A European Approach to Space Security

Xavier Pasco

AMERICAN ACADEMY OF ARTS & SCIENCES

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Please direct inquiries to:
American Academy of Arts and Sciences
136 Irving Street
Cambridge, MA 02138-1996
Telephone: 617-576-5000
Fax: 617-576-5050
Email: aaas@amacad.org
Web: www.amacad.org

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Leslie Berlowitz
Chief Executive Officer and
William T. Golden Chair
American Academy of Arts and Sciences

Preface

Space has long been the setting of especially intricate encounters between human aspirations and the implacable laws of the physical universe. It is a natural laboratory of fundamental science, at once the source of seminal conceptual achievements and bewildering mysteries. It has been the venue for both spectacular feats of engineering and tragic accidents. It has been the locus of uplifting collaboration among nations as well as ominous confrontation. It is an ever-compelling template on which popular imagination plays out.

The resulting array of interests, attitudes, and emotions engaged in the practical utilization of space has made that topic an especially demanding problem of public policy. Because of the risks and expense involved in space operations, the burden so far has been borne primarily by the major national governments. And those governments have been driven primarily by national security considerations, the legacy of confrontations between the two global alliances that dominated the latter half of the twentieth century. The passing of that era and the progressive expansion of commercial utilization of space have clearly created a new situation but not as yet the decisive reformulation of basic purpose and operational policy that the change of circumstance can be expected to require.

There has in fact been an argument about the basic character of the appropriate adjustment. An impulse emerging from within the United States government to dominate the utilization of space for national military advantage has been resisted by a nearly universal coalition of other countries defending the principle of equitable utilization for common benefit. If the outcome were to be directly decided by simple majority sentiment, the argument would have long since been settled. Most people when asked opt for collaboration and the pursuit of common interest; redirecting the inertia of established policy is anything but simple, however. The underlying argument involves a collision of intense convictions, and casual endorsement of common interest is often mixed with the residual fear of imperial aggression that is an enduring product of historical experience.

The appropriate balance between collaboration and confrontation in the era of globalization is an unsettled question, and the implications for space policy have not been worked out in the necessary detail. The effort to do so is demanding, and will undoubtedly take some time.

To stimulate the broad discussion that must accompany any fundamental redirection of policy, the American Academy of Arts and Sciences initiated the Reconsidering the Rules of Space project in 2002. Five occasional papers have been published dealing with, respectively, the basic laws of physics that apply to all space activity (*The Physics of Space Security: A Reference Manual*, by David Wright, Laura Grego, and Lisbeth Gronlund, 2005); the fundamental issues of security policy (*Reconsidering the Rules of Space*, by Nancy Gallagher and John Steinbruner, 2008); the policies of the principal national governments (*United States Space Policy: Challenges and Opportunities*, by George Abbey and Neal Lane, 2005, and *Russian and Chinese Responses to U.S. Military Plans in Space*, by Pavel Podvig and Hui Zhang, 2008); and the historical origins of China's space program (*A Place for One's Mat: China's Space Program, 1956–2003*, by Gregory Kulacki and Jeffrey G. Lewis, 2009).

A European Approach to Space Security, by Xavier Pasco, is the sixth occasional paper of the series. It documents the efforts of EU members to develop common policies and practical collaboration for space missions related to security. It notes that the European community has not as yet been able to establish authoritative coordination of national military programs and warns that balancing those programs with increasingly important commercial and social interests is a generally unresolved problem. But it also suggests that EU efforts to develop collective rules, confidence-building measures, and codes of responsible conduct can make an important constructive contribution to working out global arrangements for space.

John D. Steinbruner
Professor of Public Policy, University of Maryland
Director, Center for International and Security Studies at Maryland (CISSM)
Co-Chair, Committee on International Security Studies, American Academy of Arts and Sciences

A European Approach to Space Security

Xavier Pasco

Since the end of the Cold War and U.S.-Soviet military competition, the space sector has experienced a new dynamic brought about by two major changes.[1] First, the "space club" countries, especially the United States, have come to see space activity as a powerful tool that can provide political, economic, and military benefits in the new geopolitical environment. In particular, a number of information technology applications have rapidly appeared and become key assets in the transformation of space into a new strategic arena. The multiplication of commercial programs, especially in telecommunications, and the liberalization of formerly government-controlled activities in Earth observation and satellite navigation have radically altered the space landscape. Greater governmental use and integration of these techniques for civilian and military purposes has increased the strategic value of these systems. This has enlarged potentially competitive national interests in space, leading to new debates at the national and international levels. Space activity has gained strength as a component of state power because it provides bonuses par excellence to nations that are technologically developed, economically and industrially powerful, and politically influential on the world scene.

The interest raised by this evolution is the second major change; it has led smaller and emerging countries to invest in space applications for a wide range of economic, military, and political reasons. Although newcomers still find that investing in the space domain is difficult, the diffusion of new space technologies worldwide, including improved equipment and training for their use, is an enduring trend. A number of emerging countries are planning to increase their investment in space technologies and make them an important element of their national development.

Space now has many more players and vested interests than it did during the Cold War, resulting in a variety of positions regarding the future of space activity. These positions reflect both on the experience and capabilities of each country and on the different national projects that underlie each country's space investments. Although attention is currently focused on the rapidly ex-

1. The present paper is a revised version of Xavier Pasco, "A European Approach to Space Security," CISSM Working Paper, Center for International and Security Studies at Maryland, College Park, Maryland, July 2006.

panding U.S. military space program, on recent Chinese accomplishments in manned spaceflight (as well as on parallel anti-satellites experiments), and on the growing interest in space among developing countries, the European space program may be one of the most significant efforts to construct a space policy that is suited to the post–Cold War era.

While still modest in size, the European space program is striving to expand its mandate in ways that will both benefit from and adhere to the particular rules of an unprecedented multinational political construction process. For a few years, the program has been embedded in a political outlook that places collective security at the center of the European project at home and abroad. Europe has been moving beyond the scientific experiments that paved the way for its early space programs and is now engaging in more strategic and security-oriented space applications, which may be a sign of a nascent European feeling for a collective welfare and security policy. Key decisions have now been accepted that will lead the European Union (EU) to play a greater role in defense and security policy alongside the traditional Atlantic alliance (that is, NATO-European countries) framework. Europe's current integration efforts in the security field are a good model for addressing, at the global level, the larger security challenges in space.

THE CHANGING SPACE LANDSCAPE

For more than thirty years, civilian and military space programs were developed mainly by the United States and the Soviet Union in the context of their respective political and strategic projects and policies. At a time when ballistic nuclear arsenals were under development, the two nations wanted to watch the construction of these weapons from afar (observation), to detect and announce their use by the enemy (early warning), and to find storage and preparation sites so that missiles could be counted for arms control purposes (verification). Neither country wanted a space arms race or a nuclear war in space, so they engaged in some legal regulation, highlighted most prominently by the 1967 Outer Space Treaty. Although both countries experimented with anti-satellite (ASAT) weapons, neither deployed a significant ASAT capability or any space-to-Earth weapons. Early uses of space for military support activities were clearly defined and designed to stabilize deterrence because carefully monitoring each other's deadly missile arsenal was required. This priority gave related space applications a highly "strategic" value and explains why they have been largely supported in the two countries for more than forty-five years, through numerous governments and changing national and international priorities.

Intelligence assets in space are less vulnerable to attacks or countermeasures than surveillance aircraft or other common technologies. In the 1980s, France judged this relative safety sufficient to justify building its own space-based intelligence capabilities, albeit on a much more modest scale than that

undertaken by the two superpowers. The French military's limited reliance on these modest space capabilities (the program is essentially political in nature), as well as the principle that space can be used freely for peaceful purposes, as stated in the 1967 Outer Space Treaty, meant that France's efforts encountered little domestic opposition. From a political standpoint, France's ability to show independence in this area is similar to its decision to create its own deterrence force. The construction of independent launch vehicles (ultimately, the Ariane family of space launchers) was viewed as a complementary and necessary guarantee of this independence.[2] In this respect, the French military observation satellites (the Helios series) have primarily been considered a strategic and political tool instead of a tactical system.

Since the end of the Cold War, the "threat" to the West is no longer a massive attack by a nuclear-equipped Soviet Union, and the targets are no longer just missile silos. Instead, countries must be prepared to address a wide variety of security problems that might arise with almost no warning and in a much less predictable way than before. Adaptive and flexible reaction capabilities, including at the lower end of the combat operation spectrum (that is, the so-called Petersberg tasks: peacemaking, peacekeeping, humanitarian operations), require much more versatile and relevant intelligence and information capabilities. Addressing the new security challenges requires complete and "intelligent" information, which shifts the focus of today's space technologies toward an investment in data processing and information technology.

The United States and Europe agree on the importance of developing new space-based information systems to help manage these new security challenges, but they differ both in terms of the types of space assets that they would like to develop and the amount of resources that they plan to invest in new capabilities. Whereas the U.S. military is dramatically increasing its reliance on space, European spacefaring countries still want to keep their military space investments to a minimum, reflecting both limited resources and political and military restraints.

Under the "battlefield awareness" concept used by U.S. strategists, more and more information from space will be transmitted directly to soldiers, who will be equipped in the field with sophisticated and efficient personal communications devices. The strategic bet is that better knowledge brought by value-added information[3] and an increased ability to apply precision military force from a great distance will compensate for the difficulties of engaging forces in a poorly defined environment.[4] Increasingly, space is viewed as a "strategic enabler,"[5] its status evolving from that of a base for sophisticated armament

2. The controversy over conditions the United States placed on France's 1973 launch of two European telecommunication satellites, *Symphony I* and *Symphony II,* was at least symbolically at the root of this decision.

3. Implied by the frequently used expression "transparent battlefield."

4. See, for example, Colonel Robert C. Owens, "Aerospace Power and Land Power in Peace Operations, Towards a New Synergy," *Airpower Journal* (Fall 1999): 4–22.

5. Ibid.

programs used for specialized tasks to that of the nerve center for all military operations. For example, the troops sent to Afghanistan in 2002 used seven times more satellite communications bandwidth than the allied forces used during the first Gulf War. One year later, this ratio amounted to ten times more bandwidth for Operation Enduring Freedom.[6] As one high-ranking U.S. military officer put it, the United States has made a major strategic choice: space-based information and communications systems are now integral to military operations; they are not "a fringe operation supporting purely strategic or national objectives."[7] Additionally, the strategic nature of the information provided by space-based systems corresponds to obvious political needs and would tend to increase mutual political understanding and trust in a coalition context.

A lack of clear vision for Europe's military space presence has plagued most transatlantic attempts at cooperation in the military space field. For example, although the need to make military space telecommunications assets interoperable became clear on both sides of the Atlantic during the 1990s, the various parties could not agree on a common architecture because of different strategic, military, and political doctrines and views. Sharing early-warning capabilities or even military intelligence space assets would require a framework agreement based on convergent strategic and political views. The need for high-level political agreement can easily transform any technical discussion or concept into a highly contentious issue, as such exchanges may directly impact European security and defense policy—that is, they may become an intergovernmental issue requiring adherence to EU rules.[8] Because of its undecided military and security situation, Europe will not be able to cope with such highly strategic military discussions as a united entity for some years, especially because these discussions have traditionally been conducted under the NATO umbrella in a multilateral manner.

Performance and capacity improvements will also require increasing integration of military space applications with their civilian counterparts. The greater versatility of data-collection systems implies the use of increasingly high-performing and flexible civilian sensors for various missions, such as

6. See Joe Leland and Isaac Porche III, *Future Army Bandwidth Needs and Capabilities*, RAND Monograph, RAND Arroyo Center, RAND Corporation, Santa Monica, California, 2004, 10. See also, William B. Scott, "Milspace Comes of Age in Fighting Terror," *Aviation Week & Space Technology* 156 (14): 77.

7. Donald G. Cook "Congreve's Red Glare . . . Reflections of the Past, Visions of the Future," *RUSI Journal* 144 (5) (1999): 38. Lieutenant General Cook is the vice commander of U.S. Air Force Space Command.

8. The so-called Revolution in Military Affairs, the Joint Vision 2010 and 2020 (often presented on the U.S. side as potential repositories for better interoperable architectures), and even the current U.S. Department of Defense transformation concept have continuously been the subject of internal debates in Europe, to assess their relevance as federative strategic and military concepts for the European case. These discussions have not prevented the pursuit of some military cooperative work—as demonstrated, for example, by the ongoing Multinational Interoperability Council (MIC). As of today, the MIC effort is partnering with Australia, Canada, Germany, France, and Great Britain.

high-resolution imagery and multispectral capabilities for a range of needs, including agriculture, fishing, and general environmental observation. In the telecommunications field, several projects involving civilian low-Earth orbit (LEO) wideband satellites for mobile or multimedia users perfectly fit the military telecommunications architectures.[9]

Europe does have extensive experience with multiuse satellite systems through its long-standing scientific and experimental programs. In particular, a large number of scientific satellites or probes have been launched by the European Space Agency (ESA). Traditionally, other applied programs, such as Earth-observation satellites, have been launched by European nations themselves. Competencies are well established in countries such as France (for optical satellites), as well as Germany and Italy (for radar techniques). These national investments have directly benefited European science-oriented Earth-observation programs and are possibly useful for security purposes. One of the most important space developments was undertaken by Europe in 2002 with the satellite *Envisat*, which is equipped with multispectral sensors[10] and other new technical payloads for studying atmospheric composition. This makes it an efficient space laboratory for a large array of customers dealing with new security issues. A number of other experimental projects undertaken in the scientific program of ESA also demonstrate the excellence of European know-how.[11]

These trends are creating new tensions in space. The expected multiplication of space actors and operators, in both the state and private sector, demands a collective reflection on a new set of rules that will guarantee an equitable development of space activities consistent with the notion of the common good.

So far, though, the increasing desire by new actors to use space for civilian and military purposes has resulted in defensive military postures from existing space powers, which have tended to focus on the new dangers that would result from these developments. In particular, the United States has promulgated a new military space doctrine that promotes the right to develop ASAT weapons in order to protect its space assets, defend against any space-based attack, and deny other countries the ability to use space to enhance their own military power.

Over the last few years, this space-control doctrine stirred up debate in international forums such as the Conference on Disarmament (CD) in Geneva and the UN Committee on the Peaceful Use of Outer Space (COPUOS).

9. Although the commercial demand for such systems has been less than expected, the military has decided to purchase Motorola's system of sixty-six satellites, Iridium, which is now mainly devoted to military communications.

10. For example, the *Envisat* payload MERIS has fifteen spectral channel sensitivity, which makes the satellite well adapted to the detection or characterization of a wide range of natural and human phenomena.

11. A number of scientific space experiments either in orbit or in the planning stages have been undertaken within the framework of the Global Monitoring for Environment and Security (GMES) program using new sensing techniques, such as Light Detection and Ranging (LIDAR), designed to help better characterize the atmospheric environment and its dynamics.

These debates remain centered on the few countries—namely, the United States, China, and Russia—that have tended to disagree on the legal latitude existing treaties afford to the deployment of orbital weapons. Although tested by the USSR and the United States during the 1970s and 1980s, "space-denying" projects were not at the top of the list of diplomatic tensions until recently. During the Cold War, the need to keep space a generally, even if implicitly, protected and neutral medium in the context of the nuclear balance was a solid-enough motivation to regulate the strategic space relationship. However, renewed U.S.-Russian tensions since the end of the 1990s show that this period has come to an end. Tensions have been heightened further by China's demonstration of its anti-satellite capability on January 11, 2007 (an event that counts as one of the most space-polluting in recent history), and by the U.S. Department of Defense's destruction (in a somewhat cleaner manner) of the failing *USA 193* satellite slightly more than one year later.

Europe has not been part of the discussions surrounding security issues in space. Without a military space program comparable to that of the United States or Russia, European countries, individually or collectively, cannot approach the issue from an exclusively military angle. For a long time, Europe has restricted itself to purely civilian programs of a scientific character. The institutional arm of the European space program, ESA, was by mandate devoted to peaceful scientific activities. Only recently has Europe become more sensitive to debates about the military and strategic uses of space, and space applications are increasingly mentioned as a necessary step for enhancing European security,[12] whether in the military sense or as a way to increase the safety of populations confronted with natural disasters or catastrophes. Nonetheless, the notion of "dual-use programs" (those covering civilian *and* military needs) does not—indeed, cannot—represent a European policy per se, despite often being referred to in the case of the EU's so-called flagship programs, Global Monitoring for Environment and Security (GMES) and Galileo (Europe's satellite navigation program). The remaining differences among EU member states over the Common Foreign and Security Policy (CFSP) and the associated European Security and Defence Policy (ESDP) complicate the discussions and make notions such as "security" and "dual-use technology" highly politicized issues. The debates over the military uses of Galileo are sufficient to convince one of these political difficulties. However, holding the debate shows that member states' views can at least be discussed, which in turn allows Galileo and other space programs slowly to gain a higher status in a broader European policy context that values security.

12. Such as in the case of the Galileo global navigation satellite system and GMES, two widely supported pilot programs for Europe.

THE EUROPEAN VIEW ON SPACE AND SECURITY

Compared with the United States, fewer space programs in Europe are devoted strictly to military purposes (that is, those possessing high-end military characteristics and performance). Those programs that do have a military purpose focus on information collection for strategic purposes—similar to the early U.S. military space programs—rather than on new tactical applications. This fundamental space capability is likely to remain a priority for Europe. For example, Helios, the French-led military reconnaissance program whose first satellite was launched in July 1995, is intended to provide continuous strategic information for the management of nuclear deterrence and for improved awareness of possible major events affecting French policy in nearby zones of interest.[13] So far, however, Helios data remain modest in volume and are primarily used for strategic purposes. The Helios II series marks a clear evolution toward possibly making more use of space data for purely military purposes because its broader user capabilities are better adapted to theater requirements and would enable quicker and more efficient information collection processes for the military.[14] This evolution was recently reaffirmed in the 2008 French defense and security white book,[15] which proposed the creation of a new strategic function called "Knowledge and Anticipation," highlighting the need, according to its authors, for better-informed intelligence and calling for the development of more efficient information tools. From the sometimes vivid debates over this issue, better use of modernized space systems has emerged as a key recommendation. Fully endorsed by the French president, this recommendation should lead to the allocation of larger budgets for follow-on Helios systems that will be developed within the framework of the Multinational Space-Based Imaging System (MUSIS). This system capitalizes on efforts begun in the 1990s by six European countries[16] to define common needs and future systems, and will provide these countries with an unprecedented optical and radar intelligence capability. It is expected that this capability may also possibly be used by the EU at-large, through its common "Satellite Centre" based in Torrejón, Spain, near Madrid. However, priority uses and special exchanges between nationally owned systems will remain arranged under the control of signatory countries. The French white book also calls for space assets to be modernized with new electronic intelligence capabilities. Following its Essaim and Electronic Intelligence Satellite (ELISA) demonstrator programs, France plans to launch the Capacité de Renseignement

13. A second Helios 1 (*1B*) was launched in 1999, and a new series of improved satellites (Helios II) was inaugurated in 2004.

14. Better storage capabilities allow for more frequently refreshed information. Continuous (that is, day-and-night) information collection has also been a prerequisite for the second Helios series.

15. *Défense et sécurité nationale: Le livre blanc* (Paris: Odile Jacob, La Documentation Française, 2008).

16. See footnote 38.

Electromagnétique Spatial (CERES) satellite system in the middle of the next decade. France also plans to direct funds toward the development of an early-warning satellite system, with an operational capability envisioned for 2019.

This evolution toward tactical uses of satellites is only a first step toward a better integration of space assets in the French armed forces. Such improvements must not be overstated and can hardly be judged as being precursors in Europe of so-called network-centric capabilities, in part because Europe is at an early stage in the integration of its members' space programs. Neither the European spacefaring nations nor Europe as a whole has been eager or able to choose space as the new locus for their defense and security policy. Nevertheless, the desire for greater European integration may benefit space programs because they could be a powerful catalyst for the still nascent ESDP. The notion of strategic independence has remained at the heart of the most recent European national and collective decisions. For example, Germany's and Italy's efforts in civilian/military radar observation and the recent proposals for a collective space observation and monitoring system to be developed by ESA confirm that space programs are increasingly viewed in Europe as valuable tools for ensuring a minimal independence and strategic control in collecting and exploiting information. This viewpoint is gaining traction at a time when NATO/ESDP relationships are reshaping; for example, one result of NATO's 2009 summit should be closer ties between France and the Alliance. Recent developments in space policy in Europe show that the parallel existence of ESDP and NATO is no longer considered a zero-sum game in which each side's planning necessarily conflicts with the other's. Instead, each side's moves are coming to be seen as complementary, making room for a European desire for greater political autonomy and assertiveness in the field of defense. This progress was somewhat offset by the recent Bush administration's proposal to deploy anti-missile defenses in Poland and the Czech Republic. The classical unilateralist approach expressed by these efforts led some member states to resume their traditional divergences.

Europe, as a wealthy and willing political entity, could not stand by while non-European countries or regions became active in fields such as environmental monitoring. Furthermore, European successes in space created an increasing self-confidence in homegrown space technology and gradually led European institutions to consider striving for autonomy in several strategic areas. The GMES program and the Galileo satellite navigation program reflect this new political posture. The European states' combined space capabilities can thus form the core of a basic integrated European strategic capability, especially considering that the U.S.-Russia military monopoly over space is diminishing as the number of national and commercial space programs grows. By basing its security policy on a collectively responsive network of assets rather than on exclusive national military capacity, Europe will offer a distinct perspective on achieving the common goal of making space secure for all.

The European Political Construction Process

The European political construction process is key to understanding the European perspective on security debates. Motivated by the desire to avoid the conflicts that dominated the European scene from the end of the nineteenth to the first half of the twentieth century, the European community was structured around the need to find new common ground and the desire to share certain national resources. The economic common ground rapidly proved to be the preferred playground,[17] one on which no "hard" political decisions would be removed from the nation-states' prerogative. The economic, social, and scientific life of European citizens would be handled (within certain limits) by the European Commission, demonstrated, for example, in the progression to a single European currency. Defense policies, long considered the heart of national sovereignty, have remained under the control of more traditional intergovernmental processes: they are legally outside the mandate of the European Commission and are managed by the European Council, which comprises the heads of state of the various EU members and is intended to represent the interests of the member states' national governments.

The European decision-making process for space is unique in that some issues are handled through intergovernmental processes while others are addressed through the so-called communitary processes.[18] Because of this political construction, no real ESDP or even a CFSP has emerged that would subsume national defense and security policies. Both by design and because of the diverse political views among the twenty-seven EU countries, such a stand-alone policy is unlikely to emerge in the near future.

Since 2004, attempts have been under way to "fix" these difficulties. The 2004 Treaty Establishing a Constitution for Europe (TCE) was designed to provide Europe with a "shared competence" to develop a European space policy using the European Commission's Framework Programme for Research and Development. Although not endorsed by member states that did not ratify the TCE,[19] this "shared competence" was confirmed in the 2007 Treaty of Lisbon.[20] Calling for a "European Space Policy,"[21] the Treaty of Lisbon repre-

17. This began with the creation of the European Coal and Steel Community and then the Common Market.

18. Signed in 1991, the Maastricht Treaty created a CFSP and organized the EU around three "pillars." The first, the "communitary pillar," is organized through the European Commission, which takes care of issues delegated by the member states (such as the common agricultural policy, transportation, and the monetary and economic union). The second pillar is specifically devoted to the ESDP, which depends on intergovernmental negotiations conducted within the framework of the European Council. The third pillar deals with justice and home affairs. As clarified by the Amsterdam Treaty in 1997, the third pillar primarily involves European police cooperation.

19. French voters rejected the TCE in late May 2005; Dutch voters followed suit a few days later.

20. Signed December 13, 2007, the Treaty of Lisbon amends the Maastricht Treaty on European Union and the Rome Treaty Establishing the European Community.

21. A resolution on a European space policy adopted by the Space Council in May 2007 and providing the main orientations of such a policy was prepared in advance of the Treaty of Lisbon by the EC and ESA in order to meet the main goals of ongoing and future structuring programs, thus paving the way for the Treaty of Lisbon.

sents a further step in integrating space efforts, even if (because of the moderate enthusiasm of some EU member states) it does limit the harmonization of laws and regulations and places clear limits on any defense- and security-related aspects.

European Space as a Symbol of the Dominant "Communitary" Model

By and large, space policies in Europe have followed an evolutionary path that reflects their dominant scientific nature, as represented by ESA. In contrast to the two superpowers, space activity in Europe began with purely scientific endeavors in the satellite area, initially federated by the European Space Research Organisation (ESRO). A civilian sister organization, the European Launcher Development Organisation (ELDO), initially addressed launch technology. The merger of these two institutions confirmed the scientific orientation of Europe's space activity and led to the creation of ESA in 1975. Comprising eighteen states as of the end of 2008, including some states that are not members of the EU, such as Norway and Switzerland, ESA is mandated to focus on "peaceful" activities and has not been allowed to take the lead on any military-purpose space programs, although efforts are under way to grant ESA more flexibility. The only military-oriented European cooperative space institution is the European Union Satellite Centre (EUSC) in Torrejón, Spain, near Madrid. Formerly affiliated with the Western European Union, EUSC has been a military agency of the European Council since 2001.

Some European countries have devoted part of the resources for their national space programs to military applications, although these countries are still far from reaching the levels of military activity deployed in both the United States and the former USSR. France, which remains the leading European country for military space activity, has maintained low expenditure levels, reflecting enduring debates on the relevance of such spendings, coupled with relatively limited first-order political involvement.

As of 2009, no Europe-wide organization is capable of coordinating the various nationally driven military-oriented space programs. Attempts such as the Franco-German Helios-Horus[22] cooperation planned during the 1990s failed because of contradictory political and industrial interests in the two countries.[23] The same situation was repeated in the field of military communications satellites. Several initiatives started in the 1990s to integrate the U.K. Skynet 5 program into an interoperable satellite communications architecture with the French Syracuse 3 satellites as well as with some U.S. satellites also failed, halted by the United Kingdom in 1998 for a range of national motivations and constraints. A commercial joint venture including the United Kingdom's Skynet, France's Syracuse 3, and Italy's Sistema Italiano per Comunicazioni

22. Helios was the optical component of a common military observation system. Horus was to be the radar counterpart and was to be developed by Germany.

23. In this particular case, the simultaneous U.S. decision to commercialize high-resolution satellite imagery added to the difficulties surrounding the discussions.

Riservate ed Allarmi (SICRAL) was successfully established some years later for equipping NATO, but this initiative cannot be considered a deliberate European governmental initiative. The inability to compromise on such projects is often cited as an example of the enduring difficulties of thinking in European terms.

A New Path toward the Stars: Space for Security

Some recent developments show that Europe feels mature enough to contribute to its own security despite its intrinsic inability to build a unique ESDP. Several important texts have been approved since 1990 that show an increasing need to organize Europe in the fields of security and defense. One is the Western European Union declaration of June 1992, which set up the Petersberg tasks permitting Europe to intervene militarily in low- and mid-intensity conflicts on its borders.[24] Another is the Helsinki European Council, which in December 1999 issued the "headline goals" that led to the creation of a European military staff and, in 2003, a rapid reaction force. This paved the way for the yet-to-be ratified European Constitution, which calls for a European capacity for peacekeeping missions, conflict prevention, and strengthened security in accordance with the UN Charter. This new political stance was endorsed by both the European Council in Brussels in December 2003[25] and by the European Commission, which in 2004 launched a "Preparatory Action for Security Research," based on the *Research for a Secure Europe* report,[26] with the goal of initiating more-active research and development programs in the security field starting in 2007.[27] These developments show that the broadly defined issue of security has joined economic policy in becoming a new playground for the European construction process, allowing the EU to reinforce its political identity while leaving purely military aspects to be resolved by member states. A resolution of the European Parliament issued on July 10, 2008, provides a good example of the careful handling of the issue of "European security." The resolution underlines the need for space assets so that the political and diplomatic activities of the EU may be based on independent, reliable, and complete information in support of its policies for conflict prevention, crisis management operations, and global security, especially the monitoring of proliferation of weapons of mass destruction and their means of transportation and verification of international treaties, the transnational smuggling of light weapons and small arms, the protection of critical infrastructure and of the EU's borders, and civil protection in the event of natural and man-made disasters and crises.

24. The Petersberg tasks involve humanitarian and rescue operations, peacekeeping, and possible peacemaking—tasks combat forces might take on during a crisis-management period.

25. Javier Solana, *A Secure Europe in a Better World* [European Security Strategy], European Council; adopted December 12, 2003.

26. Group of Personalities in the Field of Security Research, *Research for a Secure Europe* (Luxembourg: Office for Official Publications of the European Communities, 2004).

27. The so-called Seventh Framework Programme for Research and Technology Development.

The resolution also notes that "the crisis management operations within the framework of the European Security and Defence Policy (ESDP) suffer from a lack of interoperability between space assets operated by EU Member States" and calls for "the promotion of equal access for all EU Member States to operational data gathered using space assets under a reinforced ESDP framework."[28]

The recent European decisions to launch and support security-oriented programs, such as the European Galileo navigation satellite program and the future GMES program, must be interpreted in the context of an enhanced political interest for security in Europe. Today, space programs are an important collective endeavor helping Europe to develop its expertise and industrial base. But, as programs that originated under clear civilian and European control and then evolved to include security and even defense aspects, they are also perfect symbols of Europe's new security policy.

Europe can take collective steps toward using space for security purposes only if those steps are based on a broad definition of security and the development of dual-use programs and applications. If Europe wants to remain an independent actor in the space arena, it will also have to find ways to protect its civilian and dual-use space programs without relying on military options that have never been attractive to its member states and that have been deliberately precluded at the communitary level.

The Illustrative Case of Galileo

The Galileo project has been a perfect example of this path. Since its inception, this European endeavor has relied on civilian management to take care of security issues. Conceived in 1999 and confirmed in 2002, Galileo rapidly emerged as a strategic program for Europe. Europeans realized years earlier that satellite navigation and time-synchronization programs would play a central role in modern societies. The first such program Europe developed, the European Geostationary Navigation Overlay Service (EGNOS)—which comprises three geostationary satellites and a network of ground stations—is intended to augment on a regional scale (including Europe, North Africa, and the Near East) the performance and signal integrity of global navigation satellite systems, including the Global Positioning System (GPS) and, eventually, Galileo. Building an improved global system that would provide more elaborate services and possibly create new commercial markets was consistent with the traditional European approach. A number of studies had predicted that a potentially huge commercial market was at stake. But the studies also predicted that concerns would arise over potentially degraded data coming from a single system controlled by one country's ministry of defense. Even after the United States ended its "selective availability" policy on GPS signals in 2000, this concern was seen as a potential showstopper for serious investment. In European

28. European Parliament Resolution of 10 July 2008 on Space and Security, 2008/2030(INI), http://www.europarl.europa.eu/sides/getDoc.do?type=TA&language=EN&reference=P6-TA-2008-0365.

eyes, the U.S. GPS constituted an unacceptable monopoly given the then-expected spin-offs of satellite navigation technology.

When conceived in 1999, Galileo was the first program of its kind to be dealt with at the communitary level without involving the usual national security and defense actors. The involvement of the European Commission's Directorate-General for Energy and Transport—besides ESA, the other important contributor to Galileo—demonstrated the EU's ability to manage a project of such strategic importance by itself. Galileo also symbolized the progress made by the EU in building its own political legitimacy while respecting national sovereignty in related domains. The need to raise funds from industry through a public-private partnership ("concession") approach and the challenge of including broad European participation were widely viewed as tasks that would prove the usefulness of European civilian institutions.

The circumstances of Galileo's origin also partly explain why the services it will provide have been structured according to the quality of the service provided instead of according to the nature of the user (that is, civilian or military), as is the case for GPS. In particular, the Galileo Public Regulated Service (PRS) will provide signals for users, mainly governmental, who require service continuity and completely secure access. This does not mean that the service will be reserved only for military users, however; that would contravene EU policy. By the same token, the relatively open nature of PRS does not preclude Galileo from being used in a military-controlled manner when necessary. However, the uses made by any military user of Galileo or GMES must be consistent with the principle that Galileo and GMES are civil systems under civil control, and consequently that any change to this principle would require examination in the framework of, Title V of the Treaty of the EU, in particular, Articles 17 and 23, as well as in the framework of the ESA convention.[29] Although somewhat ambiguous, this official wording makes clear that military uses of Galileo (or GMES) are possible.

The transatlantic controversy over the real nature of the program (that is, civilian or military) that culminated in 2001 helped make Europeans more aware of the security implications attendant on the use of Galileo-provided services and reinforced Europeans' support for the program. The United States was skeptical about the ability of Galileo's civilian management structure to deal as seriously with security matters as did GPS's overseers—the U.S. military. U.S. pressure on Europe to establish some degree of military control over Galileo was largely viewed in Europe as an attempt to undermine the collective effort by linking Galileo to politically sensitive defense decisions that had deliberately been placed out of the European Commission's reach. The EU nonetheless recognized the U.S. concerns as legitimate and tried to end nascent tensions by creating a structure to manage Europe's satellite radio-navigation program. In July 2004, a European Council regulation created a special

29. European Space Agency and European Commission, "Resolution on the European Space Policy," ESA BR 269 22.05.07, May 22, 2007, http://esamultimedia.esa.int/docs/BR/ESA_BR_269_22-05-07.pdf.

EU agency, the Global Navigation Satellite Systems (GNSS) Supervisory Authority, to take charge of all security issues related to program building and exploitation and to manage the relationship between the European public authority and the private concessionaire that will run the program. A System Safety and Security Committee composed of national representatives will "assist the Authority on all aspects relating to the system's safety and security," including protective measures to prevent any hostile or unauthorized use of Galileo.[30] The GNSS Supervisory Authority (GSA) will:

> [...]
> (ii) define the security specifications of the system and its components, and the standards of security for information techniques;
> (iii) define the cryptography which requires governmental approval;
> (iv) ensure that the European GNSS Signal/Services are controlled in compliance with security criteria [. . .];
> (v) be the European GNSS security accreditation authority, initiate and monitor the implementation of security procedures and perform system security audits;
> [. . .]
> (vii) enforce and verify compliance by the concession holder with inter-national rules and agreements (Wassenaar, Missile Technology Control Regime, International Agreements, . . .)
> (viii) implement the relevant provisions for the exchange, handling and storage of classified information;
> (ix) develop coordination and consultation procedures on security-related matters with the Secretary-General of the Council of the European Union, High Representative for the Common Foreign and Security Policy (SG/HR)
> (x) identify and inform the Council of possible measures that could be taken by the Council in the event of a threat to the security of the European Union or of a Member State arising from the operation or use of the system, or in the event of a threat to the operation of the system, in particular as the result of an international crisis;
> [. . .]
> (xii) give advice on security policy issues in international agreements related to the European GNSS programmes.[31]

With the establishment of the GSA, the political legitimacy of Galileo as a security-oriented program was sealed. The fact that all tasks related to the security of both the program and its services are entrusted to an EU agency

30. European Council, Council Regulation no. 1321/2004, 12 July 2004, *Official Journal of the European Union,* July 20, 2004, L. 246/2. The System Safety and Security Committee, which will include national representatives who are in charge of Galileo security issues in their home countries, will succeed the current Galileo Board for Security, increasing the institutionalization of the security issues at the EU level.

31. Ibid., L. 246/4.

demonstrates a commitment to addressing a broad spectrum of military and security issues without prejudice to civilian users. As the main technical point of contact, the GSA has been playing a central role in the management of the envisioned structure and uses of the future Galileo signal. The necessity to reboost the program in 2007 because of the financial failure of the initially envisioned public-private partnership scheme has resulted in a new, deliberately government-oriented approach in Europe. Since 2008, questions have been posed, especially among members of the European Parliament, about the future of the GSA and whether management of the public-private partnership should remain considered. Whatever the fate of the GSA, a more intergovernmental approach would ease security procedures.

Confronted with military-oriented space activities in the United States, China, and Russia, Europe, with no such projects of its own, has had no alternative but to help increase the security of the space environment, to ensure the security of the programs it does have. More convincing measures regarding the management structure of Galileo, as well as a compromise reached with the U.S. government to prevent the Galileo and GPS systems from using the same frequencies, helped to reduce U.S. security concerns about Galileo. In June 2004, GPS and Galileo representatives reached an agreement on the complementary use of the two systems that allowed the construction of Galileo to proceed.

Global Monitoring for Environment and Security: A Further Security Step

The GMES project has also acquired a reputation as a strategic space element and a security-oriented tool for Europe. The root of this idea can be traced to the European environmental protection policy that provides GMES with its political legitimacy. On May 19, 1998, reflecting environmental concerns expressed a year earlier in the Kyoto Protocol, a number of European national organizations and the European Commission published the so-called Baveno manifesto[32] inviting Europe to organize a global Earth observation and environmental monitoring capability using all possible technical means, with a particular role given to satellites. The deeply federative character of GMES quickly gave it a political dimension beyond the traditional impact of classical infrastructure or information-technology programs.

The underlying principles of GMES are to promote a convergence between the political (even social) demand for technology and the supply of that technology. This convergence was already visible in other Earth-observation programs, such as the "Vegetation" instruments aboard the *SPOT 4* and *SPOT 5* satellites or ESA's *Envisat* satellite equipped with an array of sensors. GMES is also representative of a growing awareness of the importance of collectively carrying out some environmental monitoring. This idea was shaped within the international framework set up by the Committee on Earth Observation

32. *Global Monitoring for Environmental Security—A Manifesto for a New European Initiative*, October 1998, BNSC, CNES, DLR, EARSC, ESA, EUMETSAT, European Commission. The discussions were held in the Italian city of Baveno in May 1998.

Satellites (CEOS) and resulted in the Integrated Global Observing Strategy (IGOS) in 1995, which became the IGOS Partnership (IGOS-P) in 1998 with the goal of networking the relevant space assets. The Baveno manifesto was shaped along these lines, taking advantage of both a strong political movement and a long-standing technical effort.

From "Environmental Security" to "Environment and Security." The title of the Baveno manifesto, *Global Monitoring for Environmental Security: A Manifesto for a New European Initiative,* at first referred to a notion of security that was radically oriented toward the monitoring and protection of the environment. One year later, this environment-only concept began to change. In a 1999 document submitted to the Space Advisory Group (SAG), the program was renamed Global Monitoring for Environment and Security, the scope was expanded to all security-related issues, and the possibility was raised of linking GMES with the nascent ESDP. The document underscored the environment-security link, stating, "Environmental problems can lead to such serious difficulties that they may, firstly, endanger the security of both individuals and nations and, secondly, lead to international conflict."[33]

GMES can also be seen as a symbol of a more mature and consistent "political Europe" in the aftermath of the conflicts in Central Europe and the Balkans during the 1990s. These conflicts sounded an alarm to many supporters of the European idea who could not help but realize how much Europe was proving impotent in the defense and security fields, even near its own borders. The expanded GMES concept built on growing European awareness of its defense and security responsibilities and gave Europe a chance to respond with existing and planned capabilities.

GMES is well suited to deal with a wide array of security aspects because of its dual (civilian and military) character. Many programs and techniques used to monitor the environment also have security applications. The dual-use capabilities of GMES have been taken into account in a number of documents produced by the European Commission and ESA. For example, the "Joint Task Force Report," which covers the whole array of European space policy, explicitly mentions the central role of the Petersberg tasks. The document specifies that the "security and dual-use dimensions of GMES have not been adequately investigated so far" and recommends the "establish[ment of] an appropriate dialogue on security and dual use issues between the Directorate General of the Commission, the Secretariat of the European CFSP, ESA, and relevant authorities in Member States."[34]

Refined Security Concepts for GMES. A consensus on mixing the traditionally well-accepted civil security with support of the CFSP builds upon some level of ambiguity because the CFSP is still "under construction." Paradoxi-

33. European Commission, "Global Monitoring for Environment and Security," SAG/99/3, July 12, 1999.

34. *Joint Task Force Report*, Draft Version 2.5, September 2001.

cally, the low profile of the CFSP has allowed GMES to gradually tackle these supplementary issues more boldly. While the design of GMES was still under study, the representatives of eleven countries created an ad hoc working group on October 18, 2002, to address how GMES could carry out some security functions. Instead of defining what kind of space-security policy the European Council should adopt, the ad hoc group chose to consider how GMES might remain flexible enough to implement several of the security policies envisioned in Europe. The group identified four security domains: 1) environmental and technological crisis prevention and rapid reaction; 2) conflict prevention and treaty verification; 3) support for the Petersberg tasks; and 4) European border surveillance.

This combination of missions creates a nebula of security missions with direct links to the more defense-oriented aspects of security. From the European Commission's perspective, this reflects the extension of so-called civil security missions to an enlarged security concept, which was at the heart of the research and development budget preparation starting in 2007. The European Commission has supported this extension by accenting key areas, such as the security of the European citizen, critical infrastructures, protection of supply chains (goods, energy, food), and civil-security force cooperation[35] on consensual issues such as maritime pollution, major disasters monitoring, and educational activities.[36] Another use consistent with these priorities involves "risk mapping": using GMES to document a wealth of geographic elements that are linked to natural events or human activities. This capability can be used for humanitarian aid in a crisis, but also has monitoring and detection applications that are more continuous. A September 2003 position paper notes that GMES would have supplementary missions related to the threat of nuclear, biological, or chemical weapons "where military assets and expertise has its place alongside civilian and response mechanisms."[37] The paper summarized the security missions to which GMES should directly contribute, such as treaty verification and crisis management; aircraft and missile identification; and peacekeeping and enforcement efforts.

"Besoin Opérationnel Commun": Toward a "Dual-Use" Space Security Concept for Europe?

The rapid evolution of proposed GMES services reflects the simultaneous emergence—independent of the GMES project itself—of dual-purpose Earth-observation space systems in Europe. The Franco-Italian Pléiades-COSMO

35. As previously decided in the European Council meeting in Feira, Portugal, in June 2000. See Santa Maria Da Feira, European Council, June 19 and 20, 2000, Conclusions of the Presidency, http://www.europarl.europa.eu/summits/fei1_en.htm.

36. This effort was initiated by the so-called Report of the Group of Personalities in the Field of Security Research, *Research for a Secure Europe*, European Communities, 2004; see http://www.src09.se/upload/External%20Documents/gop_en.pdf.

37. GMES Working Group on Security, "The Security Dimension of GMES: Position Paper of the GMES Working Group on Security," September 29, 2003, 12.

program, a cooperative program built under the terms of the Torino Agreement signed by France and Italy on January 29, 2001, will combine optical and radar satellites for Earth observation, and is a significant example of a dual-use European space system.

In January 2003, the European Commission suggested that the GMES initiative could complement the *Besoin Opérationnel Commun* (Common Operational Need; or, BOC), an effort among six countries' ministries of defense.[38] Initially a Franco-German initiative, the BOC aims to start, even if only in the limited field of Earth observation, a high-level cooperative process designed to solidify, and possibly guarantee, longer-term multilateral military space cooperation. The goal is to go beyond simple cooperative financing agreements and set common objectives and operational requirements prior to determining the technical developments next-generation satellites will need. The BOC was an initial effort that reflects some of the hard lessons European countries learned during difficult joint ventures in the field[39] and could be a first building block of a new "bottom-up" approach for Europe.[40] Although such an effort cannot guarantee better use or interoperability of existing or currently planned systems—such as the French Helios II satellite series, the German military radar satellite program SAR-Lupe, or even the French-Italian Pléiades-COSMO dual-use observation system—it does prepare the ground for common planning of next-generation systems that will go into effect after 2015.

From both a multilateral cooperative point of view and a more technical point of view, the BOC and GMES share several significant points of intersection. The technical capabilities of the satellite platforms could be used at least partially in a complementary manner to satisfy both security and environmental needs. For example, because GMES covers a wide range of missions that have something to do with low-level military missions as defined in the Petersberg tasks, it can serve some functions envisaged by the BOC. Still, a number of difficulties must be overcome. For example, any system of military interest must be able to provide imagery nearly in real-time and in a totally protected and discreet fashion, yet the GMES promoters usually plead for a multiplication of widely disseminated products and services to meet the needs of non-military users as well.

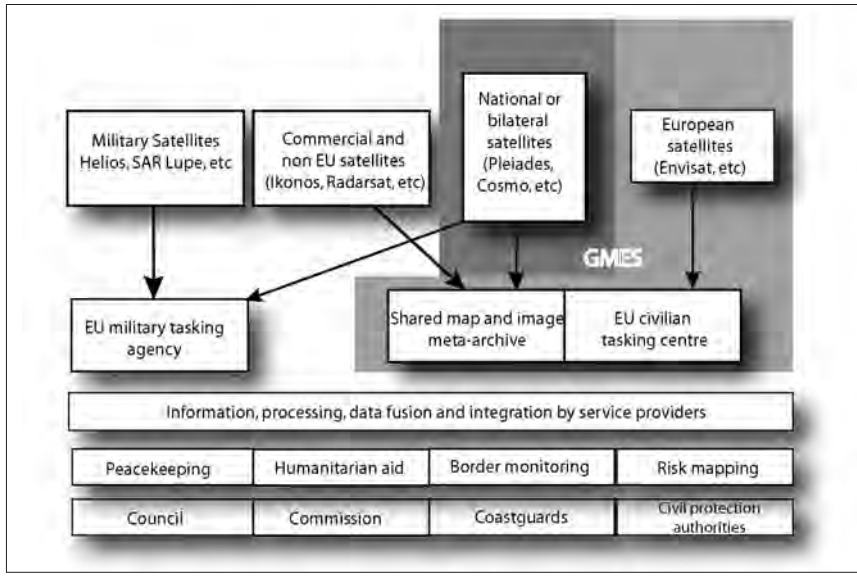
Two experts from the EU Satellite Centre near Madrid described three requirements for any BOC system: 1) protection from hostile access; 2) confidentiality surrounding the tasking of the system; and 3) confidentiality sur-

38. The six are Belgium, France, Germany, Greece, Italy, and Spain. The suggestion was made in the so-called Green Paper, *European Space Policy*, Commission of the European Communities, COM (2003), 17 Final, Brussels, January 21, 2003, 24.

39. For example, the earlier Franco-German attempt to co-develop the French Helios optical satellites and the German Horus radar satellite proved impossible.

40. The BOC has been at the heart of the European Capabilities Action Plan (EPAC) that was established at the December 1999 Helsinki European Council meeting. EPAC heavily influenced later European Commission work, such as the SPASEC report produced for the European Commission by a group of experts on space and defense. See SPASEC Working Group, *Report of the Panel of Experts on Space and Security* (European Commission, March 2005).

rounding the performance of the system.[41] If the first two requirements apply to both military and civilian systems like GMES, the third requirement may not be fulfilled by GMES, as dual-use systems usually multiply the levels of authorized users, making a complete dual-use structure extremely difficult to manage, especially at the ground-segment level. In this respect, GMES cannot be considered a military-civilian system, but merely a civilian system that may complement military capabilities. The experts depicted GMES as a global system for Earth observation, environment and security monitoring, and data dissemination—all activities destined to coexist with parallel military activities without totally replacing them.



GMES Possible Data Policy as Perceived in 2003. Adapted from I. Shepherd and B. Routledge, *GMES and the BOC* (Torrejón, Spain: JRC and EU Satellite Centre, November 13, 2003).

Although GMES has the potential to be used in ways that go far beyond its initial environmental-monitoring objectives, security-oriented communities of users have not yet expressed clear requirements for such expanded capabilities. Still, GMES shows how Europe is starting to progress toward more security-oriented space applications without confronting the usual difficulties related to the building of a genuine collective defense and military policy. This security-oriented evolution does not reflect a rational political decision-making process at the level of the European governments. Instead, GMES is the perfect example of a slow but logical process that is constrained by a number of national and collective rules that must stay within the agreed conception of "security" to keep moving forward.

41. I. Shepherd and B. Routledge, *GMES and the BOC* (Torrejón, Spain: JRC and EU Satellite Centre, November 13, 2003).

EUROPEAN SECURITY EFFORTS UNDER CONSTRUCTION

Joint space-related projects such as Galileo and GMES have stirred the interest of all European institutions involved with promoting a more proactive European Commission security policy. Both a European Commission white paper made public in November 2003—"Space: A New European Frontier for an Expanding Union: An Action Plan for Implementing the European Space Policy"[42]—and the nascent European Security Research Policy started in 2004 by the European Commission (and associated with a new security-and-space budget line in the EU's Seventh Framework Programme for research and technological development) have indicated a larger effort to link space, security, and the European construction process. The European Commission also initiated the *Report of the Panel of Experts on Space and Security* (also known as the SPASEC Report), published in March 2005. The report "strongly recommends that the security applications of space should be given a high relevance in the forthcoming European Space Program" and that "this programme should be fully harmonised with other national and commercial programmes so as to obtain maximum synergy and affordability offering an enhanced capability for all aspects of security."[43]

ESA has paid close attention to these security developments. The formation of a joint ESA-EU Space Council (with a mandate to give a wider political perspective to the elaboration of space programs in Europe and also to deepen the security aspects of those programs) represented a dramatic rapprochement with the European Commission. ESA is reforming itself to address space security issues more boldly. As the European Defence Agency (EDA) is getting organized, ESA is trying to reassert itself in a rapidly evolving landscape.

Behind possible institutional turf battles, real strategic issues are at stake for Europe, where the sharing of responsibility for security programs in space is now openly discussed. Many practitioners recognize that the only workable political direction for a twenty-seven-nation Europe consists in dealing with a broad and generic security concept rather than a more classical military one, with a possible major contribution from dual-use, high-technology space systems. Indeed, space information systems are perceived as important contributors—some might say "security enablers"—because the roots of such systems lie in well-entrenched European industrial know-how and may prove to be an important high-tech investment for future economic and industrial well-being.[44]

The European investment trend in generic security in space differs notably from the more military-oriented choices made by the United States. This fun-

42. http://register.consilium.eu.int/pdf/en/03/st14/st14886.en03.pdf.

43. SPASEC Working Group, *Report*, 41.

44. This is one of the main motivations underlying the Galileo satellite navigation program.

damental trend has a number of direct and indirect consequences. It results in the absence in Europe of a real strategic shift toward space. Although space is perceived as an important asset for Europe, it is not yet considered a "vital national interest" as it is in the United States.[45] A different mindset exists on each side of the Atlantic when it comes to considering the relative importance of space assets in military organization and equipment or in military doctrine itself. Even if some avenues for cooperation have been followed—notably through NATO, with the recent decisions concerning a common military satellite architecture—the different levels of investment, as well as the different roles devoted to the space segment in military operations, have greatly complicated the prospects for transatlantic cooperation in the military space field.

More indirectly, the relative divergence of views about the military value attached to the space segment points to transatlantic differences in conceptions of security in space. The security-oriented European decision to hold back on dedicated militarization contrasts with the U.S. position. The two positions are likely to be with us for some time. More important, the two distinct positions will continue to define two distinct security strategies.

Europe: Moving Closer to "Cooperative Security" in Space?

The increasing European interest in space has legitimized the view that any spacefaring nation can look for more security in space. The issue that remains is what type of security. The EU's "Code of Conduct for Outer Space Activities," drafted at the end of 2008, argues that "security" must be conceived as addressing a large range of threats: "The purpose of the present code is to enhance the safety, security and predictability of outer space activities for all. . . . This Code, in codifying new best practices, contributes to transparency and confidence-building measures and is complementary to the existing framework regulating outer space activities." Subscribing states would then "establish and implement national policies and procedures to minimize the possibility of accidents in space, collisions between space objects or any form of harmful interference with other States' right to the peaceful exploration and use of outer space."[46]

Because security has for so long not been a prime issue in the European space debate, a "European" position and even national opinions on the subject are hard to find. Acceptance of the principles embodied in the 1967 Outer Space Treaty has remained the basic diplomatic posture of all European countries that have considered these issues. Until 2008, the subject had not been part of any work commissioned by the European Commission or by ESA on the security aspects of space. These works and proposals have instead insisted

45. Department of Defense (DoD), "Space Policy," DoD Directive 3100, July 9, 1999.

46. European Council, "Council Conclusions and Draft Code of Conduct for Outer Space Activities," December 17, 2008, 5, 8.

on internal European coherence, both politically and institutionally, as a basis for common security-oriented programs.[47] Still, Europe could no longer ignore the debate after the United States communicated its perspectives on the "weaponization of space" and triggered reactions from China at the CD. Even then, Europeans could do little more than note how much discussions about this particular issue among the United States, China, and Russia have been stalled for almost a decade in a forum largely influenced by nuclear-related issues.

Europe has been more active in another forum, the UN COPUOS in Vienna. Europe feels more comfortable talking about collective security in space than negotiating in a forum oriented toward military policy or disarmament. Several initiatives on collective security in space were launched in the 2006–2008 period under the direction of COPUOS Chairperson Gérard Brachet, a French space scientist and former director of the Centre National d'Etudes Spatiales (CNES), the French space agency. The push for some "rules of the road in space" (promoting greater transparency and more practical regulations) that could be presented for the consideration of COPUOS's technical and scientific subcommittee was a new move for COPUOS.[48] The move influenced discussions of the "sustainable development of activities in space," as well as the EU proposal for a "Code of Conduct for Outer Space Activities."

The idea for a code of conduct grew out of a proposal made by the Italian ambassador to the CD in Geneva during the spring of 2007, and found a clear support in the more general effort initiated during the same year by the European Council to promote collective security in space. A working group has been developing a draft version of the code of conduct since summer 2007. A first "food for thought" paper was presented in September 2007 to the First Committee of the UN General Assembly, and a first version of a draft code of conduct was circulated to the United States, China, and Russia in July 2008. A second improved version of the text is under preparation for another round of consultations, envisioned for 2009. Japan, India, or Canada likely will be added to the list of countries consulted by the EU.

Considering the perceived need for protection of its space assets, Europe has ample room to discuss security matters without approaching the issues of weaponization. From Europe's point of view, discussing weaponization is premature as long as several immediate collective security challenges are not properly addressed. Brachet has suggested that not focusing on the issue of armaments in space makes sense if one wants to deal with security at large.[49]

47. The issue is notably absent from the SPASEC Report, which concentrates on the possibilities for Europe to acquire and build a first European security capability in space. Only the issue of space surveillance is mentioned as a potentially critical area where a gap would damage the idea of a serious and autonomous European security capability in space. SPASEC Working Group, *Report,* 36.

48. See Gérard Brachet, *Le rôle et les activités du Comité des Nations Unies pour les utilisations pacifiques de l'espace extra-atmopshérique (CUPEEA)*, vol. IX of *Annuaire Français des relations internationales 2008* (Paris: La Documentation Française; Brussels: Bruylant, 2008), 905–915.

49. Ibid., 911.

At a minimum, discussing security and weaponization issues in a transatlantic fashion cannot be disconnected from wider perspectives on future general changes in space. The effects on security of armaments in space would then be considered a sub-issue of the collective security architecture for future space activities. The space landscape will change dramatically over the next few years and will thus create new conditions for security. Increased activity, much like increased space debris, will create more opportunities for interference, intentional or not. The European response to divergent security strategies (especially the strategy favored by the United States) will likely be first to address impending changes, fix glaring security problems, and create the conditions for realistic security management in space—and only then to engage in dialogue about what further level of security or insecurity anti-satellite weapons could bring. Putting the issue of weaponization of space in such an enlarged perspective would allow it to be dealt with in a more comprehensive manner, thus improving the chances that this particular problem will be solved.

Which near-term security problems in space should be fixed before the issue of militarization is worth considering? A number of experts have already identified a set of candidate problems that could become part of active European policies.[50]

Cooperative Space Security as a Way toward Stabilization: A Possible European Challenge?

From Europe's perspective, the space security debate is centered on a few axiomatic positions that must be taken into account if one hopes to devise broadly acceptable proposals. The current space security debate involves only a few countries (namely, the United States, China, and, to a lesser extent, Russia) that link their position in this domain to their larger strategic positions and relationships. The CD's Prevention of an Arms Race in Outer Space (PAROS) initiative is also affected by the difficulties presented by the disarmament policies and institutions of the main players.

Space security talks have made little progress since 1999, when China revived the idea of negotiating measures to prevent an arms race in space. The PAROS initiative has encountered two types of obstacles: one relates to the strategic and military importance placed on space systems by the United States in the post–Cold War era; the other derives from the current diplomatic reluctance, mainly on the part of the United States, to accept new legal constraints on military activities. Whereas the United States wants to stick with the general terms of the 1967 Outer Space Treaty, which allows some military activities in space, China and Russia have tried to develop more explicit prohi-

50. See, for example, *Europe and Space Debris*, 10th International Colloquium on Aerospace Security, National Academy of Air and Space, Toulouse, France, November 27–28, 2002; *Space for Defense: A European Vision* (Paris: Académie National de l'Air et de l'Espace, Association Aéronautique et Astronautique de France, 2005); and Bertrand de Montluc, "Space Security, A Non-U.S. Point of View," in *Perspectives on Space Security,* ed. John Logsdon and Audrey Shaffer (Washington, D.C.: Space Policy Institute, George Washington University, 2005), 79–90.

bitions on space weapons.[51] In 2003, China claimed that the United States wants to achieve space dominance by expanding its military uses of space, accelerating space weapons research and development, and developing military concepts.[52] The United States merely reiterated that it "didn't see the need for a new treaty."[53] Only very recently, discussions in the CD have been given a possibility to reopen with an agreement to set up a working group "to discuss substantively, without limitation, all issues related to the prevention of an arm race in outer Space."[54]

This new perspective may result from a number of attempts that have been made since 2003–2004 to break this deadlock and give new dynamism to the CD debates by broadening the debate and finding more flexible methods. The attempts reflect a realization that the space security discussion must be considered more seriously by "external" actors in order to find new rationales to stir up new discussions. In January 2004, the French representative to the CD in Geneva noted that "the dominating thinking in Geneva was very much the result of the Cold War with predictable and heavy international verification systems apparatus, legally binding treaty commitment that come from very formal and codified negotiations." He cautioned the CD not to ignore "the new forms of action in the disarmament domain, with politically binding agreements based on more flexible and informal working procedures."[55]

A proposal presented by five ambassadors in January 2003 delinked three strategic issues: negotiations on a treaty to end fissile material production; nuclear disarmament; and space security.[56] The proposal led, in May 2004, to an informal plenary session allowing a first "exchange of views." The president of the May 2004 session remarked that the importance of both commercial and military space activities would make any interruption of these services catastrophic. After he stressed the necessity to "secure" activities in space, several other participants underscored the inadequacy of existing legal rules and the urgency of addressing this issue before space weapons become an international fact of life. Sponsors proposed assembling experts, users, and other interested nongovernmental organizations to help forge a common understanding of the PAROS debates.

51. See, for example, "Possible Elements for a Future International Legal Agreement on the Prevention of the Deployment of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects," Working Paper CD/1679, Conference on Disarmament, Geneva, June 2002, http://disarmament2.un.org/Library.nsf/0/0b9bdb56abb694a385256c0f004fa9c0/$FILE/cd1679.pdf. The paper was jointly presented by China, Russia, Vietnam, Indonesia, Belarus, Zimbabwe, and Syria.

52. "Final Record of the Nine Hundred and Thirty-Third Plenary Meeting, UN, Conference on Disarmament," CD/PV.933, July 31, 2003.

53. Eric M. Javits, "Remarks to the Conference on Future Security in Space," press release, United States Mission, Geneva, May 29, 2002.

54. CD/1863–Draft Decision for the establishment of a Programme of Work for the 2009 session, http://www.reachingcriticalwill.org/political/cd/papers09/ 2session/CD1863.pdf.

55. See, in French, http://www.reachingcriticalwill.org/political/cd/speeches04/Jan22France.htm.

56. "Initiative of the Ambassadors Dembri, Lint, Reyes, Salander and Vega: Proposal of a Programme of Work," CD/1693, Conference on Disarmament, Geneva, January 23, 2003.

The May 2004 plenary session helped persuade some of the most intractable nations to adopt new positions. China and Russia showed some flexibility in two "non-papers" distributed in August 2004 that, while reiterating that the ultimate goal was to negotiate a new agreement, affirmed that these countries were ready to start with more informal discussions in a special space committee proposed during the session.[57] Other countries, including Canada, also reiterated their opposition to space weaponization and recognized the need for action. In March 2004, Canada co-organized (in collaboration with the UN Institute for Disarmament Research and a number of nongovernmental organizations), an international working group on "security in space," forwarding the message that a coordinated and global approach was needed to guarantee security in space. On October 5, 2004, Russia pledged that it would not be the first country to deploy arms in space, inviting other spacefaring countries to follow the same path.

Although the United States was not receptive,[58] these initiatives found political resonance with a significant part of the international community. The proposal for an enlarged discussion in renewed forums has been endorsed by a number of countries. France is ready to support a separate mandate for the special committee, and Sweden, which supports the proposal, also favors launching informal technical discussions in the CD, with the possibility of inviting a wide array of space stakeholders from both the public and private arenas. According to the Swedish representative to the CD, the Geneva working process would directly benefit from interaction with a broader range of space users because space applications are increasingly dual use in nature and because conceptions of security are expanding in the post–Cold War era.

As of 2008, the CD forum has widely been perceived as presenting a difficult case for diplomacy in space. A Chinese and Russian proposal for a Treaty on the Prevention of the Placement of Weapons in Outer Space submitted to the CD in February 2008[59] has often been seen as presenting too many gaps and undefined notions (such as "space weapon") to provide a good basis for collective space security. Emerging alternative forums that deal directly with "bottom up" issues, such as space surveillance data exchange, so-called space weather (addressing the issue of solar flares and radiations predictions), and possible "down to Earth" rules of the road or "best practices," appear more promising in the current international context. Although born in the context of the CD, the EU draft "Code of Conduct for Outer Space Activities" is now more likely to be pushed as a political initiative without any direct link to the

57. The two non-papers are "Verification Aspects of PAROS," a non-paper by Chinese and Russian delegations to the Conference on Disarmament, August 26, 2004; and "Existing International Legal Instruments and Prevention of the Weaponization of Outer Space," a non-paper by Chinese and Russian delegations to the Conference on Disarmament, August 26, 2004.

58. In September 2004, U.S. Under Secretary of State John Bolton recalled, "We are not prepared to negotiate on the so-called arms race in space. We just don't see that as a worthwhile enterprise." John R. Bolton, "G8 Senior Group Meeting," press release, September 10, 2004, http://www.us-mission.ch/press2004/0910BoltonTrans.htm.

59. See http://www.fmprc.gov.cn/eng/wjb/zzjg/jks/jkxw/P020080220634677505482.doc.

CD. Similarly, without a common foreign policy, Europeans will likely find reasons to consolidate the "code of conduct" approach in lieu of the more formalized treaty-like follow-ups that automatically render topics more political and thus more sensitive.

COMBINING THE DIFFERENT SECURITY APPROACHES IN A NEW COMPREHENSIVE FRAMEWORK

Any new consideration given to the security issues in the space debate should build on the following "facts of life" in space. On the one hand, the will of the United States to strengthen the defense of its space assets is now largely acknowledged. The use of ASAT systems to achieve such a goal has appeared to be the subject of a limited debate among U.S. policy-makers, with some consequences at the international level. As the ASAT-type events that occurred in 2007 and 2008 demonstrate, this debate is part and parcel of a larger strategic debate about the positioning of the United States as a political and military power on the world stage, with its relationship with China as one of the key variables in the equation. On the other hand, in coming years the space landscape will change at an increasing pace, and the definition of the "threat" will grow increasingly complex because of the emergence of new spacefaring countries and other actors.[60] As more and more players arrive, the range of national motivations for being in space will diversify; and as the interest of emerging spacefaring nations in using the most advanced space technology to promote economic and social development grows, so, too, will interest in technologies that have inherent military applications.

This means that the intensity and the multinational character of civilian space activities, particularly those conducted in LEO, will increase at the same time that the potential for military use is on the rise. This simultaneity creates great challenges that warrant serious discussions on both the nature and efficiency of the technical protective measures that might be implemented and the political difficulties associated with those measures. Military-oriented technical protection measures can address only part of the general security problems in space. A military approach to space security is intrinsically ill-equipped to mitigate the political consequences such an approach might have on the international scene. Those consequences could have the potential to erode the overall level of space security. Moreover, military-oriented technical protection measures (that is, "defensive assets") could increase tensions by becoming targets themselves.

The notion of comprehensive security in space being advanced by European representatives in the CD and elsewhere can act as a bridge to connect the security interests shared by all parties, covering both the security aspects and the promotion of space activities for developing countries.

60. See, for example, Simon Collard-Wexler, Jesse Cowan-Sharp, Sarah Estabrooks, Thomas Graham, Jr., Robert Lawson, and William Marshall, *Space Security 2004* (Waterloo, Ontario: Space Security.org, 2004), 43–46, http://www.spacesecurity.org/SSI2004.pdf.

Room exists to tackle the different conceptions of space security using an approach that would be both comprehensive and efficient. The key elements of the U.S. space control doctrine—namely, space surveillance, passive protection of space assets, and space systems protection with more active assets[61]—should be considered in an orderly fashion that leads to some acceptable international framework, with the ultimate goal of rendering the last of these items unnecessary. Because any serious spacefaring country would be willing to recognize the existence of present and short-term security threats in space, a gradual approach that starts by addressing immediate or very short-term technical concerns would create a spill-over effect that could ultimately lead to better mutual political understanding and trust. Such an approach might follow a three-step sequence: identifying problems that require cooperation; agreeing on which projects are the best candidates for cooperation; and using successful experiences as a base for more ambitious forms of cooperation.

First Step: Identifying Problems That Require Cooperation

Several issues contribute directly to the changing space landscape and call for minimal agreements between nations because they pose serious security challenges even though they do not involve deliberate attacks on space assets.

The Issue of Orbital Debris Management. The security of the space environment already faces two physical challenges: the pollution by space debris of some orbital zones, especially in LEO; and satellites' end-of-life cycles, which, if poorly managed, can lead to a shortage of orbital slots and/or frequencies in orbit, whether LEO or geostationary orbit (GEO), with potentially harmful and wide-ranging consequences.

More than 12,000 identified pieces of debris orbit Earth at various altitudes, with more than two-thirds distributed at altitudes between 300 and 1,500 kilometers and the rest in GEO (at an altitude of approximately 36,000 kilometers). As the modifier *identified* suggests, the actual amount of orbiting debris is potentially much greater (detected debris typically has a size larger than about 10 centimeters in LEO and larger than one meter in GEO). Some experts estimate that currently undetectable pieces of debris could number in the hundreds of thousands. Even these tiny pieces of debris can damage or destroy a satellite's solar panels or instrumentation. Much orbiting debris is the result of launch and on-orbit disposal operations. Such debris comprises metal particles used in solid propellants and materials left over from the on-orbit breakup of the liquid upper stages of the rockets that place satellites in orbit. Spacecraft explosions and malfunctions in orbit also contribute to debris production.

61. See Richard Kaufman, Henry Herzfeld, and Jeffrey Lewis, *Space, Security and the Economy* (Annandale-on-Hudson, N.Y.: Economists for Peace and Security, 2008), 10–21, http://www.epsusa.org/publications/papers/spacesecurity.pdf. Some of those systems were included in the U.S. federal budget for the 2009 fiscal year. See also, http://www.cdi.org/pdfs/SpaceWeaponsFY09.pdf.

In the 1970s, the main spacefaring nations began to recognize the debris problem. Since then they have adopted debris-mitigation measures that reduce debris associated with launching phases, spacecraft accidents, and the normal mechanical procedures that occur during a satellite's life cycle. Cooperative measures have been implemented by the main space agencies to lower debris production during satellites' on-orbit life cycle, to diminish the probability of accidental explosions, and to improve debris monitoring so as to minimize collision risk. The Inter-Agency Space Debris Coordination Committee (IADC) was created in 1993 under the auspices of the United Nations; it comprises the main national space agencies and ESA. In 2001, the IADC had been engaged in a more proactive posture that led to the adoption of guidelines by the UN. At the European level, a cooperative effort is under way to propose preventive and protective measures for activities in LEO and GEO. These efforts to propose an international norm have been coordinated in the framework of the IADC with the goal of support at the UN COPUOS level. After a number of technical difficulties have been resolved, a consensus has been reached about different disposal measures to be adopted by spacefaring countries, in particular for the de-orbitation of low Earth orbit spacecrafts (that is, with an altitude inferior to 2,000 km) with a limit of twenty-five years after their end of life. In June 2007, UN COPUOS finally endorsed the IADC so-called space debris mitigation guidelines, which were subsequently endorsed by the UN General Assembly in 2008.[62]

International efforts to reduce orbital debris demonstrate that technical negotiations can progress without too much political and legal conflict. The relatively long-standing international cooperation on space debris also shows that a collective view of common concerns can lay the groundwork for future technical cooperation, such as Europe's integrated efforts to get a better collective surveillance system.

Orbital Traffic and Electromagnetic Spectrum Management Issues. Another sensitive issue that must be addressed in the near term involves the collective management rules for dealing with orbital slots and satellites' end-of-life cycles. The need for such rules is particularly true in the case of telecommunications satellites, which are typically positioned in GEO, where slot positions and frequencies are commercially exploitable resources that have become somewhat scarce. Interference problems and traffic-management issues arise from the growing use of GEO. To avoid conflicts in orbit, the minimum distance between satellites has generally been set at 0.05° at 36,000 kilometers, with a maximum of seven satellites per orbital slot. In GEO, the very ability of the satellite operator to provide telecommunication from and to the Earth's surface and traffic-management issues (due to overcrowded orbital slots) are interrelated because both geographical position and frequency selection need be

62. UN General Assembly, "International Cooperation in the Peaceful Uses of Outer Space," A/RES/62/217, January 10, 2008.

objects of fierce competition to ensure commercially viable activity. Indeed, some geographical positions are highly valuable due to their associated market, as well as broadband capacities provided in a limited portion of the electromagnetic spectrum and needed to satisfy ever-increasing worldwide telecommunication fluxes.

Managing end-of-life cycles for commercial and publicly owned satellites poses difficult questions because the operational lifespan of a satellite can make the difference between commercial success and failure. Indeed, geostationary satellites must typically be de-orbited some three months before the end of their life so they can use their on-board fuel to reach a so-called graveyard orbit above the geostationary orbit, where they don't pose any risk to the remaining active satellite population. It is easy to imagine that reducing any telecommunication service by three months does not go without financial impact on any commercial project. Moreover, in the case of satellites developed for military purposes, governments will also be hard pressed to deliberately stop exploiting them in order to execute disposal procedures. Given the increasing military dependence on space assets, one can expect such a situation to get worse if militaries become more inclined to fight to extend the life of their on-orbit systems.

In recent years, the International Telecommunication Union (ITU) has recommended that a graveyard orbit, some 200 to 300 kilometers beyond GEO, be used to dispose of satellites when they still have enough fuel left to reach this new position. A satellite graveyard would free up scarce orbital slots. In 2004, the U.S. Federal Communications Commission mandated that commercial satellite operators follow the IADC guidelines, which will create some pressure for other nations to follow suit.[63]

The exploitation of GEO may be one of the most contentious international space issues, pitting current spacefaring countries against emerging ones. Recently, some countries with an increasing interest in using GEO, such as Iran, have filed requests with the ITU to change rules inherited from a time when only a few dominant spacefaring nations shared the geostationary resource. The requests call into question the traditional international balance underlying those rules and signal the will to open them up for political debate. In particular, demands for non-permanently-attributed slots are growing and have become over the years a key issue for the ITU, obligating the institution to clarify its position on the subject.[64]

All of these issues will continue to evolve as the number of operators in orbit increases and will get more complicated as space becomes a field of more intense commercial and governmental competition. This competition has generated a large number of "paper satellites": applications to the ITU

63. Peter de Selding, "FCC Enters Orbital Debris Debate," *Space News,* June 28, 2004, http://www.space.com/spacenews/businessmonday_040628.html.

64. See Ram Jakhu, "Legal Issues Relating to the Global Public Interest in Outer Space," *Journal of Space Law* 32 (1) (Summer 2006): 38–41, http://www.cissm.umd.edu/papers/files/jakhu.pdf.

for orbital slots from countries simply wanting to reserve space for projects that are, at present, little more than hypothetical. The large number of applications has caused a work backlog for the ITU, which only makes it harder for legitimate applications to be approved. Spacefaring nations will have to find creative political and technical ways to cope with this growth. While the challenges this growth brings do not involve direct hostile uses of space and cannot be mitigated by military responses, the situation is one of the most serious issues on the collective security agenda. Without careful collective examination, these difficult issues could potentially degrade the space environment and spark international confrontation. Using new technologies to place multiple satellites on the same orbital slots will make the management of these orbital platforms more delicate and will require increased transparency through commonly accepted rules. Establishing rules for behavior in space that are acceptable to every country will be one of the key international security challenges in the years to come.

Traffic Management Issues and Related Responsibilities. Except in the case of GEO, where the ITU is the main regulatory body, orbital activities have not been subject to widely applicable rules. A study published in 2006 by the International Academy of Astronautics (IAA) underscores the relative paucity of UN regulations concerning behavior on orbit.[65] In particular, the wide range of legal statuses among satellite operators increases the difficulty of assigning responsibility in case of collision or interference with orbital operations. The IAA study points to the difficulties that can arise when parties are more numerous and use continually improving techniques and services in orbit—for example, extended maneuverability, orbital changes, formation flying, constellation management techniques, and reentry capabilities. Among the most noteworthy of the potential problems are:

- An increase in the danger of maneuvers in geostationary slots;
- The inadequacy of the precision and level of reliability of existing orbital data in the face of increasing space traffic;
- The lack of right-of-priority rules for orbital maneuvers;
- The lack of obligation to communicate in advance about space activities;
- The lack of precise regulations for LEO (that is, regulations comparable to ITU rules for GEO);
- The complications for collective debris management related to reentry operations; and
- The difficulties of reentry operations in relation to the selection of descent corridors and impact zones on scarcely populated areas.

65. International Academy of Astronautics, *Cosmic Study on Space Traffic Management*, ed. Corinne Contant-Jorgenson, Petr Lála, and Kai-Uwe Schrogl (Paris: International Academy of Astronautics, 2006), http://iaaweb.org/ iaa/Studies/spacetraffic.pdf.

These problems are further complicated by the ambiguity of terms such as *launching state* and space vehicle *registration*. The term *launching state* implies legal responsibility should a problem occur during the launch phase. The term remains ill-defined, however, and could mean the state that actually launches or orders a launch or the state whose territory and facilities are used for the launch. The range of possible meanings can lead to cases in which several states are held legally responsible for the same launch.[66] Because of the potential for ambiguity, private operators of launch systems tend to limit their responsibility precisely. For example, the European launching firm Arianespace limits by contract its responsibility to the rocket propulsion stages, with the customer being obliged to take all necessary measures to register its satellite and take legal responsibility for the satellite thereafter (or transfer that responsibility to the state).

In theory, only one state of registry can exist for any satellite. But in reality, the multiplication of actors in space and their often multinational status have complicated the matter, leading de facto to a number of unregistered operational satellites. Because these developments may have a direct impact on the security of space activities, better regulations would lead to a net improvement in the collective space security framework by making both inadvertent interference and, in the worst-case scenario, potentially hostile or aggressive exploitation more difficult.

Second Step: Agreeing on Which Projects are the Best Candidates for Cooperation

Some technical programs relevant to collective space security are good candidates for cooperation. The European experience, which is informed by Europe's unique approach to collective security, is inspirational. Because a few European states have already developed equipment for space surveillance, ESA has emerged as a regional leader in federating existing national capabilities.

These systems can be as different as France's initially defense-oriented Grand Réseau Adapté à la Veille Spatiale (GRAVES) bistatic radar system (managed by the Office National d'Etudes et Recherches Aérospatiales [ONERA], the French national aerospace research center); or the French Navy's ballistic missile-tracking ship *Monge,* which is equipped with several advanced types of radar, including the ARMOR; or Germany's FGAN-TIRA–Forschungsgesellschaft für Angewandte Naturwissenschaften's (Research Establishment for Applied Science) Tracking and Imaging Radar; or the U.K.'s Chilbolton Facility for Atmospheric and Radio Research, which includes several types of radar systems and is run by the Rutherford Appleton

66. See Armel Kerrest, "La notion d'état de lancement à la lumière des évolutions de l'activités spatiales," UN COPUOS, Legal Subcommittee, 39th Session, April 2000, http://fraise.univ-brest.fr/~kerrest/IDEI/Copuos_SCJ_00_Fr_def.pdf.

Laboratory; or the Starbrook wide-field telescope located in Cyprus and sponsored by the British National Space Centre.[67]

These and other systems in Europe form the basis for renewed consideration of a Europe-wide space surveillance network that, even with modest initial capabilities, could help inform common policies in Europe while allowing ESA to be part of wider exchanges with the United States. The GRAVES system, fully operational since December 2005, can be considered as a possible contributor of such a European endeavor.[68] Further improvements to GRAVES include improving both the emitting system (doubling the system allows a 180° azimuth cover with observation of all detected satellites at least twice a day) and the signal processing system for the new data, which will include new orbital data-processing tools to construct and maintain a catalog of orbital parameters.

Further cooperative endeavors are under way to federate the European monitoring and tracking assets into a standardized system. In 2002, ESA took a leading role in coordinating these efforts by commissioning a study about the design of a European Space Surveillance System based on past national experiences. An initial proposal suggests pooling resources and technologies to build improved space surveillance systems in LEO and GEO.[69] The main challenge will be to maintain a catalog of orbital objects that provides a genuine analytical capability, allowing, for example, links to be formed between detected debris and its origin (for example, a given satellite that exploded on orbit).

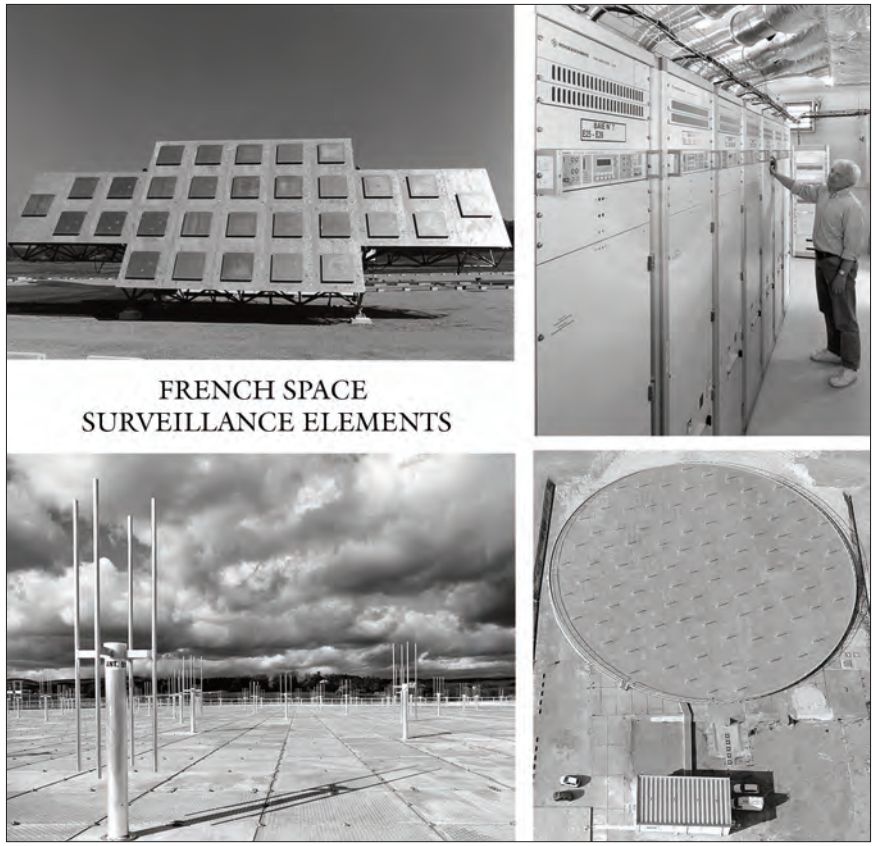
Because of the increased space activity expected in years to come, the cataloging and monitoring of orbital objects will be one of the main applications of both regional and global cooperative systems. Any GEO survey and cataloging strategy will require repeated and updated observation of space objects to secure correct orbital data, to better identify uncataloged objects, and to task observation for catalog maintenance and maneuver identifications.[70] Cooperative technical solutions or strategies would pay off quickly here by offering participating states improved data collection, which in turn would provide better

67. See Heine Klinkrad, "Monitoring Efforts—Efforts Made by the European Countries," presentation made during the 10th International Colloquium on Aerospace Security, Toulouse, France, November 27–28, 2002. See also Richard Crowther, "The Current Situation Regarding Space Debris and Future Problems," presentation made during the 10th International Colloquium on Aerospace Security, November 27–28, 2002. For a discussion of GRAVES functioning and perspectives, see Thierry Michal, "Les perspectives d'avenir pour les équipements-sols" presentation made during the 10th International Colloquium on Aerospace Security, November 27–28, 2002.

68. Control of the GRAVES system has been transferred from ONERA to the French Air Force.

69. This study, led by the ONERA with expertise from Germany and the United Kingdom, was presented in a 2005 technical paper. A first system envisioned for 2010, with upgrades in 2015, would reach 1,700 kilometers and provide 98 percent LEO coverage. A second system for 2015 would provide 95 percent GEO coverage (based on the use of three globally distributed sites). T. Donath, T. Schildknecht, P. Brousse, J. Laycock, T. Michal, P. Ameline, and L. Leushacke, "Proposal for a European Space Surveillance System," in *Proceedings of the Fourth European Conference on Space Debris 18–20 April 2005, ESA/ESOC, Darmstadt, Germany*, ESA SP-587, ed. D. Danesy, 31–38 (Noordwijk, The Netherlands: ESA Publications Division, 2005), http://www.esa.int/esapub/conference/toc/tocSP587.pdf.

70. Ibid.



The GRAVES transmitter and receiver in Dijon and Apt, France. © ONERA–Centre de Recherches Aerospatiales. Reprinted with permission from ONERA.

The Télescope à Action Rapide pour les Objets Transitoires (Rapid Action Telescope for Transient Objects; or, TAROT), which CNES uses to monitor the geostationary orbit. © CNES, France. Reprinted with permission from CNES.

space-management capabilities and better security assessments. Already, France and Germany have been closely cooperating on better coordination of the use of their respective space surveillance assets. This nascent cooperation foreshadows the future European Space Situational Awareness (SSA) program. While extra-European cooperation—for example, by increased transatlantic data exchanges—logically fits with future planning, intra-European coordination remains at the heart of the project to produce data of "European" origin. Political autonomy is the key underlying concept for the future SSA technical architecture.

The main spacefaring countries recognize that improving space surveillance capabilities is necessary for the further development of their space activity and that by not pooling their existing capabilities and working in concert toward a future upgraded system they will be missing a tremendous opportunity. Recognizing this, the ESA ministerial council gave the European SSA program an official green light in November 2008. Initially, four services were considered: the surveillance and tracking of objects, the imaging of objects, a better space weather capability, and a survey of near-Earth objects (NEOs). As of 2009, the focus has narrowed to "one core element covering governance, data policy, data security, architecture and space surveillance, and three additional optional elements": space weather studies, NEO surveillance, and pilot data centers.[71] So-called enabling capabilities, including new supplementary surveillance radars, would come later, most likely in 2011 for the next ESA ministerial council. The support of ESA member states for SSA can be seen in the fact that the council pledged €50 million for SSA over the next three years. As such, the 2008 ESA ministerial council appears to have endorsed the political need for Europe to invest in a more complete space surveillance system and to define an SSA governance and data policy, allowing, when necessary, the confidential, secure exchange of information among the European member states as well as with other SSA systems.[72] If successful, SSA might in a few years prove to have been the first concrete demonstration of the ESA's political willingness to promote collective security in space.

Practical technical measures such as improved registration mechanisms may also help the international community deal with the projected increase in the number of space objects and actors. In the case of launch-debris mitigation, the international community will need to persuade countries that pursue autonomous launching efforts to comply with collective security rules by grant-

71. "Ministers Meet to Define the Role of Space in Delivering Europe's Global Objectives," ESA Portal, November 18, 2008, http://www.esa.int/esaCP/SEMUPQ4DHNF_index_0.html.

72. A first European study on SSA governance and data policy mandated by ESA was led in 2008 by the Fondation pour la Recherche Stratégique (and coordinated by the author of this paper) with the objective of identifying possible organizational models and data policy mechanisms that would allow mixing data of different types and nature (civilian and military) into a multinational organization. This aspect of the European SSA system presents a key challenge that will need further research in the context of the core SSA program approved by the ESA ministerial council. See the Executive Summary of the study at esamultimedia.esa.int/docs/gsp/completed/C21443ExS.pdf.

ing them access to launch-related debris-mitigation techniques not accessible to all countries.[73] Although such mechanisms have become the norm among the main spacefaring countries, new spacefaring countries might see such policies as too intrusive and as interfering with their own right of access to space. Still, given the expected increase in the use of space by new countries, the international community will have to develop an equitable debris-mitigation policy.

International discussions about debris mitigation have made progress only because they are not intended to build a legally binding framework and because they deal with immediate concerns. In the case of launch-debris mitigation, existing international regulatory agreements, such as the Missile Technology Control Regime, which reflects a shared view of collective security interests, should improve the possibility that Europe and the United States can find common ground for a coordinated policy using flexible negotiating schemes.

Because the technologies to dispose of orbiting rocket stages and satellites at the end of their operational life remain costly and have been utilized by only a few nations, both the United States and Europe should help other countries to develop their own capabilities. Pooling technical and diplomatic skills and resources at the international level would make clear to third parties that launch and end-of-life regulations are not meant to thwart national space-development efforts, but rather to foster the openness of such efforts.

Third Step: Using Successful Experiences as a Base for More Ambitious Forms of Cooperation

This overview of some of the most commonly noted difficulties in the utilization of space demonstrates that the relationships among diverse users are at the heart of the most immediate security concern for the international community. Coordinating national and commercial behaviors by creating a regulatory framework acceptable to all parties would be an efficient way to address the most probable near-term dangers in space. Collective transparency would be encouraged if connected to a properly designed regulatory framework for defining and detecting suspect or uncontrolled activity in space. Ideally, a collective approach to space security would prove pragmatic and efficient enough to diminish drastically any spacefaring nation's interest in pursuing contentious activities in space.

At a time when discussions about security in space are almost stalled, a gradual approach might help states reach agreement about what the current problems actually are and might help them understand the extent to which a continuation of current activities could worsen the situation by degrading the space environment. Many authors have advocated new codes of conduct for

73. The main space agencies have worked together in the Interagency Space Debris coordinating committee to promote sophisticated techniques allowing them to passivate the orbital stages of launch vehicles—that is, prevent their explosion in space. The techniques for doing this involve elaborate technical skills and capabilities not accessible to any one country.

space activities, or even additional treaties.[74] To be efficient and acceptable, any legal approach to better-codified collective security in space will have to consider some basic facts of today's and tomorrow's international space environment. These include:

- The existence of competing interests among spacefaring countries, emerging spacefaring countries, and nonspacefaring countries;
- The existence of potentially competing positions and strategies among public and private actors; and
- The diffusion of new space technologies that will irrevocably change the future space environment.

Europe is well positioned to be an honest broker because it is a spacefaring entity with strong interests in preserving space as a strategic investment area and because it is a political outsider vis-à-vis the most active participants in the CD's PAROS standoff. Having based its own view of security on the preservation of a balanced use of space without massive investments in the military field, Europe is well placed to promote a renewed effort to reach agreement on collective rules of the game. A broader range of perspectives could fruitfully inform new discussions about both the implications of some military uses of space under development by some nations—namely, the United States and, possibly, China in the mid-term—and the evolution of civilian space techniques similar to some military techniques.

Any effort in this direction will have to deal first with the technical aspects of reinforcing the collective security of the space environment. Europe, because of its nascent effort to build the first cooperative space surveillance system, might find itself particularly well placed to lead in this area as well. Setting up a genuine European space surveillance network involving a number of EU member states could help Europe reach the technical and political critical mass needed to start discussions at the international level—but notably with the United States—for a global network with increased performance. At present, any discussion surrounding these issues would be limited to technical exchanges in which Europe's contribution would be marginal compared to that of the United States, with its large investments and experience.

At the European level, such internal technical cooperation could pave the way for a more proactive European "security in space" policy on the international scene by giving the member states a better common awareness of the security issues associated with the development of space activities. Adopting such a proactive policy would mean giving Europe sufficient autonomy to

74. See, for example, Richard Garwin, Kurt Gottfried, and Len Meeker, "A Draft Treaty Limiting Anti-Satellite Weapons," Union of Concerned Scientists, 1983, http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/policy_issues/a-draft-treaty-limiting.html; Michael Krepon and Michael Heller, "A Model Code of Conduct for the Prevention of Incidents and Dangerous Military Practices in Outer Space," *Disarmament Diplomacy*, 77 (May/June 2004), http://www.acronym.org.uk/dd/dd77/77mkmh.htm; and Hitchens, *Future Security in Space*. The EU used the phrase "Code of Conduct" for its 2008 "Code of Conduct for Outer Space Activities."

make its investment in space more credible and in-line with the security orientations announced in recent documents (such as the EC's 2003 white paper and the *Report of the Panel of Experts on Space and Security*). The resulting increase in the performance of space surveillance systems would also offer the possibility of new talks promoting better sharing of data. One area that would benefit from increased data sharing is space-debris monitoring and detection, where, at present, the volume of data to process is huge and the modeling is relatively inaccurate. Additional detection facilities would multiply the amount of data collected for any given object, thus improving monitoring accuracy and allowing orbital measurements to be made more quickly.[75]

Technical cooperative advances such as these can occur only if the political aspects of cooperation for space security are simultaneously addressed. To be acceptable by all parties, such cooperative advances will have to define "win-win" rather than "zero-sum" situations so that all spacefaring nations see the collective advances as being highly beneficial to their national interest. Important work must be carried out to define in a precise and realistic fashion when and how the space security and defense interests of any nation, including the United States, would be technically and legally better guaranteed in the mid- and long-term by a collective security system than by the pursuit of national interests only. The ultimate goal of the international community would be to implement new rules of the road that could reduce the perceived need for accelerated military options while promoting an important collective effort to convince the more reluctant countries to take part in some kind of new space regime. The heart of this diplomatic effort would consist in demonstrating how such a space regime, often easily discarded as unrealistic, could be a perfect fit with pragmatic security policies.

Reflecting on a Collectively Acceptable Space Security Framework

The role of such a framework would be to set the scene for renewed international cooperation in space. As has been (and is still) the case for European security and defense construction, such a collective undertaking requires a gradual, mutually acknowledged approach. A cooperative framework must appear equitable (it has to allow the entrance of newcomers without any perceived discrimination) and rigorous (new entrants must comply with technical and legal rules, the goal of which is to make sure that the new activity will not create either military or security challenges). Possibly forming the basis for a genuine new international regime, this general understanding would be a decisive step toward reinforcing the regulation of the conditions under which new actors access space.

75. All of this depends on technical advances in the field of "intelligent" software design. The required software will need to be able to take into account all the exceptional or unpredictable events that might accompany space activity (such as multiple launches, more frequent orbital maneuvers, and orbital explosion tracking). The development of software capable of sophisticated identification and monitoring simulations is currently well under way (for example, ONERA's S3 software). See Michal, "Les perspectives d'avenir."

Europe should identify potentially cooperative domains where it can make its own contribution (such as collaborative space surveillance) and then develop active diplomacy in these areas. The goal would be to prepare a future international exchange forum, either under a new organization dedicated to this purpose or under an existing institutional structure, that would focus on the security of space activities within a definition of collective monitoring capabilities acceptable to a wide range of countries. Such an approach should include political incentives for participation but not legally binding constraints (at least initially), because they would immediately lead a number of countries to refrain from participation. Several domains present attractive opportunities for cooperation.

Collective Rules for Debris Prevention and Mitigation and for Spectrum Management. The current debris-mitigation procedures promoted by the IADC should be extended to form the basis for a cooperative international framework that would regulate each delicate step of spaceflight (launch phase, disposal on orbit, management, end of life, and, possibly, reentry). Although the IADC guidelines are not legally binding, they can create normative obligations for parties who wish to access and use space in a responsible manner. Such normative guidelines aim to diminish the risks inherent in increased space activity without creating obligations that are so technologically demanding as to exclude emerging spacefaring countries from the benefits of national space activities. De facto discrimination should be avoided to preserve the win-win principle at the heart of this collective undertaking. Creative thinking might be needed to protect trade secrets and other sensitive information. All parties would also have to reach agreement on jurisdiction over private operators involved in the management of space applications.

This framework could also create the conditions for acceptable short-term regulatory measures addressing spectrum management issues. Keeping in mind the goal of improving political incentives for all countries to adhere to voluntary rules, near-term objectives could be to suggest the development of techniques to diminish the risk of electromagnetic interference, to better share orbital and frequency resources (especially for newcomers in space), and to ensure that private operators respect GEO management procedures.

Reinforcement of Legal Responsibilities. Reinforcing legal rules in space will significantly contribute to the reduction of uncertainty and thus may curb associated threats. Legal liability should be clear for any functional objects in space and should start with registry procedures that are more in depth and that take into account new technical features, such as increased maneuverability or new energy sources and that provide a more complete description of vehicles. The goal would be to increase collective awareness of space traffic at a time when it is expected to grow, thus preempting misunderstandings between

nations.[76] Given the sensitivity of this information, careful discussion among nations would be needed to set rules that both protect legitimate national and commercial interests and advance collective security, the latter being the key objective.

Regulations for better transparency and more responsible behavior by all actors and stakeholders should address registration issues, prenotification of maneuvers in space, satellite end-of-life management procedures, rights of priority and respect for protected zones in orbit according to the density of space vehicles in those zones. Once these initial security measures have been accepted and applied by all parties, considering relevant limits on offensive military activities, such as deployment of ASATs, should be easier.

A Political Framework for Developing International Cooperation for Space Surveillance beyond First Technical Steps. The international community should adopt the principle that all countries have a right of access to space-traffic and surveillance data.[77] A functional and accessible international database would include both registry information (for example, registry procedures and forecasted orbital data of any launched objects) and actual space-object data, possibly produced by an "international space surveillance network." Such an effort would derive its legitimacy from an already widely accepted code of conduct for space activities.

THE NEED FOR BETTER AWARENESS OF THE STRATEGIC CHARACTER OF SPACE

The multiplication of actors and objects in space in the near future will result in a sizable security risk that cannot be handled by the current collective agreements, and will not be avoided by purely military solutions. As such, a number of issues present a collective security challenge that may make the existing situation worse, both technically and legally, and may, in the very short term, put at risk any space asset, civilian or military. Thus, even from a purely defensive perspective, confidence-building measures (or "best practices"), far from being illusory, can prove more effective in the short and mid-term than an enhanced national military posture would be. As a consequence, the new collective rules, although initially based on voluntary political acceptance by all nations, will have to be conceived in such a way that potentially hostile or aggressive behaviors in space are rendered more difficult, more easily identifiable, and collectively reproved and sanctioned. Combining concrete technical and behavioral regulation with longer-term transparency and political agreements may open new possibilities for space regulation.

76. The February 10, 2009, collision of a U.S. commercial Iridium satellite and a Russian government-owned Kosmos satellite highlights the need for improved information sharing, even if only at the level of better satellite cataloging and performance monitoring.

77. Such a principle would mirror the UN's "Principles Relating to Remote Sensing of the Earth from Outer Space," December 3, 1986, A/RES/41/65, http://www.un.org/documents/ga/res/41/a41r065.htm.

Europe may be ready to play a more active role in supporting this evolution because of its experience as a regional collective political and institutional construction with regular and sometimes difficult discussions on the balance between national and collective interests. Moreover, Europe's approach to space security may demonstrate a common basis on which to stimulate and help shape international debate on the subject. This capability will mainly depend on the ability to act collectively in space, as in other foreign policy and defense arenas. As the current debates on the European Constitution show, considering Europe as a single political entity remains difficult. However, one hopes that the progress of this political construction will eventually make the "Old Continent" a dynamic and constructive party in a debate that will be crucial for building the peaceful and more secure international society of which we all dream.

About the Author

Xavier Pasco received his doctorate in political science from the University of Paris-Sorbonne. He is Senior Research Fellow and head of the Department of Technology, Space, and Security at the Fondation pour la Recherche Stratégique (FRS) in Paris. Previously, he was a researcher at CREST, the Center for Research and Evaluation of the Relationships between Strategies and Technology, of the Ecole Polytechnique. His current research focuses on space and high-technology policies and decision-making processes associated with national security strategies. He is involved in a number of projects studying the use of space for security, at both the national and European levels, including for the Preparatory Action for Security Research (PASR) and the Seventh R&D Framework Programme (2007–2013) coordinated by the European Commission. He has also supported the work of the Subcommittee on Security and Defense of the European Parliament and has contributed to the European Space Agency's (ESA) ongoing work on governance and data policy. He is Associate Research Fellow at the Space Policy Institute at George Washington University, and is the European Editor of the international academic review *Space Policy*. He is a permanent Invited Member of the French National Marine Academy. In 2006, he was elected Corresponding Member of the International Academy of Astronautics.

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