union*, L246 (12 July 2004), URL <http://europa.eu.int/eur-lex/en/archive>.

ate action'.[14] While the regulation refers specifically to threats against EU member states rather than allies, the legislation does in theory create a tool for blocking unauthorized use of Galileo against US interests.

III. European organizations

The European Space Agency

The 17-member ESA, an intergovernmental agency established in 1975, is responsible for coordinating the official European space programme.[15] ESA is independent from the EU, although the two organizations have signed a framework agreement for cooperation (see below). The Agency's work includes research into the earth sciences, the near-space environment, the solar system and deep space; developing satellite-based technologies and services; and promoting Europe's space industry. ESA is also the leading European space launch service group: it builds the Ariane rocket series used for commercial and civil payloads and is a partner with European firm EADS and the Russian Space Agency on the (Russian-built, but jointly owned) Soyuz rockets. ESA further manages Europe's primary launch facility, the Guiana Space Centre at Kourou, French Guiana.

ESA's budget, funded by its member states, was set at €2.9 billion for 2006, and its staff numbers at about 1900.[16] ESA has four associated centres, each of which has different responsibilities: (*a*) the European Space Research and Technology Centre (ESTEC), which is the design hub for most ESA spacecraft and technology development, based in Noordwijk, the Netherlands; (*b*) the European Space Operations Centre (ESOC), responsible for controlling ESA satellites in orbit, based in Darmstadt, Germany; (*c*) the European Astronaut Centre (EAC), which trains astronauts for future missions, based in Cologne, Germany; and (*d*) ESA's European Space Research Institute (ESRIN), based in Frascati, Italy. ESRIN's responsibilities include collecting, storing and distributing earth-observation satellite data to ESA's partners, and acting as the Agency's information technology centre.[17]

ESA's activities run the gamut from launch technology research to participation in the International Space Station (ISS) and planetary exploration. ESA's current launch fleet consists of three primary rockets: (*a*) the heavy-lift

[14] Council Joint Action 2004/552/CFSP, *Official Journal of the European Union*, L246 (20 July 2004), URL <http://europa.eu.int/eur-lex/en/archive>.

[15] ESA member states are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK. Canada, the Czech Republic and Hungary also participate in some projects under cooperation agreements, with the latter 2 countries preparing for full membership. ESA further has a framework cooperative agreement with the Russian Space Agency and is increasingly involved in cooperative projects with the Chinese Space Agency. ESA was set up in 1975 as a successor to the European Space Research Organisation (ESRO) and the European Launcher Development Organisation (ELDO), both established in 1964.

[16] European Space Agency, 'ESA facts and figures', URL <http://www.esa.int/esaCP/GGG4SXG3AEC_index_0.html>.

[17] European Space Agency (note 16).

Ariane 5 ECA, successfully launched by Arianespace (ESA's contractor for space launches) for the first time in February 2005, and capable of lifting 6–10 tonnes to geosynchronous orbit (GEO) and 21 tonnes to low earth orbit (LEO);[18] (*b*) the jointly owned Soyuz medium launch vehicle, capable of lifting 3 tonnes to GEO and which is due to enter into ESA service in 2007; and (*c*) the small launch vehicle Vega, capable of lifting 1.5 tonnes to LEO and currently planned for first launch in 2007.[19]

In December 2005 the ESA ruling council approved a budget of €8.26 billion—nearly the entire €8.8 billion proposed by ESA—to fund the planned ESA programme in 2006–2010.[20] The ministers on the council also approved a resolution to give preference to European-built launchers for ESA space launches, although they did not rule out non-European options.[21]

The European Union

ESA cannot be the vehicle for developing EU space policy as such, given the different memberships. Two ESA members—Norway and Switzerland—are not members of the EU, while none of the 10 countries that recently joined the Union is in ESA (although the Czech Republic and Hungary cooperate in certain ESA projects and will eventually become members). In November 2004 all 27 EU and ESA countries met at the first European Space Council, in Brussels. At that meeting, the exploitation of space was identified as a shared competence of the EU. A formal European Space Policy has, however, yet to be established, although it was debated in 2005 on the basis of a discussion paper prepared by the British EU Presidency.[22]

In November 2003 the European Commission presented a first White Paper on European Space Policy with the intention of providing a point of reference for the development of EU space policy. It included an action plan containing a list of recommended actions. The White Paper represented the first clear articulation of the relationship of space to Europe's common security and defence policy, as well as outlining the key space-related requirements necessary for European security. It stated:

Space technology, infrastructure and services are an essential support to one of the most rapidly evolving EU policies—the Common Foreign and Security Policy including European Security and Defence Policy. Most space systems are inherently cap-

[18] GEO is about 36 000 km in altitude, where most communications satellites orbit. LEO is generally defined as orbits up to 1000 km in altitude, where many earth-observation satellites orbit.

[19] European Space Agency, 'The first stone for Vega at Europe's Spaceport', 4 Nov. 2005, URL <http://www.esa.int/SPECIALS/Launchers_Home/SEM4AU0A90E_0.html>; 'ESA proceeds with Vega launch vehicle', *SPACEandTECH*, 8 Jan. 2001, URL <http://www.spaceandtech.com/digest/sd2001-01/sd2001-01-005.shtml>.

[20] De Selding, P. B., 'Ministers approve 8.26 billion euro package for ESA', *Space News*, 12 Dec. 2005, p. 6.

[21] Strohecker, K., 'Europe increases funds for space research', MSNBC, URL <http://www.msnbc.msn.com/id/10352128/from/RL.2>; and De Selding (note 20).

[22] European Commission, 'Third Space Council focuses on GMES', Press release, 28 Nov. 2005, URL <http://europa.eu.int/comm/space/news/article_2291_en.html>.

able of multiple use and the credibility of the above polices will be significantly strengthened by taking better advantage of space applications. EDSP needs access to suitable space-based systems and services, both because of their strategic capabilities and because they confer a capacity for autonomous decision-making.[23]

Following publication of the White Paper on 11 November 2003, the Commission and ESA agreed on respective EU and ESA roles and the planned cooperation between them. The division of labour places the EU as the political driver for setting Europe-wide priorities, promoting and enabling cooperation, providing research funding and ensuring a favourable EU-wide regulatory regime governing space activities. ESA, by contrast, is to develop space technology to meet EU-wide requirements, spearhead innovative research and advise the EU on requirements to ensure access to space services.

The White Paper further recommended the establishment of a Panel of Experts on Space, Security and Defence to examine European capabilities. The panel was launched in June 2004 and its final report was published in March 2005. The report made it clear that Europe still has a long way to go in developing a common approach to space for security and military purposes. It identified three primary gaps in capability: (*a*) lack of a common agreed architecture and interface standards for the user ground segment of earth-observation systems;[24] (*b*) lack of European space surveillance capabilities; and (*c*) lack of very high or high data rate mobile telecommunications.[25]

The panel highlighted a number of improvements in space capabilities that are required by the EU, including: improved performance and interoperability of earth-observation systems; improved collection of critical data from earth-observation systems, communications satellites, signals intelligence satellites, space-based early-warning satellites, and positioning and navigation systems; improved access to, and dissemination of, data from space surveillance systems; and harmonization of operational standards for all satellite systems.[26] The panel recommended that a new forum be established to tackle these issues. Its main tasks would be: (*a*) establishing a network between the users;[27] (*b*) determining how existing capabilities could be considered in multiple-use systems to fulfil these needs; (*c*) refining capability gaps; (*d*) translating user needs into requirements; and (*e*) assessing how space capabilities can match the requirements.[28]

[23] 'White Paper, Space: a new European frontier for an expanding the Union; an action plan for implementing the European space policy', European Commission document COM(2003)673, Brussels, 11 Nov. 2003, URL <http://europa.eu.int/comm/space/whitepaper/pdf/whitepaper_en.pdf>.

[24] The user ground segment is the land-based technical facilities that provide information to the users of the satellite system.

[25] European Commission (note 2), pp. 35, 38–39.

[26] European Commission (note 2), pp. 38–39.

[27] Users of satellite systems for security purposes include critical infrastructure services such as transportation authorities, authorities responsible for civil protection and search and rescue, police and intelligence services, border surveillance authorities, crisis management teams, and humanitarian aid organizations and governmental authorities. See European Commission (note 2), pp. 18–19.

[28] European Commission (note 2), pp. 41–42.

Europe's collective space ambitions, both civil and military, continue to be plagued by budgetary troubles as EU member states dispute priorities for collective research in the medium-term planning period 2007–2013.[29] In the spring of 2005 the European Commission released the seventh framework programme, which outlined proposed EU research efforts and a funding package for that period. In that proposal, the Commission called for €3.96 billion to be spent on security and space, which was the first occasion that Commission security and space funding had been lumped into a single category. However, officials have said that the funding will again be split into roughly equal parts. The proposal would represent an increase of the Commission's space budget from 2006, which was set at €235 million.[30] As of November 2005, however, no final decision had been made on the allocations under the seventh framework programme because of a major disagreement among EU member states about the Commission's priorities.[31] Consequently, the Commission has been unable to fulfil its promises of funding for collective programmes.

The Commission has, however, funded at least one new programme under its Preparatory Action in the field of Security Research (PASR) effort for 2004–2006. The Advanced Space Technologies to Support Security Operations (ASTRO+) programme, funded largely by the EU budget but with input from a number of industry partners, is studying how earth-observation, reconnaissance, navigation and telecommunications satellites can improve European military operations, particularly operations abroad. In part, the aim of the project is to convince EU security officials of the positive role that space capabilities can play in military operations.[32] The ASTRO+ effort is also aimed at developing a research and technology innovation roadmap for security-related space capabilities. The project is estimated to cost €2.9 million.[33] The initial plenary session of ASTRO+ took place on 31 August 2005 in Paris.[34]

European institutions, programmes and projects

While there is currently no single body that gives direction to space policy at the European level, there are a number of collective institutions, programmes and projects in which most or all EU member states participate.

[29] European Commission, 'Proposal for a decision of the European Parliament and of the Council concerning the seventh framework programme of the European Community for research, technological development and demonstration activities (2007 to 2013)', COM (2005) 119 final, 6 Apr. 2005, URL <http://europa.eu.int/comm/research/future/basic_research/brp_era_en.htm>.

[30] De Selding, P. B., 'European Commission unveils space spending plan', *C⁴ISR*, 25 Apr. 2005, URL <http://isr.dnmediagroup.com/story.php?F=807586>.

[31] De Selding, P. B., 'ESA seeks major earth-observation funding', *Space News*, 17 Oct. 2005, p.12.

[32] Institute of International Affairs, 'Advanced space technologies to support security operations: ASTRO+', Rome, 3 Feb. 2005, URL <http://www.iai.it/sections_en/ricerca/difesa_sicurezza/ASTRO/ASTRO+.asp>.

[33] 'Advanced space technologies to support security operations', Grant Agreement no. SEC4-PR-00960, URL <http://europa.eu.int/comm/enterprise/security/doc/astro_en.pdf>.

[34] European Commission, 'Space and European security', Brussels, 2005, URL <http://europa.eu.int/comm/space/themes/security_en.html>.

The European Organization for the Exploitation of Meteorological Satellites

The 18-state European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) is an intergovernmental organization that serves as Europe's meteorological satellite agency.[35] It was founded in 1986. Weather forecasting data and images from the EUMETSAT fleet of Meteosat satellites are provided to the national meteorological services of member and partner countries, which in turn provide funding. EUMETSAT works with ESA, and the two agencies often jointly fund projects. EUMETSAT is also a key player in the ESA–European Commission GMES programme.

The European Union Satellite Centre

The European Union Satellite Centre (EUSC) became operational in January 2002 as an agency of the Council of the European Union under a July 2001 Council joint action.[36] Located in Torrejón de Ardoz, Spain, the centre was established as the Western European Union (WEU) Satellite Centre, but was adapted to its new status and transferred to the EU in 2001 as part of the launch arrangements for the ESDP. The EUSC's primary mission is to provide the EU with imagery analysis and data from European earth-observation satellites to support the CFSP and the ESDP. Data provided by the centre can be used by the various EU bodies, EU member countries, third-party countries and international organizations to support: (*a*) general security surveillance; (*b*) humanitarian and rescue, peacekeeping, crisis management and peacemaking (the so-called Petersberg Tasks);[37] (*c*) treaty verification; (*d*) arms and proliferation control efforts; (*e*) maritime surveillance; and (*f*) environmental monitoring.[38]

In practice, the work of the centre is supervised by the EU High Representative for the Common Foreign and Security Policy, Javier Solana. Among the EU users of EUSC imagery are the Commission's Directorate-General for External Relations as well as the EU Military Staff and Situation Centre within the Council apparatus. Despite its clear mandate vis-à-vis Europe's collective security, the EUSC's role in GMES and in coordinating imagery from national military assets remains somewhat hazy. The centre's budget is only some €10 million a year and its staff is just 20 strong, at a time when demand for imagery analysis is growing.[39] The EUSC is largely forced to pay

[35] EUMETSAT members are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey and the UK. Another 11 countries have signed cooperation agreements with the agency: Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Serbia and Montenegro, Slovakia and Slovenia.

[36] European Union Satellite Centre, 'The Centre', URL <http://www.eusc.org/centre.html>.

[37] The Petersberg Tasks are the range of crisis management missions first agreed by the WEU in 1992 at the Hotel Petersberg near Bonn, Germany, and later incorporated into the EU Treaty and ESDP funding documents.

[38] European Union Satellite Centre, 'Mission', URL <http://www.eusc.org/html/centre_mission.html>.

[39] Tigner, B., 'EU tries to assess compatibility problems: fixing a disconnect', *Defense News*, 31 Oct. 2005, URL <http://www.defensenews.com>.

for available imagery from civil and commercial systems.[40] The EUSC's agreement with France in 2003 on sharing data from the French military imagery satellite, Helios I, has yet to be put into force. Meanwhile, a French-led coalition that is funding the follow-on Helios II system has reached an internal agreement to share a limited amount of that system's data with the EUSC, but a final accord may prove difficult.[41] The EUSC is also exploring how it might provide analysis to the EU Military Committee.[42]

Galileo

Galileo is arguably the most ambitious of the European security-related collective space programmes. This effort to develop an alternative to the US GPS and the Russian GLONASS satellite navigation and positioning systems was officially launched on 26 May 2003, by the EU and ESA, although studies of such a network began as early as 1998. Galileo is designed primarily for civilian use and will be civilian controlled, in contrast to GPS, which—even though its civilian usage has exploded over the past decade—is owned and operated by the US military. However, Galileo's signals do offer a wide range of security applications, and at least some governments have invariably regarded it as a military tool. In fact, US and British concerns that Galileo represented a misallocation of European military resources held up the project for several years. Galileo, in effect, became part of a wider transatlantic debate on the need for Europe to improve its military capabilities.

Galileo is intended to provide users with: greater precision than is currently available from GPS or GLONASS; improved coverage of satellite signals at northern latitudes; and guaranteed availability and reliability for customers even in times of war.[43] In addition, Galileo's signals will be compatible with both GLONASS and GPS to provide enhanced services for specific applications.

Galileo is described by EU and ESA officials as a wholly civilian system, but as noted above it will have military applications (although European militaries have been loath to specify them) as well as applications for homeland security and public security, such as firefighting. GPS, for example, is currently widely used by European and US militaries to steer precision-guided munitions to their targets and for navigation purposes.

Development of the network of 30 satellites (27 active and three spares), with an estimated cost of €1.1 billion, is being financed jointly by ESA and the European Commission. Private industry is pledged to provide two-thirds of the approximately €2.5 billion required to deploy the network, recouping this

[40] Fiorenza, N., 'French, German sats to widen intelligence capabilities', *C⁴ISR*, 6 Dec. 2005, URL <http://isr.dnmediagroup.com/story.php?F=328012>.

[41] De Selding, P. B., 'Red tape hinders EU military space cooperation', *C⁴ISR*, 12 May 2005, URL <http://isr.dnmediagroup.com/story.php?F=844999>.

[42] Tigner, B., 'EU tries to assess compatibility problems: fixing a disconnect,' *Defense News*, 31 Oct. 2005.

[43] European Space Agency, 'What is Galileo?', 17 Mar. 2005, URL <http://www.esa.int/esaNA/GGGMX650NDC_index _0.html>.

investment by charging for services outside the free core service (designed for general public applications such as navigation systems in vehicles); the remainder will be provided by ESA and the EU. The development programme is managed by the Galileo Joint Undertaking, which includes representatives of the European Commission and ESA, but ultimately may include private companies and the European Investment Bank.[44] In addition, a number of international partners—China, India, Israel, Morocco, Saudi Arabia and Ukraine—are contributing funds in exchange for data. Talks are also ongoing with Argentina, Australia, Brazil, Canada, Chile, Souh Korea, Malaysia, Mexico, Norway and South Korea.[45]

The network is expected to provide an array of services with different levels of accuracy.[46] Aside from an open service and commercial pay-for-use service, the functions most relevant for security will be: an encrypted PRS reserved for EU governments and public security authorities, such as police forces, intelligence services and militaries; a safety-of-life service aimed at public safety applications such as air traffic control and shipping; and a search and rescue service able to detect and broadcast signals globally from the international search and rescue satellite-aided tracking system, COSPAS-SARSAT,[47] and thus to serve as part of the Global Maritime Distress Safety System (GMDSS).

It was originally planned that Galileo would be fully deployed and operational by 2008. However, the schedule has slipped considerably owing to disputes among the European partners over funding, work shares and the location of the network's ground facilities. The first Galileo test satellite, called GIOVE-A (Galileo In-Orbit Validation Element), was launched on 28 December 2005; the second, GIOVE-B, is scheduled to be launched in the spring of 2006. Both are designed to demonstrate basic technologies, including atomic clocks and the simultaneous use of two signal transmission channels.[48] Four more satellites are scheduled to be launched in 2008 to complete the testing phase, which was originally to have been completed by 2006.[49] It is still unclear when the full network of satellites will be deployed and operational.

[44] European Union Directorate-General for Energy and Transport, 'Galileo European satellite navigation system', URL <http://europa.eu.int/comm/dgs/energy_transport/galileo/programme/index_en.htm>.

[45] Spongenberg, H., 'EU unveils first Galileo satellite', Associated Press, 9 Nov. 2005, URL <http://abcnews.go.com/Technology/wireStory?id=1296543>.

[46] European Space Agency, 'Galileo services, Galileo specifications', URL <http://www.esa.int/esaNA/SEMTHVXEM4E_ galileo_0.html>.

[47] COSPAS-SARSAT was founded in 1988 by Canada, France, the Soviet Union and the USA. See URL <http://www.cospas-sarsat.org/MainPages/indexEnglish.htm>.

[48] De Selding, P. B., 'ESA's Galileo system faces key milestones over next 12 months', *Space News*, 28 Nov. 2005, p.10; and European Space Agency, 'First Galileo signals transmitted by GIOVE-A', Press release, 12 Jan. 2006, URL <http://www.esa.int/SPECIALS/Galileo_Launch/SEMQ36MZCIE_0.html>.

[49] European Space Agency, 'Europe's first Galileo satellite named "Giove"', Press release, 11 Nov. 2005, URL <http://www.spaceflightnow.com/news/n0511/11giove>; and European Space Agency (note 46).

Global Monitoring for Environment and Security

The massive and highly complex GMES earth-observation programme grew out of a 1998 plan devised by ESA and the EU to improve Europe's capabilities in environmental monitoring.[50] It also has direct security and military applications, specifically tasked to support the CFSP and the ESDP. GMES could markedly improve the capacity of European militaries to independently generate mapping, weather prediction and targeting data. According to a February 2004 EU–ESA report, GMES will be used 'in support of conflict prevention and crisis management: monitoring of international treaty [treaties] for preventing the proliferation of nuclear, chemical and biological weapons; monitoring population; assessment of sensitive areas for early warning; [and] rapid mapping during crisis management'.[51]

While there has been an EU decision to support GMES and an implementation plan drawn up, many uncertainties dog the programme. A key question is what role national satellites, such as the French SPOT, will play; even stickier is the question of what data from military satellites, such as France's Helios or Germany's SAR-Lupe, will be shared and how. Funding is also uncertain, with no Commission budget established as of the end of 2005. However, ESA found strong support during its December ministerial meeting: ESA had proposed spending €200 million on the programme over the period 2006–2010, but ministers pledged a total of €235 million.[52]

The current GMES action plan was approved in November 2001.[53] It consists of two phases: an 'Initial Period', 2001–2003, and an 'Implementation Period', 2004–2008. In parallel, the ESA–EU high-level framework agreement that entered into force on 28 May 2004 identifies GMES as one of its key priorities for short-term action.[54] The first goal of the GMES implementation phase—reiterated by a ministerial-level meeting of the Space Council on 28 November 2005[55]—is to launch three so-called fast-track services by 2008.

[50] A call for a collective European earth-observation network first came from a high-level ESA meeting at Baveno, Italy, in May 1998: 'Global monitoring for environmental security: a manifesto for a new European initiative', also known as the Baveno Manifesto. See *GMES Forum*, URL <http://www.gmesforum.com/workingfor.htm>. GMES is intended to be a European contribution to the Global Earth Observation System of Systems, launched by the USA in 2003 at the Earth Observation Summit to improve sharing of imaging and data for climate research and to monitor and respond to natural disasters.

[51] European Union and European Space Agency, 'Global Monitoring for Environment and Security: final report for the GMES initial period (2001–2003)', Brussels, 10 Feb. 2004, URL <http://www.gmes.info/115.0.html>, p. 18.

[52] De Selding (note 20), p. 6.

[53] Management of GMES is provided by 2 separate bodies: the GMES Advisory Council and the GMES Programme Office. The Advisory Council serves as a coordinating body with national governments and the various user communities. The Programme Office consists of national experts and officials of involved international organizations, including the European Commission and ESA. See URL <http://www.gmes.info>.

[54] 'Earth and space—Europe sets its sights on GMES', *RTDinfo*, no. 44 (Feb. 2005), URL <http://europa.eu.int/comm/research/rtdinfo/44/01/print_article_2027_en.html>.

[55] The Space Council is a joint and concomitant meeting of the ESA Council and the EU Competitiveness Council at the level of ministers. The 28 Nov. 2005 meeting was the third such annual meeting and focused on GMES issues. For a report of the meeting see European Commission (note 22).

These are the Emergency Management Service, aimed at reinforcing Europe's capacity to predict and respond to disasters; the Land Monitoring Service, providing information on land use and land cover; and the Marine Service, providing information on the marine environment.[56]

Additional services are to be added between 2009 and 2013. According to ESA sources, the GMES implementation budget was set at €2.7 billion for the space component and its associated ground infrastructure, with another €150 million per year estimated for the services segment.[57] The total cost over a 10-year timeframe is estimated at €5 billion.[58] Currently, it is agreed that ESA will fund the first segment of the programme, running from 2006 to 2012, 'with the possibility of incorporating [a European Commission] contribution as it becomes available'; the second segment, 2008–2013, is expected to be co-funded.[59]

Besoins Opérationnels Communs

In 2002 Belgium, France, Germany, Italy and Spain sought to develop Common Operational Requirements for a European Global System of Observation by Satellite—usually known as Besoins Opérationnels Communs (BOCs). Greece joined the effort in 2003. The process is intended to define the elements of a dedicated, independent European military earth-observation system to support future peacekeeping missions and joint operations. The sponsoring states have said that the EU will be granted access to the network.[60] A key obstacle for BOCs, however, has been developing ground systems that allow participating governments to link into each other's satellite networks, and protocols for what data would be exchanged.[61] Reflecting the sensitivity of this last point, a French military expert has noted that 'the EU will not own the system, because strategic intelligence is not shared, it is exchanged'.[62]

The proposed European space surveillance system

While several European countries operate radar and optical telescopes to locate and track objects orbiting in space, Europe is fundamentally dependent on the USA for the data necessary for detection and routine tracking. The US Air Force's Space Surveillance Network is the only global system capable of providing more or less comprehensive tracking data on satellites and space debris,

[56] 'Global monitoring for environment and security: first concrete steps', *SpaceRef*, 16 Nov. 2005, URL <http://www.spaceref.com/news/viewsr.html?pid=18704>.

[57] European Commission, 'Volker Liebeg, ESA's earth-observation head, speaks about GMES', European Space Policy, 3 Feb. 2005, URL <http://europa.eu.int/comm/space/news/article_2048_en.html>.

[58] 'Earth and Space—Europe sets its sights on GMES', *RTDinfo*, no. 44 (Feb. 2005), URL <http://europa.eu.int/comm/research/rtdinfo/44/01/print_article_2027_en.html>.

[59] European Space Agency, 'Discovery and competitiveness: the keywords in Europe's policies and programmes for space', 28 Nov. 2005, URL <http://www.esa.int/esaCP/Pr_2_2005_i_EN.html>.

[60] De Selding, P. B., 'Europe pools space spy efforts', *Defense News*, 1–7 July 2002, p. 18.

[61] European Commission (note 2), p. 33.

[62] Quoted in De Selding, P. B., 'One European space system unlikely for foreseeable future', *Space News*, 11 Oct. 2004, <http://www.space.com/spacenews/archive04/futurearch_101804.html>.

and such data are used to 'prime' current European surveillance assets. There is growing European interest in an independent space surveillance capability both for security and military purposes and to better predict, and avoid, collisions with dangerous space debris. Most recently, the Panel of Experts on Space and Security asserted in its March 2005 final report: 'The lack of a European Space Surveillance Capability is identified as a serious capability gap that must be one of the priority [priorities] of the future European Space Programme. Beyond the security of the European space assets, this system must contribute to the control of the application of International Space Treaties and to the evaluation of the activities of the space-faring nations or organizations.'[63]

The European Space Operations Centre laid out a design study for a future independent European Space Surveillance System in 2002 and subsequently awarded a contract to a team led by France's Office National d'Études et de Recherches Aérospatiales (ONERA, National Aerospace Research Centre), to provide options for achieving such a system.[64] The study, presented in 2004, found that a network able to provide detection and tracking capabilities roughly equivalent to the USA's would cost around €330 million to develop by 2015.[65] Such a network, although requiring several new sensors, would primarily be based on linking current European assets. Despite support from ESA, the European Commission and France, no specific development plan has yet been put forward, and the issue is highly sensitive politically.

IV. Major national programmes

France, Germany, Italy and the UK are the dominant European national players in space, but France is the undisputed leader. France's Centre National d'Études Spatiales (CNES, National Centre for Space Study) is a civilian agency that also handles military space programmes via cooperation with the Ministry of Defence (MOD). France's space budget was about €1.7 billion in 2005—including its contribution to ESA—the largest of any European state.[66] Of all the European countries only France has a dedicated military space budget.

While joint (bilateral or multilateral) projects are becoming more common, mainly because of the need for cost sharing, there is no mechanism to develop common military space requirements and no Europe-wide apparatus for sharing current military capabilities. Instead, there exists a patchwork of collective European, national, bi-national and multinational projects that often fail to work together effectively, leaving major gaps in European military space capabilities.

[63] European Commission (note 2), p. 36.

[64] Donath, T. et al., 'European space surveillance system study—final report', Document no. DPRS/N/158/04/CC, ESOC, 12 Oct. 2004, p. 6.

[65] Donath et al. (note 64), pp. 2, 18, 23.

[66] Center for Non-Proliferation Studies, 'Current and future space security: France', Monterey, Calif., 2006, URL <http://cns.miis.edu/research/space/france>.

Total European spending on military space is estimated at about €1 billion per year, versus about €5.5 billion spent annually on civil space projects.[67] The USA spends six times more than Europe on space and 30 times more on military space.[68]

European national space projects related to security and defence include earth-observation systems, satellite communications networks and very limited space surveillance assets. Of the other primary assets required for a robust military space capability—signals intelligence and missile early warning—the only ongoing efforts are planned French experiments.

Earth-observation assets

While France currently operates the only dedicated military earth-observation satellites, the Helios series (the current generation, Helios II, is designed to provide a day-and-night capability, with an estimated best resolution of 0.5 metres),[69] that is set to change over the next five years. The British MOD has orbited a low-cost, experimental microsatellite, TopSat, and is considering a follow-on programme. In 2006 Germany will launch SAR-Lupe, a synthetic-aperture radar (SAR) constellation of five satellites for military reconnaissance, expected to provide a best resolution of 0.5 m.[70] In addition, Italy is planning a dual-use cooperative venture with France to replace the venerable SPOT civilian system, under a programme called ORFEO (Optical and Radar Federated Earth Observation). France will provide Pleiades, a two-satellite optical military reconnaissance system;[71] and Italy will provide the dual-use Constellation of Small Satellites for Mediterranean Basin Observation (COSMO-SkyMed), comprising four high-resolution-radar satellites.[72]

The trend in Europe towards embracing earth-observation satellites for military applications is accompanied by improvements in the capabilities of such systems to allow for their use as tactical battlefield assets. Earth-observation satellite systems are used by militaries to make detailed maps, monitor troops in the field (both friendly and enemy), look for suspicious activities (such as the construction of nuclear facilities), and provide geo-

[67] New Defence Agenda, 'Tracking European space policies—have we got the civil/military balance right?', <http://www.forum-europe.com/publication/NDA_SOD_18Oct2005.pdf>.

[68] New Defence Agenda (note 67), p. 7.

[69] De Selding, P. B., 'France debuts Helios IIA recon satellite images', *C⁴ISR*, 29 Mar. 2005, URL <http://isr.dnmediagroup.com/story.php?F=750641>.

[70] Sell, D., OHB-System AG, Communication with the authors, 28 Nov. 2005; Embassy of France in the USA, 'Fifth Franco-German Council of Ministers, Statement by the Franco-German Defence and Security Council', 26 Apr. 2005, URL <http://www.ambafrance-us.org/news/statmnts/2005/franco_germany_defense042605.asp>; De Selding, P. B., 'German military prepares for 2005 SAR-Lupe deployment', *C⁴ISR*, URL <http://isr.dnmediagroup.com/story. php?F=327973>; and OHB-System AG, 'SAR-Lupe', URL<http://www. ohb-system.de/Security/sarlupe.html>.

[71] France and Italy signed a memorandum of understanding in Jan. 2001, under which each country would pay for its own space system but the costs of ground systems to use the satellites would be shared. See 'Pleiades (high resolution optical imaging constellation of CNES)', *eoPortal*, URL <http://directory.eoportal.org/pres_PleiadesHRHighResolutionOpticalImagingConstellationofCNES.html>.

[72] Alenia Spazio, 'Cosmo-Skymed', URL <http://www.alespazio.it/earth_observation_page.aspx?IdProg=23>.

graphic data to missiles and other weapon systems for use in targeting and so on. To be useful in a conflict or crisis, high-resolution images must be taken repeatedly at the shortest time intervals possible, and data relayed and analysed as quickly as possible. All these capabilities are being sought under planned European programmes.

As noted above, the key political question that remains unresolved is whether and how these assets, including GMES, will be integrated into collective European operations. There continues to be strong antipathy among European military leaders towards sharing imagery and analysis.

Satellite communications

Communications satellites are of increasing importance to militaries around the world for global communication and data transfer, allowing an unprecedented degree of networking of forces and commanders. In the short term, European governments and institutions, including NATO, will have access to at least 20 different commercial, military and dual-use communications satellite systems.[73]

Most of the world's militaries rely on commercial satellite networks for the bulk of their communications needs. However, commercial satellites do not provide the same level of security (via encrypted signals, component hardening, anti-jam techniques, etc.), as those built to military specifications; thus several European countries have chosen to pursue dedicated military satellites. The UK currently operates five Skynet IV satellites, and two Skynet V satellites will be launched in 2006/2007.[74] Italy has one SICRAL satellite with an upgraded version, SICRAL 1B, to be launched in early 2007 and the more capable SICRAL 2 by 2009.[75] France's Syracuse IIIA was launched in October 2005 and Syracuse IIIB will be in orbit in 2006.[76] Spain's planned SPAINSAT is also due for launch in 2006, and XTAR-EUR, a US–Spanish satellite, was launched in February 2005.[77] Germany plans to have two SATCOMBw Stufe 2 satellites in orbit by 2008.[78] NATO's two operational NATO IV satellites are being replaced by NATO SATCOM Post 2000, which comprises services from three SKYNETS, one Syracuse and one SICRAL under agreements with France, Italy and the UK.[79]

[73] Donath et al. (note 64), p. 30.

[74] Donath et al. (note 64), p. 30.

[75] Donath et al. (note 64), p. 30; Dutch Space, 'Sicral', URL <http://www.dutchspace.nl/pages/business/content.asp?id=200&LangType=1033>, p. 31; and European Commission (note 2).

[76] Donath et al. (note 64), p. 30; and 'Syracuse III', Alcatel Space, May 2003. URL <http://www.alcatel.com/space/pdf/telecom/syracusegb.pdf>. In addition, the older Syracuse II remains operational.

[77] Donath et al. (note 64), p. 30; and Loral Space and Communications, 'XTAR-EUR enters full commercial service, beginning a new era of military satellite communications', Press release, 4 Apr. 2005, URL <http://www. loral.com/inthenews/050404.html>.

[78] De Selding, P. B., 'Two firms win tentative German milcom sat contracts', *C⁴ISR,* 11 May 2005, URL <http://isr.dnmediagroup.com/story.php?F=842556>.

[79] Howell, R. R. N., 'International leaders call for strategies and changes that support a stronger NATO', *Signal*, URL <http://www.afcea.org/signal/articles/anmviewer.asp?a=1010&z=8>.

Electronic intelligence

Electronic intelligence (ELINT) satellites are designed to intercept electromagnetic signals such as radio communications. France is the only European country known to be currently operating a standalone ELINT system, Essaim (meaning swarm), which itself is only a demonstration programme. The French Government hopes that this demonstration will convince other European governments of the value of an independent European ELINT system.[80] Essaim is a network of four satellites, launched in December 2004 and operational since May 2005.[81] It 'analyze[s] the electromagnetic environment on the ground in a number of frequency bands that are used exclusively for military communications'.[82] A follow-on, tentatively named Elint, is being planned for launch in 2008 or 2009. It would comprise an LEO constellation of three small satellites to monitor radar signals and radio communications,.

Missile warning

The French MOD is financing Spirale, a system designed to demonstrate an initial capability to detect missiles during their boost phase.[83] The experiment involves two micro-satellites carrying advanced, high-resolution infrared payloads.[84] Two satellites are to be launched in 2008.

Space surveillance

There are about a dozen European radar facilities with potential applicability to space surveillance and a handful of optical telescopes.

The European Incoherent Scatter Scientific Association's incoherent scatter radar network should be noted here, even though it is a multinational programme. At its main facility in Tromsø, Norway, a project is under way to try to routinely piggyback surveillance of objects in LEO with the network's primary job of atmospheric and ionospheric research.

The French MOD's GRAVES, a radar 'fence' that detects objects passing through its beam, is the only European system that can independently detect and track space objects down to a size of about 1 m in diameter at altitudes of up to 1000 km.[85]

[80] De Selding, P. B., 'CNES, DGA to fund demonstration satellite', *C⁴ISR*, URL <http://isr.dnmedia group.com/story.php?F=842558>.

[81] Malik, T., 'Ariane 5 successfully orbits France's Helios 2A satellite', *Space*, 18 Dec. 2004, URL <http://space.com/missionlaunches/ariane5_helios_launch_041218.html>.

[82] EADS, 'ESSAIM, micro-satellites in formation', 6 June 2005, URL <http://eads.net>.

[83] EADS, 'Astrium selects Arianespace to launch Spirale', Press release, 17 Oct. 2005, URL <http://www.space.eads.net/press-center/press-releases/eads-astrium-selects-arianespace-to-launch-spirale>.

[84] 'French Spirale to launch aboard Ariane 5', *Space News*, 24 Oct. 2005, p. 8.

[85] 'Imminent delivery of French space surveillance system' *France ST*, no. 75 (24 Aug. 2005), URL <http://www.fitscience.org/media/upload/FranceST_075.pdf>.

The UK maintains the most powerful space surveillance radar in Europe, located at Fylingdales Air Base and operated by the British MOD under agreement with the US DOD and US Air Force. Fylingdales has traditionally been used for early warning of ballistic missile launches, but it also has a secondary role as a so-called collateral sensor as part of the US space surveillance network (SSN).[86] While Fylingdales is being upgraded to perform ballistic missile tracking as well as detection under a February 2003 agreement with the USA,[87] the UK has shown no interest in incorporating it into, or providing data for, any future European network. The nature of Fylingdales's relationship with the US DOD would make doing so extremely complicated if not impossible. No data are currently made available to other European space agencies.[88]

Another facility that is part of the SSN is the Globus II radar at Vardø, Norway, operated by the Norwegian Intelligence Service under a 1997 agreement with the USA. It has operated since 2002 with sub-metre resolutions.[89] In addition, the Danish Government controls a similar radar at Thule Airbase in Greenland that is part of the SSN, and like Globus, it will be upgraded to play a role in the planned US missile defense launch-warning network.[90] The German Research Establishment for Applied Science operates the tracking and image radar (TIRA) system at Wachtberg, Germany, which has been used to provide data on potential collision hazards to ESA satellites.[91]

Optical systems for GEO tracking include ESA's Space Debris Telescope at the Teide Observatory in the Canary Islands, the British MOD's three PIMS telescopes, and the French ROSACE and TAROT telescopes.

V. Conclusions

For Europe, the move to entrust the EU with using space for military purposes carries much significance, at least in terms of future aspirations. With the exceptions of Galileo, GMES and the EU Satellite Centre the control of the vast majority of assets with clear military and security applications remains in the hands of individual European countries and the USA; however, there are undeniable signs of convergence under the EU umbrella. The integration of European military assets, in its early stages but evident in projects such as the EU battle groups, points in this direction, as does the desire of many member states to endow the EU with true foreign and security policy tools, independ-

[86] 'Fylingdales: radar on the moors', BBC News Online, 14 Dec. 2002, URL <http://news.bbc.co.uk/2/2575759.stm>.

[87] Spring, B., 'Congress should commend Britain on missile defense upgrade', Heritage Foundation, Executive Memorandum #861, 21 Feb. 2003, URL <http://www.heritage.org/Research/NationalSecurity/em861.cfm>.

[88] Klinkrad, H., 'Monitoring space—efforts made by European countries', Paper presented at the International Colloquium on Europe and Space Debris, Académie Nationale de l'Air et de l'Espace, Toulouse, 27–28 Nov. 2002, URL <http://www.fas. org/spp/military/program/track/klinkrad.pdf>.

[89] Klinkrad (note 88).

[90] Boese, W., 'Greenland Radar Cleared for US Missile Defense', *Arms Control Today*, July/August 2004, URL <http://www.armscontrol.org/act/2004_07-08/GreenlandRadar.asp>.

[91] Klinkrad (note 88).

ent of the USA. Many EU member states clearly share a sense that their foreign policy influence, when acting alone, is inherently limited, and that the future requires greater pooling of all foreign policy and security tools. The strong US influence over national space surveillance networks in Europe is also a driver for greater EU common action in this area.

With the lead-in time to the launch of new space assets measured in decades rather than years, decisions made today are not likely to translate into common projects in the near future. However, the practical expressions of this trend are already visible. The framework agreement between ESA and the EU brings the technological dimension of European space projects closer to the EU's political heart. The military organs and staffs of the EU are brainstorming for ways in which space can add to the effectiveness of future collective military action. Debate within EU institutions has moved on from downplaying the security implications of projects formerly billed as purely civilian, such as Galileo, to discussing the possibility of the EU's actually managing the next generation of military satellites.

It would be wrong to claim that this trend is inevitable. Space is the ultimate high ground, the enabler of most security and military operations taking place on earth. It is the key to building the political case for use of force as well as to the planning and implementation of any modern military operation. As such, the military use of space is probably more akin to nuclear weapons than conventional arms in terms of its international significance. The EU's member states will probably continue to guard their ability to make independent judgements based on national assets and selective partnerships. However, the more the EU becomes the tool of choice for the security and military operations of its member states, and the more it seeks to profile itself as a global actor, the further it will be driven towards the use of space for security and military purposes. If the trend continues, the Union will most probably progress from operating dual-use assets and distributing data from national networks to deploying collectively owned technology for the exploitation of space for security purposes.