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Multilateralism in Space: Opportunities and Challenges for Achieving Space Security

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Human activity in space has, from the dawn of the space age, been characterized by a “push me, pull you” dynamic between competition and cooperation. There is no doubt it was the Cold War rivalry between the United States and the then Soviet Union that drove initial efforts to breech the space frontier, and that military competition has long been, and continues to be, a central factor in states’ pursuit of space capabilities. At the same time, even during the height of tensions between the two superpowers, international cooperation in the space exploration and sciences was considered a high priority. Not only did the United States and the Soviet Union seek to cooperate with each other regarding human space flight, but they also reached out to other less-developed space players.

This fragile balance between competitive pressures and cooperative benefits has helped to create the foundation for the rapid expansion of global space activities over the last 50 years that has greatly benefitted economic and social development around the world. There are now some 1,100 active spacecraft on orbit and more than 60 states and/or commercial entities owning and/or operating satellites.[1]

However, the ever increasing usage of space by more and more actors is inevitably leading to pressures on the rather weak body of international legal instruments and multilateral institutions that govern space activities – many of which sprang from the Cold War era and the efforts by the United States and Soviet Union to put boundaries around their military space race. For example, there is more and more competition for the limited resource of frequency spectrum, particularly for satellites in the coveted and ever more crowded geosynchronous (GEO) orbital belt.[2] The past 20 years have also seen an explosion in the use of space-related technologies for tactical military applications, such as weapons targeting and real-time imaging, creating potential geopolitical instability among major space players as each seeks to reduce its own vulnerabilities in space and exploit those of potential adversaries.

Finally, the February 2009 collision between a working Iridium communications satellite and a defunct Russian Cosmos military satellite – the first-ever collision of two intact satellites that created a very large debris field – spurred concern among satellite owners, operators, and governments about the challenge of tracking, avoiding, mitigating, and removing uncontrolled space debris that threatens satellite operations.[3] For all three of these

[1] James N. Miller, Testimony to the House Armed Services Committee Strategic Forces subcommittee, 16 March 2010, http://armedservices.house.gov/pdfs/StratForces031610/Miller_Testimony031610.pdf (accessed March 2010).

[2] GEO is located at 36,000 km in altitude, where satellites essentially remain over the same spot on Earth allowing continuous broadcasting to fixed receiver sites.

[3] See “Iridium 33 – Cosmos 2551 Collision” at http://www.agi.com/media-center/multimedia/current-events/iridium-33-cosmos-2251-collision/default.aspx; and also see *Orbital Debris Quarterly News*, http://orbitaldebris.jsc.nasa.gov/newsletter/newsletter.html (both accessed May 2010).

reasons, it is becoming important for multilateral cooperation to avoid harmful competition, accidents, and increased potential for conflict in space, which is legally enshrined as a global commons. This, in turn, increases the need for more attention to, and more focused work by, the three major multilateral institutions aimed at ensuring the global commons of space remains safe, secure, and available for the use of all: (1) the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS); (2) the International Telecommunication Union (ITU); and (3) the United Nations Conference on Disarmament (CD).

This article will review the status of, opportunities for, and challenges to these three multilateral institutions. It will further examine the arguable need for better cross-fertilization of effort among the three, given the interconnectivity of space activities in the civil, commercial, and military arenas, and the potential for competition and accidents to contribute to a climate of tension and potential conflict.

Foundations of Multilateralism

The *Outer Space Treaty* (OST) of 1967 provides the basic foundation for international space law, and could be seen as the central pillar of the current multilateral institutional framework.[4] OST was primarily negotiated in a bilateral back and forth between the United States and the Soviet Union, both of which submitted drafts to the United Nations (UN) General Assembly in 1966, as a means of mitigating what both sides saw as a risky elevation of the nuclear arms race to space, and to quell growing fears of just such a nuclear space race among the international community.[5] Most critically, the OST establishes space as a global commons "not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[6] It further prohibits the stationing of weapons of mass destruction in space or on celestial bodies; limits uses of the Moon and other celestial bodies to exclusively peaceful purposes; and forbids the establishment of military bases, the testing of weapons, and military maneuvers on the Moon and other celestial bodies.

As of January 2009, 100 countries have ratified the OST and 26 others have signed, but not yet ratified.[7] The OST is the basis for the four other international treaties governing space activities, all of which were developed and negotiated under the auspices of COPUOS.

1. The 1968 *Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space (Rescue Agreement)*, with 90 ratifications, 24 signatures and one acceptance of rights and obligations as of January 2009.
2. The 1972 *Convention on International Liability for Damage Caused by Space Objects* (*Liability Convention*), with 87 ratifications, 23 signatures and three

[4]For a brief history of the treaty negotiations, see Arms Control Association, http://www.armscontrol.org/documents/outerspace (accessed April 2010).

[5]One should note that the negotiations took place in the aftermath of the Cuban missile crisis, which itself gave added impetus to superpower efforts to control their nuclear competition.

[6]*Treaty on Principles Governing Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies* (hereafter, *Outer Space Treaty*), http://www.oosa.unvienna.org/oosa/SpaceLaw/outerspt.html (accessed April 2010).

[7]"Report of the Legal Subcommittee on its forty-eighth session in Vienna from 23 March to 3 April 2009," Committee on the Peaceful Uses of Outer Space, http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_935E.pdf (accessed April 2010).

acceptances of rights and obligations as of January 2009.

3. The 1976 *Convention on Registration of Objects Launched into Outer Space* (*Registration Convention*), with 52 ratifications, four signatures, and two acceptances of rights and obligations as of January 2009.
4. The 1984 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), with 13 ratifications and four signatures as of January 2009.

According to the UN Office of Outer Space Affairs (OOSA), which implements decisions made by COPUOS and the UN General Assembly on space issues, the legal principles enshrined in these five treaties (OST, *Rescue Agreement, Liability Convention, Registration Convention, and Moon Agreement*) include:

> …non-appropriation of outer space by any one country, arms control, the freedom of exploration, liability for damage caused by space objects, the safety and rescue of spacecraft and astronauts, the prevention of harmful interference with space activities and the environment, the notification and registration of space activities, scientific investigation and the exploitation of natural resources in outer space and the settlement of disputes. Each of the treaties lays great stress on the notion that the domain of outer space, the activities carried out therein and whatever benefits might accrue therefrom should be devoted to enhancing the well-being of all countries and humankind, and each includes elements elaborating the common idea of promoting international cooperation in outer space activities.[8]

[8]http://www.oosa.unvienna.org/oosa/en/SpaceLaw/treaties.html (accessed April 2010).

Committee on the Peaceful Uses of Outer Space

As noted above, the body of international space law was negotiated under the auspices of COPUOS, which was established in 1959 by the General Assembly to promote research, information sharing, and international cooperation in space; create cooperative space programs under UN auspices; and assume legal problems and issues surrounding the use of space.[9] COPUOS is the only formal body empowered to negotiate new international space laws. There are 69 member states in COPUOS and a large number of non-governmental and intergovernmental organizations are observers. COPUOS activities are centered in two subcommittees – the Scientific and Technical Subcommittee, and the Legal Subcommittee – which meet annually and report to the annual meeting of the full committee. The last COPUOS meetings were held 3-12 June 2009 and 9-18 June 2010.[10] Decisions within COPUOS are taken via voting by member states, although consensus is usually sought, and reported out to the General Assembly where those decisions are considered, and usually endorsed.

Much of the work of COPUOS is dedicated to information sharing, education, and capacity building in developing countries. COPUOS oversees, for example, the work of the UN Program on Space Applications, implemented by OOSA and aimed at building capacity through international workshops, training courses, and pilot projects on issues, such as satellite navigation systems. The committee

[9]Resolution Adopted by the General Assembly 1472 (XIV), *International co-operation in the peaceful uses of outer space*, http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares_14_1472.html (accessed April 2010).

[10]The committee's report is available at http://www.oosa.unvienna.org/pdf/gadocs/A_64_20E.pdf (accessed April 2010).

also oversees implementation of the recommendations emanating from UNISPACE III, a major international conference held from 19-30 July 1999 in Vienna, Austria with the goal of identifying and taking actions designed "to maximize opportunities for human development through the use of space science and technology and their applications."[11] COPUOS, under the Scientific and Technical Subcommittee, continues to follow national, regional and multinational efforts to implement UNISPACE III's Plan of Action on an annual basis.

Similarly, the Scientific and Technical Committee follows progress reports of the UN Platform for Space-based Information for Disaster Management (UN-SPIDER). UN-SPIDER, launched by the General Assembly in 2006, "to provide universal access to all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management to support the full disaster management cycle."[12] UN-SPIDER implementation is supervised by OOSA, with input from several regional support offices and national focal points, who work with UN-SPIDER staff "to strengthen national disaster management planning and policies, and implement specific national activities that incorporate space-based technology solutions in support of disaster management."[13]

[11]"Draft Report of the Committee on the Peaceful Uses of Outer Space on the implementation of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III)," UN General Assembly, 21 November 2003, http://www.unoosa.org/pdf/limited/c1/AC105_C1_L272E.pdf (accessed April 2010).

[12]"Committee on the Peaceful Uses of Outer Space Report on activities carried out in 2009 in the framework of the United Nations Platform on Space-based Information for Disaster and Emergency Response," UN General Assembly, 23 December 2009, paragraph 1, http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_955E.pdf (accessed April 2010).

[13]Ibid, paragraph 10.

While there has been a great deal of activity in this arena in recent years, a chronic shortage of funding – which although subsidized by the UN regular budget, is primarily provided by contributions of member states – is an ongoing constraint. It should be clear to states that such activities are necessary for ensuring the safety and security of space assets, as newcomers to the arena require assistance not only to most efficiently benefit from the use of space, but also to avoid harmful impact on others. In addition, "buy-in" to best practices is required by all spacefaring states, as the physics of space cannot be avoided, and inevitably mean that what any one actor does in space has the potential to affect all others, whether positively or negatively.

> *…implementation of the voluntary guidelines for the mitigation of space debris at the national level would increase mutual understanding on acceptable activities in space, thus enhancing stability in space...*

COPUOS also has been relatively active, and relatively successful if at a slow pace, in studying emerging technical issues and making recommendations for how states might address these problems. The most recent success was the development of a set of voluntary guidelines for space debris mitigation adopted in 2007, based on technical recommendations developed by the Inter-Agency Debris Coordinating Committee (IADC)[14] and subsequently endorsed by the

[14]The IADC – comprised of the space agencies of China, France, Germany, India, Italy, Japan, Russia, Ukraine and the United States, plus the European Space Agency – was

General Assembly in January 2008.[15] The accord is a significant achievement for space security, especially regarding Article 4, which pledges nations not to deliberately create long-lived debris.[16] In its most recent report, the Scientific and Technical Subcommittee agreed that "implementation of the voluntary guidelines for the mitigation of space debris at the national level would increase mutual understanding on acceptable activities in space, thus enhancing stability in space and decreasing the likelihood of friction and conflict."[17]

That said, the process took seven years and the guidelines that resulted are less technically specific than those recommended by the IADC (as some states objected to measures that would be more costly), are voluntary, lack any elaboration of how they are to be implemented, and contain loopholes related to national security. All this leads to questions about whether states will adopt them and how strictly they will be adhered to. While there has been some discussion in COPUOS about further strengthening the guidelines, and having the Legal Subcommittee consider how they might be translated into a legally binding mechanism, there has been no agreement to proceed.

established in 1993 as a mechanism for space agencies to exchange information.

[15]UN General Assembly, Resolution A/Res/62/217, 10 January 2008, http://www.oosa.unvienna.org/pdf/rares/ARES_62_217E.pdf (accessed April 2010).

[16]Gerard Brachet, "Long-term Sustainability of Space Activities," Annex, p.131, "*Security in Space: The Next Generation – Conference Report*, 31 March-1April 2008, UN Institute for Disarmament Research (UNIDIR), 2008, http://www.unidir.ch/bdd/fiche-activite.php?ref_activite=363 (accessed April 2010).

[17]"Report of the Scientific and Technical Subcommittee on its forty-sixth session, held in Vienna from 9 to 20 February 2009," Committee on the Peaceful Uses of Outer Space, UN General Assembly, 6 March 2009, p.13, http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_933E.pdf (accessed April 2010).

However, continued consideration of methods to combat space debris is likely to take place at the Scientific and Technical Committee through a new agenda item, "long-term sustainability of outer space activities." At its 18 February 2010 meeting, the subcommittee established a new working group on the issue. According to the agreement, the working group should:

> …examine the long-term sustainability of outer space activities in all its aspects, consistent with the peaceful uses of outer space, and avail itself of the progress made within existing entities, including but not limited to the other working groups of the Subcommittee, the Conference on Disarmament, the International Telecommunication Union, the Inter-Agency Space Debris Coordination Committee, the International Organization for Standardization, the World Meteorological Organization and the International Space Environment Service. The Subcommittee agreed that the Working Group should avoid duplicating the work being done within those bodies and instead identify areas of concern for the long-term sustainability of outer space activities that are not covered by them. [The Subcommittee also agreed that the Working Group should consider organizing an exchange of information with the commercial space industry to understand the views of that community.][18]

This agreement is significant for several reasons. First, it for the first time recognizes the need for COPUOS to liaise more closely with the CD and the ITU on issues related to space safety and security of the future environment. For years, there have been set in

[18]"Addendum, Draft Report of the Scientific and Technical Subcommittee on its forty-seventh session, held in Vienna from 8-19 February 2010," Committee for the Peaceful Uses of Outer Space, UN General Assembly, http://www.oosa.unvienna.org/pdf/limited/c1/AC105_C1_L304Add3E.pdf (accessed April 2010).

place rather artificial boundaries among the three UN bodies, both for political reasons and out of competition among the various bureaucracies. There is now a growing appreciation among diplomats dealing with the space portfolio that the emerging challenges to the safe and equitable use of space are interlinked, and that attempting to separate the civil, military and commercial realms of space activities is largely futile. Further, there is also a growing appreciation of the need to link efforts in the political sphere to activities of the technical community – given the highly technical nature of space operations. Since the 1970s, the numerous UN bodies that are active in peacetime space applications – ranging from ITU to the UN Educational, Scientific, and Cultural Organization (UNESCO) – have meet annually for the Interagency Meeting on Outer Space Activities, with the last meeting held at ITU headquarters in Geneva, Switzerland on 10-12 March 2010. Results of the meetings, which are coordinated by OOSA, are reported annually to COPUOS.[19] The goal is to ensure that all these UN bodies are, in particular, working to apply space technology to meet human development goals and to minimize duplication. Interestingly, this group does not include the CD. The result is the effective isolation of the political decision-makers charged with efforts to protect space security from potential conflict from those within the UN system who have the most hands-on knowledge about the need for sustained access to space systems, and the most knowledge about how space can be, and cannot be, utilized and how best to ensure safe space operations.

Second, the subcommittee agreed to charge the working group with considering new measures to enhance the sustainability of space activities and a possible set of "best practice guidelines."[20] Based on the discussions so far, these guidelines are likely to fall under the rubric of "space traffic management" – that is processes, procedures, and new regulations for how spacecraft are launched, operated and disposed of at the end of their working lifetimes. While the need for a space traffic management regime has for many years been a topic for scientific, industry, and academic organizations, the issue has not been widely addressed in the political or legal realm. It is clear that given the increased usage of space and the growing problems of orbital crowding and debris, space operations – like international air travel – will soon require more robust and accepted rule sets to avoid accidents and collisions, as well as dampen drivers for conflict in the case of such incidents. One example of the growing recognition of the need for better processes is the decision in 2010 by OOSA and the ITU to exchange, for the first time, data on satellite positions – which OOSA monitors through the UN Registry of Space Objects and the ITU through its Master International Frequency Register, which registers radio frequency transponders rather than actual satellites. A key problem with the UN Registry is failure by many states to actually register their satellites, especially military or intelligence

> *…the emerging challenges to the safe and equitable use of space are interlinked, and that attempting to separate the civil, military and commercial realms of space activities is largely futile.*

[19] See http://www.uncosa.unvienna.org/uncosa/iamos/index.html (accessed April 2010).

[20] Ibid.

gathering satellites.[21] By contrast, almost all states register the transponders on those satellites with the ITU. Thus harmonization of the two lists is a step toward a better picture of what exactly is in space, which is in turn a necessary foundation for ensuring both sustainability and security in space.[22]

And while COPUOS limits itself to addressing the "peaceful uses" of space and avoids any discussion of military space, it is obvious that a key factor in ensuring the long-term sustainability of space for peaceful purposes will be avoiding military conflict in space. Indeed, if COPUOS is able to formulate a set of "best practice guidelines" for space operations, those guidelines are almost inevitably going to include provisions for data sharing, which could serve as transparency and confidence-building measures (TCBMs) for international security. It is already the case that the increased interest of the international community in TCBMs, also confidence and security-building measures (CSBMs),[23] has led to considerable discussion of whether efforts to build such a regime, whether voluntary or legally binding, should be undertaken in COPUOS, the CD, by both, or by neither. What is certain is that there is growing interest in confidence-building, witnessed by the near universal support since 2005 for a Russian-sponsored General Assembly resolution calling on states to make concrete proposals for new space-related TCBMs – the United States and Israel were the only hold-outs. Under the new administration of President Barak Obama, the long-standing U.S. opposition to multilateral action has waned, and it is likely that the United States will support some forward motion on TCBMs, although it remains unclear in what forum or fora.

While most satellite interference is caused by technical issues or operator error, there has also been an increase in acts of deliberate interference...

Thus, the long-term sustainability work within COPUOS could serve the dual purpose of building much-needed bridges between the key multilateral institutions (as well as with the technical community and industry) assigned with international space governance, and opening an alternative pathway to long-stalled efforts to address the problem of growing military tensions in, and the potential weaponization of, space.

In addition, at the June 2009 meeting, COPUOS Scientific and Technical Subcommittee agreed to launch ad-hoc working groups on a new initiative by the current chair, Ambassador Ciro Arévelo of Colombia: "Toward a UN Space Policy."[24] The initiative is designed to both better coordinate the some 25 UN bodies responsible for some aspect of space to improve UN governance, and to improve how the UN uses space applications including building capabilities in emerging space states. A key goal of the overall initiative is to raise awareness, both within the UN and among member states, of the value of space to humanitarian and development goals – which

[21] Jonathan McDowell, "The United Nations Registry of Space Objects," http://www.planet4589.org/space/un/un_desc.html (accessed April 2010).

[22] Theresa Hitchens, "Future Security in Space: Charting a Cooperative Course," Center for Defense Information, Washington, DC, September 2004, pp.63-67.

[23] The terms of art are slightly different and hold different political connotations for different states.

[24] "Toward a UN Space Policy: An initiative of the Chairman of the Committee for the Peaceful Uses of Outer Space," Committee on the Peaceful Uses of Outer Space, Fifty-seventh Session, 3 June 2009, http://www.unoosa.org/pdf/limited/l/AC105_2009_CRP12E.pdf (accessed April 2010).

in turn could promote cooperative behavior in space and to dampen risk of conflict.

If the COPUOS Scientific and Technical Subcommittee can be said to have made reasonable, if slow, progress over recent years, the picture is less positive in the Legal Subcommittee. The Legal Subcommittee for decades has continued to debate basic questions for international space law, such as delineating where outer space begins and how to define a launching state, which is necessary for assigning liability. Further, no substantial legal accords have emanated from COPUOS since the formation of the OST Regime in the 1960s and 1970s. Even the most recent accomplishment of COPUOS, the *Moon Agreement*, has little validity with only 13 ratifications of which there are no space powers.[25]

It is somewhat ironic that the most progress in setting multilateral legal accords was made during the Cold War period, but perhaps also understandable in that the treaties crafted at that time were essentially based on bilateral understandings between the United States and then Soviet Union about how to protect their best interests in space. At best, the Legal Subcommittee has served as a forum for exchange of information about national implementation of current treaties. For example, at its most recent meeting in June 2009, the subcommittee established a new Working Group on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space.[26] At worst, it has done nothing more than serve as a platform for states to assert competing political views – the real problems in the subcommittee are not questions of law, but those of politics.

…willingness by China to include terrestrial-based ASATs in any discussions or negotiations would in essence be a signal about China's "good faith" on efforts to prevent space weaponization…

COPUOS has a mixed record in contributing toward multilateral action to achieve space security. Nevertheless, there is a recent resurrection of interest in establishing new forms of space governance, even if voluntary, within COPUOS and among the member states.

International Telecommunications Union

The ITU is the progeny of the International Telegraph Union, begun in 1865 to coordinate cross-border usage of the telegraph. While certain portions of the radio-frequency (RF) spectrum can be shared, fundamentally there is only so much room for users to operate – thus, telecommunications systems based on RF are regulated by national and international processes designed to prevent interference. The RF spectrum and satellite orbital slots are considered limited natural resources that all states have equal rights to use. Each state manages use of the RF spectrum within its borders, but international coordination is required when RF signals cross borders, as is the case for all satellites. The ITU began coordinating space radio-communications in 1963, and is comprised of governments who

[25] The 13 states include: Australia, Austria, Belgium, Chile, Kazakhstan, Lebanon, Mexico, Morocco, Netherlands, Pakistan, Peru, Philippines, and Uruguay. France and India, which are space powers, have signed, but have not ratified. Space power as used in the context here is a state that possesses indigenous capabilities to access orbital space.

[26] "Report of the Legal Subcommittee," paragraph 10c, http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_935E.pdf (accessed April 2010).

join as member states as well as industry groups who join either as "sector members" or "associates" and may participate in ITU activities, but do not have voting rights.[27] There are 191 member states and more than 700 sector and associate members.[28] The legal framework for the ITU was established in 1992 with the signing of the *Constitution of the International Telecommunication Union*, which entered into force in 1994 as a legally binding treaty based on the major principles of efficient use of and equitable access to the spectrum and orbits. Among other things, the constitution empowers the ITU to:

> a) effect allocation of bands of the radio-frequency spectrum, the allotment of radio frequencies and the registration of radio-frequency assignments and, for space services, of any associated orbital position in the geostationary-satellite orbit or of any associated characteristics of satellites in other orbits, in order to avoid harmful interference between radio stations of different countries;
> b) coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio-frequency spectrum for radio-communication services and of the geostationary-satellite and other satellite orbits;
> c) facilitate the worldwide standardization of telecommunications, with a satisfactory quality of service;
> d) foster international cooperation and solidarity in the delivery of technical assistance to the developing countries and the creation, development and improvement of telecommunication equipment and networks in developing countries by every means at its disposal, including through its participation in the relevant programmes of the United Nations and the use of its own resources, as appropriate...[29]

Member states of the ITU are bound to abide by the provisions of the *Constitution of the International Telecommunication Union*, as well as the "Administrative Regulations" that govern use of the spectrum, operations of telecommunications facilities, and coordination to avoid harmful interference with other operators. The specific regulations that govern spectrum and orbital band usage – with comprise procedures for frequency notification, coordination and registration of transponders, primarily aimed at avoiding harmful interference – are contained in the Radio Regulations, which are administered by the ITU Radiocommunication Sector and the Radiocommunication Bureau.[30] Notably, the constitution exempts military installations, although states are urged to comply with the rules "so far as possible," especially with the requirements for providing assistance in case of distress and the avoidance of harmful interference.[31] That said, most states comply, including their military satellites and receiving facilities, if for no other reason than to establish legitimate rights for frequency allocations and orbital slots.[32] While the ITU system is a legal framework, the organization has no enforcement powers, and member states are essentially expected to comply in good faith.

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[27]ITU, see http://www.itu.int/net/about/membership.aspx (accessed April 2010).
[28]Ibid.

[29]"Constitution of the ITU, Chapter I, Basic Provisions," http://www.itu.int/net/about/basic-texts/constitution/chapteri.aspx (accessed April 2010).
[30]"Radiocommunication Sector," ITU, http://www.itu.int/net/about/itu-r.aspx (accessed April 2010).
[31]"Constitution of the ITU, Chapter VII, Special Provisions for Radio, Article 48," ITU, http://www.itu.int/net/about/basic-texts/constitution/chaptervii.aspx (accessed April 2010).
[32]Tim Bonds and et. al., "Employing Commercial Satellite Communications: Wideband Investment Options for DOD," Project Air Force, RAND, Santa Monica, Calif., 2000, p.15, see http://www.rand.org/publications/MR/MR1192 (accessed April 2010).

Top-level policy, including possible revisions to the *Constitution of the International Telecommunication Union*, financial plans and strategy, including plans for providing technical assistance to developing countries and setting equipment standards, are made by ITU Plenipotentiary Conferences, which are held every four years. The next Plenipotentiary Conference will be held in Guadalajara, Mexico on 4-22 October 2010.[33]

World Radiocommunication Conferences (WRCs) are normally held every two to three years, but in recent years the intervals have stretched to four years. The WRCs are set to review and revise the Radio Regulations and the Table of Frequency Allocations, which identify what portions of the spectrum can be used by specific types of systems (such as mobile telecommunications or broadcast television), including allocating or reallocating frequencies for uses by new technologies.[34] At the last WRC, held 22 October to 16 November 2007, an agreement was reached on assigning certain frequencies for international mobile communications.[35] The next WRC is set for 23 January to 17 February 2012.

The two formal meetings essentially serve as fora for resolving disputes about spectrum and slot allocations, rules, regulations and technical standards. Each country gets one vote at the Plenipotentiary and WRC conferences, although in practice geographic regions usually coordinate their voting. According to ITU officials, however, every effort is made at such meetings to obtain consensus.

The process for allocating spectrum and an orbital slot to an individual user is complex, and can take a decade to resolve. Essentially, a government must apply to the ITU for the rights to use certain frequency bands and orbital slots before launching a new satellite or satellite network in any orbital plane, as well as Earth stations for communications with satellites and terrestrial stations within a certain area of an Earth station. Governments must apply even when the satellite owner and operator is a private company; most governments also include the majority of their military satellites in the ITU process. Assignments are given on a first-come, first-serve basis – provided that the proposed system will comply with the existing Table of Frequency Allocations and that no other user nation objects. A state can object if the proposed satellite's operations will interfere with the use of the same frequency bands by users within its borders.[36]

According to a background paper on spectrum and orbit coordination procedures by the ITU Radiocommunication Bureau,[37] the procedure for application has three stages: (1) advance publication; (2) coordination; and (3) notification. The coordination process is a formal regulatory obligation on all parties, and the results confer rights and obligations on all – and failure by a potentially affected government to respond to the coordination process within four months after publication of the request is considered acceptance of the new allocation. Once the coordination process, which is complex and differs for different types of systems, is completed, the applying government must follow a set of procedures for notification and registration of its new assignments in the Master International

[33] See ITU, http://www.itu.int/plenipotentiary/2010/index.html (accessed April 2010).

[34] See ITU, http://www.itu.int/ITU-R/index.asp?category=conferences&rlink=wrc&lang=en (accessed April 2010).

[35] "ITU World Radiocommunication Conference concludes after four weeks: International treaty sets future course for wireless," ITU Press Release, 16 November 2007, http://www.itu.int/newsroom/press_releases/2007/36.html (accessed April 2010).

[36] "Frequently Asked Questions," ITU, http://www.itu.int/ITU-R/terrestrial/faq/index.html#g005 (accessed April 2010).

[37] This background paper was provided to the author thorough personal correspondence with the ITU Radiocommunication Bureau.

Frequency Register that lists all ITU approved allocations. However, governments are obliged to bring the system into operation no later than seven years following the advance publication; failure to do so may cause the applicant to lose the allocation.

While the ITU system is complex, it has been successful in managing use of the limited resources of spectrum and orbital slots on a multilateral basis – also, due to the fact that owners and operators are aware that avoiding interference is in their own interests. One critical key in the success of the ITU has been the practice of reserving some frequency allocations for new users from the developing world, which has lessened, although not totally eliminated, concerns about perpetuating the digital divide between developed and developing states – given that a majority of the satellites in operation are owned and operated by governments or companies registered in the developed world, and that owners and operators do their best to hang onto RF and slot allocations as long as possible by piecemeal replacement of their satellite networks.[38]

However, satellite operators and ITU officials say that in recent years there has been a trend of more incidences of interference – including deliberate interference – as spectrum and orbital crowding has grown. The ITU defines interference as: "The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information, which could be extracted in the absence of such unwanted energy."[39] It defines "harmful" interference as that "which endangers the functioning of a radionavigation service or other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance" with the Radio Regulations.[40]

The first step in resolving interference issues is for the parties involved to engage in bilateral negotiations, and if the incident is considered serious enough, the affected party can alert the ITU. If bilateral discussions are unsuccessful, the affected party can ask for the assistance of the ITU Radiocommunication Bureau in resolving the problem. However, the ITU has no power to force the offending party to stop the interference – it can only arbitrate. While ITU officials say in most cases a simple inquiry by the ITU usually causes the offending party to find ways to resolve the situation, in the case of deliberate interference because of political issues, there is not much recourse. According to an official at the ITU Radiocommunications Bureau, at the World Radiocommunication Seminar held in Geneva 8-12 December 2008, there were 69 cases of harmful interference reported to the ITU in 2008, 11 of which involved space services and 58 of which involved terrestrial services.[41]

While most satellite interference is caused by technical issues or operator error, there has also been an increase in acts of deliberate interference, such as jamming of satellite broadcasts. The most recent incident involved Iranian jamming of European satellite

[38]For background on this issue, see: "Report on WRC-03 (Geneva, 9-June-4July 2003)," 29 July 2003, European Radiocommunication Office website, http://www.ero.dk/wrc-03 (accessed April 2010).

[39]"Glossaire," RR1.166, ITU, http://www.itu.int/ITU-R/terrestrial/seminars/glossary/index.html#Q0524 (accessed April 2010).

[40]Ibid.

[41]Ben Ba, "Harmful Interference," Document WRS08/PRES/39-E, World Radiocommunications Seminar, 8-12 December 2008, Geneva (available on ITU website only for ITU members.)

broadcasts, especially those of Eutelsat Communications headquartered in France. The jamming began in earnest in December 2009 and worsened until 11 February 2010, the anniversary of the Iranian revolution, when according to a report in *Reuters*, some 70 Eutelsat radio and television programs were being jammed.[42] In January 2010, French officials asked the ITU to step in on the matter, particularly in the case of jamming of BBC World Television Persian language broadcasts, which are carried by Eutelsat.[43] However, despite ITU efforts at intervention, the Iranian jamming is continuing, according to ITU officials. Indeed, the European Union (EU) at a 23 March 2010, meeting of Foreign Ministers called on Iran to stop the jamming, and pledged to take action if the Iranian government failed to respond – although, exactly what action was not defined.[44] On 26 March 2010, the ITU's radio regulations board – in a first for the organization – issued a public exhortation to Iran to stop the jamming. "In this case there is evidence that there is a deliberate attempt to block the satellite transmissions and so they are saying this should be stopped. This is prohibited under the regulations."[45] Iran has not admitted the jamming, and has responded to all concerns by saying that it is investigating the matter.

Two other longstanding disputes that have remained unresolved as well, despite ITU intervention, involve Cuban allegations of deliberate U.S. government jamming of radio and television broadcasts from Cuba, and interference with Slovenian broadcasts by Italian broadcasters who, according to Slovenian charges, are using uncoordinated frequencies.[46] Discussions on both issues are apparently continuing.

There is a concern among many in the satellite industry that if instances of deliberate, or wilfully ignored, interference are not resolved, nor punished, more actors might be tempted to violate the ITU rules – leading to a breakdown of the system. A breakdown of the ITU regulatory system would, in the end, do no operator any good – as a break out of "interference wars" would result in large-scale broadcast outages. Eutelsat, in its 2010 report to the COPUOS Legal Subcommittee, raised this issue with regard to the Iranian jamming: "This matter could affect the credibility in general of satellites by posing a threat to the secure

Although progress in the CD is not plausible for the foreseeable future, there is a growing possibility that diplomats at the conference will take up the issue of "soft law" regarding space activities…

[42]Luke Baker, "EU ready to act on Iran satellite jamming – draft," 19 March 2010, *Reuters*, http://www.alertnet.org/thenews/newsdesk/LDE62I13N.htm (accessed April 2010).

[43]Peter B. de Selding, "France Seeks ITU Help To Halt Satellite Signal Jamming By Iran," *Space News*, 8 January 2010, http://www.spacenews.com/satellite_telecom/100108-france-seeks-itu-signal-jamming-iran.html (accessed April 2010).

[44]"EU slams Iran's jamming of satellite signals as 'unacceptable'," *DW-World.DE* Deutsche Welle, 23 March 2010, http://www.dw-world.de/dw/article/0,,5377813,00.html (accessed April 2010). According to a *Reuters* report, retaliation could include sanctions, such as blocking exports or Eutelsat's blocking Iranian broadcasts in retaliation. See Luke Baker, "EU ready to act on Iran satellite jamming – draft," 19 March 2010, *Reuters*, http://www.alertnet.org/thenews/newsdesk/LDE62I13N.htm (accessed April 2010).

[45]Stephanie Nebehay, "UN tells Iran to end satellite jamming," *Reuters*, 26 March 2010, www.reuters.com/article/idUSTRE62P21G20100326; and Luke Baker, "EU ready to act on Iran satellite jamming – draft," 19 March 2010, *Reuters*, http://www.alertnet.org/thenews/newsdesk/LDE62I13N.htm (both accessed April 2010).

[46]See Peter B. de Selding, "France Seeks ITU Help To Halt Satellite Signal Jamming By Iran," *Space News*, 8 January 2010, http://www.spacenews.com/satellite_telecom/100108-france-seeks-itu-signal-jamming-iran.html (accessed April 2010).

transmission of programmes by satellites" and asked the COPUOS Legal Subcommittee to look into the issue as a violation by Iran of the *Outer Space Treaty*.[47]

Conference on Disarmament

The Geneva-based Conference on Disarmament was established by the General Assembly in 1979 as the only multinational forum dedicated to the negotiation of arms control and disarmament treaties and agreements, and currently has 65 member states and about 40 observer states. It meets in three annual sessions starting in January, and takes decisions – including on procedural issues such as a program of work – by consensus. The CD has been debating the question of "Prevention of an Arms Race in Outer Space (PAROS) since 1985, when an ad-hoc committee was formed – by consensus – to examine the issue. This committee was disbanded in 1994, and since then, discussions of PAROS have taken place in the CD on an informal basis.[48]

Even though the United States was one of the key counties that called for the development of the CD ad-hoc committee, the chief naysayer on any formal activity regarding PAROS has been the United States, which in the past has simply rejected the need for any new space arms control agreements. As Karen House, U.S. delegate to the 63rd Session of the UN General Assembly, told the First Committee (the GA committee dedicated to disarmament issues) on 20 October 2008: "There is much rhetoric about the prevention of an arms race in outer space. For nearly three decades, the United States has consistently pointed out that it is not possible to define the nature of a space-based weapon. The United States also believes it is not possible to develop an effectively verifiable agreement for banning either space-based weapons or terrestrial-based anti-satellite (ASAT) systems."[49]

Since the late 1990s and early 2000s, the primary "movers" behind the PAROS agenda at the CD have been China and Russia, which long have been concerned by U.S. interest in space-based missile defense – a program that both nations view as a threat to their nuclear deterrence capabilities. On 27 June 2002, Russia and China introduced into the CD a joint working paper, "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."[50] The paper noted that there was an increasing threat of "armed confrontation and combatant activities" in space, and it further stated: "Only a treaty-based prohibition of the deployment of weapons in outer space and the prevention of the threat or use of force against outer space objects can eliminate the emerging threat of an arms race in outer space and ensure the security for outer space assets of all countries, which is an essential condition for the maintenance of world peace."[51]

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[47] "Report on the activities of Eutelsat IGO to the forty-ninth session of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space (2010), European Telecommunications Satellite Organization Intergovernmental Organization (Eutelsat IGO), http://sz0129.wc.mail.comcast.net/service/home/~/Eutelsat%20Igo%20statement%20to%20COPUOS%20LSC.pdf?auth=co&loc=en_US&id=304020&part=2 (accessed April 2010).

[48] See "Outer Space Background and History," http://www.reachingcriticalwill.org/legal/paros/osbackground.html (accessed April 2010).

[49] Karen E. House, "United States Public Delegate to the 63rd Session of the United Nations General Assembly," Delivered in the Debate on Outer Space (Disarmament Aspects) of the General Assembly's First Committee, 20 October 2008, *Arms Control Update*, U.S. Delegation to the Conference on Disarmament, Geneva, http://geneva.usmission.gov/CD/updates/1020OuterSpace.html (accessed April 2010).

[50] See "CD," http://www.reachingcriticalwill.org/political/cd/speeches02/chiruswp_062702cd.html (accessed April 2010).

[51] Ibid.

Between 2002 and 2008, Russia and China submitted a number of "non-papers" on various issues related to PAROS, although the CD itself was, and continues to remain, deadlocked over its proposed agenda of work, which also covers nuclear disarmament and the potential negotiation of a treaty on fissile materials – as states with different priorities insisted on linking activities on one agenda item with those on another, resulting in a long-standing lack of consensus as to just what the CD ought to be discussing and negotiating. On 12 February 2008, Russian Foreign Minister Sergey Lavrov, on behalf of Russia and China, formally presented the CD with a draft treaty: *Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects* (PPWT), and called for the immediate launch of CD negotiations based on the draft.[52] Russia and China also called on CD members to make comments based on the draft as a foundation for future discussions.

The United States administration of George W. Bush objected to the draft treaty – the administration rejected in principle multilateral treaties and pursued a policy of "space control," including the development of offensive space capabilities. In particular, the United States criticized the draft treaty text for failing to bar development, testing, and deployment of ground-based ASATs.[53] The United States national security community had been challenged in January 2007 by China's successful testing of a kinetic energy, hit-to-kill, ASAT based on a ground-based rocket on one of its own aging weather satellites. The Chinese test, while breaking no new technical ground – indeed, both the United States and Russia tested ASAT systems in the 1980s – did violate the norm of self-restraint on testing of such weapons, created a large and dangerous debris field that will continue to threaten satellite operations for decades, and elicited widespread concern about the renewed potential for a space arms race. In the United States, in particular, it hardened the attitudes of those in national security policy-making circles arguing for "space control" programs. "Space is no longer a sanctuary," said then-Secretary of the Air Force Michael Wynne. "This change is seismic in nature."[54]

While the substance of U.S. concerns with the PPWT did not change with the 2008 election of President Barak Obama, the new administration came into power with a much different view than the previous one on the value of multilateral diplomacy and fora. In part, this new American flexibility helped underpin the 29 May 2009 agreement to a formal program of work (CD/1864) – for the first time in more than a decade – which included a decision to establish a working group on PAROS "to discuss substantively, without limitation, all issues…"[55] While Russia and China expressed regret that the breakthrough decision did not call for formal PAROS negotiations, they did not insist on linking the discussions to formal negotiations; the lack of linkage to treaty negotiations was exactly the reason that the United States could sign on.

However, this new consensus at the CD to move forward with a work program shattered almost immediately after it was reached.

[52] PPWT, http://reachingcriticalwill.org/political/cd/papers08/1session/Feb12%20Draft%20PPWT.pdf (accessed April 2010).

[53] Karen E. House, "United States Public Delegate to the 63rd Session of the United Nations General Assembly," Delivered in the Debate on Outer Space (Disarmament Aspects) of the General Assembly's First Committee, 20 October 2008, *Arms Control Update*, U.S. Delegation to the Conference on Disarmament, Geneva, http://geneva.usmission.gov/CD/updates/1020OuterSpace.html (accessed April 2010).

[54] Michael Sirak, "Air Force Leadership: Chinese ASAT Test Marked Turning Point; Space No Longer Sanctuary," *Defense Daily*, 12 February 2007.

[55] See CD, http://www.reachingcriticalwill.org/political/cd/papers09/2session/CD1864.pdf (accessed April 2010).

Pakistan, reversing its decision to go along with the program's mandate for the launch of negotiations on a Fissile Material Cutoff Treaty, played out the rest of the CD's 2009 session with a variety of procedural objections to implementing the agreement.[56] At the beginning of the CD's January 2010 session, it became even more clear that Pakistan had no intentions of allowing treaty negotiations to go forward due to concerns in the Pakistan military about somehow bridging the gap between its nuclear arsenal and that of India – concerns that were exacerbated by the 2008 agreement by the Nuclear Suppliers Group to endorse a civil nuclear cooperation agreement between the United States and India..[57] The CD remains at a standstill with no resolution in sight, despite the pressure for achieving some measure of success at the review conference of the foundational *Nuclear Non-Proliferation Treaty* (NPT) and the importance of fissile material negotiations to forwarding the NPT goals.

Still, it is by no means clear that discussions within the CD would result in the near-term or medium-term establishment of negotiations on PAROS or the PPWT. First of all, while the Obama campaign signaled support for an eventual space weapons treaty, the administration's stance has shifted considerably over the last year toward a more cautious approach and, according to American insiders, there is a serious debate within the administration on what, if any, multilateral agreements for space security should be pursued. Led by the Department of Defense (DOD), a review of U.S. national security space posture was begun in May 2009.[58] In July 2009, the National Security Council began a review of U.S. National Space Policy, last revised by the Bush administration in 2006.[59] The space posture review originally was slated to be finished by 1 February 2010, but in January stalled and will now not likely be completed until year end or even the beginning of 2011. While Pentagon officials cited the need to wait for the new National Space Policy before formally deciding on a national space posture – which would outline what space systems would be pursued by DOD, the Air Force, and the intelligence community – U.S. officials familiar with the internal discussions also noted that fierce infighting between the National Reconnaissance Office (NRO) and DOD on responsibility and budgeting for satellite assets had contributed to the delay.[60]

Efforts at multilateral approaches toward developing new regulations and legal measures… remain difficult. The critical obstacle… is the desire to obtain consensus.

The National Space Policy review was originally given a deadline of 1 October

[56]Jonathan Lynn, "Geneva nuclear arms talks fail to overcome block," *Reuters*, 31 August 2009, http://in.reuters.com/article/worldNews/idINIndia-42108520090831 (accessed April 2010).

[57]Eric Auner, "Pakistan Raises New Issues at Stalled CD," *Arms Control Today*, March 2010, http://www.armscontrol.org/act/2010_03/CDStalled (accessed April 2010).

[58]Andrea Shalal-Esa, "U.S. harvesting canceled satellites for future uses," *Reuters*, 11 May 2009, http://www.reuters.com/article/domesticNews/idUSTRE54A6HY20090511 (accessed April 2010).

[59]Frank Morring, "U.S. Space Policy Review Underway," *Aviation Week & Space Technology*, 22 July 2009, http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=space&id=news/Review072209.xml&headline=U.S.%20Space%20Policy%20Review%20Under%20Way (accessed April 2010).

[60]John T. Bennett, "Flournoy Confirms Space Posture Review Delay," *Defense News*, 2 February 2010, http://www.defensenews.com/story.php?i=4481146 (accessed April 2010).

2009,[61] and then was delayed until December 2009, and as of today remains unfinished. While the review is expected to call for a renewed emphasis on multilateral cooperation in space, there is little evidence that U.S. agreement to PAROS negotiations on a space weapons ban will be forthcoming, due to ongoing concerns about the verifiability of such a treaty. At the October 2009 session of the General Assembly First Committee, Garold Larson, then acting head of the United States mission to the CD, said: "In consultation with allies, the Obama administration is currently in the process of assessing U.S. space policy, programs, and options for international cooperation in space as a part of a comprehensive review of space policy. This review of space cooperation options includes a "blank slate" analysis of the feasibility and desirability of options for effectively verifiable arms control measures that enhance the national security interests of the United States and its allies."[62]

Second of all, despite China's strong diplomacy surrounding the need for a PPWT, it remains unclear whether the Chinese government would be willing to trade-off ASAT development capabilities in exchange for a space-based weapons ban. However, Chinese diplomats over the last few months have shifted their rhetoric to insist that an ASAT ban could be considered in future negotiations on the PPWT.

The Pentagon's 2009 annual report to Congress on Chinese military power, released in late March 2009, stated that: "China is developing the ability to attack an adversary's space assets. People's Liberation Army (PLA) documents emphasize "destroying, damaging, and interfering with the enemy's reconnaissance/ observation and communication satellites," suggesting that such systems, as well as navigation and early warning satellites, could be among initial targets of attack to "blind and deafen the enemy." The same PLA analysis of U.S. and Coalition military operations also states that "destroying or capturing satellites and other sensors… will deprive the opponents of initiatives on the battlefield and [make it difficult] for them to bring their precision guided weapons into full play."[63]

Concomitantly, willingness by China to include terrestrial-based ASATs in any discussions or negotiations would in essence be a signal about China's "good faith" on efforts to prevent space weaponization – in that while it is not certain that the United States would under any circumstances agree to negotiations of a space-based weapons ban, it is certain that the United States would not enter such negotiations without the inclusion of terrestrial-based ASATs. In addition, India – with an eye to rival China – has been sending signals that it too is working to develop ASAT capabilities. At a January 2010 meeting of Indian scientists, the director general of India's Defense Research and Development Organization (DRDO) said that India is

…there is a gathering impetus for "soft law" action to mitigate the twin problems of space safety and security.

[61]Joanne Irene Gabrynowicz, President Orders Sweeping Policy Review," 5 July 2009, *Res Communis*, http://rescommunis.wordpress.com/2009/07/05/president-orders-sweeping-u-s-policy-review (accessed April 2010).

[62]Amy Klamper, "Obama Space Policy to Emphasize International Cooperation," *Space News*, 30 November 2009, http://www.spacenews.com/policy/091130-obama-space-policy-emphasize-international-cooperation.html (accessed April 2010).

[63]"Annual Report to Congress: Military Power of the People's Republic of China 2009," Office of the Secretary of Defense, U.S. Department of Defense, http://www.defense.gov /pubs/pdfs/China_Military_Power_Report_2009.pdf (accessed April 2010).

"working to ensure space security and to protect our satellites. At the same time, we are also working on how to deny the enemy access to its space assets."[64]

Many Indian experts now believe that India would not be willing to negotiate any space weapons treaty until it has successfully demonstrated ASAT technologies. India's political and military elites, these experts say, never reconciled themselves with the fact that India's failure to conduct a nuclear test prior to the 1968 NPT accord demoted India to a "have not" status, and are determined not to make the same mistake again. "If and when globally negotiated restraints are placed on such strategic defensive systems or technologies – perhaps restraints of some sort of ASAT testing, hit-to-kill technologies – India will already have crossed the technical threshold in that regard, and acknowledgement of such status [will be] grand-fathered into any such future agreement."[65] Indeed, according to Indian diplomats, the thinking in India is that efforts toward PAROS have been superseded by events, and that any international accords will need to focus instead on managing the already on-going ASAT arms race – and the time for a treaty negotiation is nowhere near mature. Needless to say, development by India of ASATs would, in turn, almost assure similar efforts by Pakistan – and thus mitigate any support of a weapons ban treaty. And certainly, if India resists near-term moves to launch the PAROS talks, Pakistan will also.

Although progress in the CD is not plausible for the foreseeable future, there is a growing possibility that diplomats at the conference will take up the issue of "soft law" regarding space activities and norms in other fora. In particular, Russia and the United States are moving closer toward mutually embracing an effort to push the UN General Assembly to more formally take up the creation of TCBMs under a so-called Group of Governmental Experts (GGE) that would report to the Secretary General, according to Russian and American diplomats who have been involved in recent bilateral talks on the issue of space. The renewed interest in bilateral space cooperation, including improved sharing of orbital positioning data, stems largely from the collision of an Iridium communications satellite with a defunct Cosmos satellite in February 2009 mentioned earlier.

Every year since 2005, Russia has been the key sponsor of a General Assembly Resolution calling for the development of TCBMs. The latest version of the resolution was adopted at the First Committee meeting in October 2009 – and was significant because the voting marked a change of U.S. policy under the Obama administration. Rather than voting against the resolution, as the United States did during the Bush administration, the United States abstained.[66] The resolution invites all UN nations to submit concrete proposals to the Secretary General and instructs the Secretary General to compile a report containing all the proposals for the October 2010 meeting of the First Committee.

Russia has further proposed that future TCBMs could be developed under three categories: (1) measures aimed at enhancing more transparency of space programs; (2) measures aimed at expansion of information on space objects in orbits; and (3) measures related to the rules of conduct during space

[64]Peter J. Brown, "India targets China's satellites," As*ia Times*, 22 January 2010, http://www.atimes.com/atimes/South_Asia/LA22Df01.html (accessed April 2010).
[65]Ibid.

[66]"Transparency and confidence-building measures in outer space activities," UN General Assembly, First Committee, Sixty-fourth Session, 16 October 2010, http://www.reachingcriticalwill.org/political/1com/1com09/res/L40.pdf (accessed April 2010).

activities.[67] More specifically, the Russian proposal, which was submitted to the CD in a 14 August 2009 letter from Ambassador Valery Loshchinin, calls for:

> *1. Exchange of information on:*
> -the main directions of the states' outer space policy;
> -major outer space research and use programs;
> -orbital parameters of outer space objects.
> *2. Demonstrations:*
> -experts visits, including visits to space launch sites, flight command and control centers and other objects of outer space infrastructure on a voluntary basis;
> -invitation of observers to launches of spacecraft on a voluntary basis;
> -demonstration of rocket and space technologies.
> *3. Notifications of:*
> -the planned spacecraft launch;
> -the scheduled spacecraft maneuvers which may result in dangerous proximity to spacecraft of other states;
> -the beginning of descent from orbit of unguided outer space objects and the predicted impact areas on Earth;
> -the return from orbit into atmosphere of a guided spacecraft;
> -the return of a spacecraft with a nuclear source of power on board, in case of malfunction and danger of radioactive materials descent to Earth.
> *4. Consultations:*
> -to clarify the provided information on outer space research and use programs;
> -on ambiguous situations, as well as other issues of concern;
> -to discuss the implementation of the agreed TCBMs in outer space activities.
> *5. Thematic workshops:*
> -on various outer space research and use issues, organized on bilateral and multilateral basis, with the participation of scientists, diplomats, military and technical experts.[68]

U.S. diplomats state an interest in the development of TCBMs on a voluntary basis, and the United States and Russia are conversing about the potential for convening a GGE. The question for the United States will be ensuring that the GGE, in its terms of reference, does not directly link the development of TCBMs with negotiations of a PAROS treaty or the PPWT.

As China is traditionally a co-sponsor of the UN General Assembly resolution on TCBMs, and as all of the member states of the EU voted for the latest version, it is likely that if the United States and Russia agree on a GGE that such a group will be established via a resolution at the October 2010 First Committee meeting, which would imply it could start work in early 2011.

Meanwhile, the First Committee at the 2009 meeting also endorsed the draft "Code of Conduct on Outer Space Activities" adopted by the EU Council of Ministers in 2008.[69] The proposed code, which was presented to the CD in 2009, in effect would be another approach to TCBMs by establishing best practice guidelines for space activities and pledging signatories to certain norms of behavior. In particular, the draft code, which would be voluntary, would pledge signatories to: "refrain from any intentional action which will or might bring about, directly or indirectly, the damage or destruction of outer

[67] "Transparency and Confidence-Building Measures in Outer Space Activities and the Prevention of the Placement of Weapons in Outer Space," Permanent Mission of the Russian Federation to the UN Office and Other International Organizations in Geneva, http://www.geneva.mid.ru/disarm/d-01.html (accessed April 2010).

[68] See http://disarmament.un.org/library.nsf/a61ff5819c4381ee85256bc70068fa14/871f014d29f0686b8525762500713d4f/$FILE/cd-1874.pdf (accessed April 2010).

[69] Carol Naughton, "United Nations First Committee 2009, Keeping Space Peaceful," http://www.acronym.org.uk/un/0905.htm (accessed April 2010).

space objects unless such action is conducted to reduce the creation of outer space debris and/or justified by imperative safety considerations."[70]

During the course of 2009, the EU consulted with a number of non-EU states, including the United States about the content of the draft code, and is now in the process of re-drafting the text. According to European diplomats and experts, the hope is that a new version can be adopted during the second half of 2010 under the Belgian EU presidency and then opened for signature by other states – perhaps, via COPUOS or through the UN General Assembly, albeit the code is envisioned as a free-standing accord along the model of the Hague Code of Conduct on Ballistic Missiles rather than a COPUOS or CD initiative.

The fact remains that what any one actor does in space has the potential to affect all others, whether positively or negatively.

Canada also has developed an initiative for confidence-building measures, which has been proposed to the CD as an alternative to the Chinese-Russian PPWT. Submitted to the CD as a working paper on 29 March 2009, and codified as a CD document on 5 June 2009, the Canadian proposal envisions "a declaration of soft legal principles" that would in effect provide a middle ground between the EU draft code and the PPWT.[71] Accordingly, Canada has suggested that the proposal could be adopted either as a voluntary code or as a legally binding treaty. The key provision of the Canadian proposal would be a commitment by states "not to test or use a weapon against any satellite so as to damage or destroy it," as well as establish a ban on the placement of weapons in space.[72] Canada elaborated on its proposal in a statement to the First Committee in October 2009, noting that in addition to the two above proposed commitments, states should also agree not to use a satellite as a weapon.[73]

Conclusions

Efforts at multilateral approaches toward developing new regulations and legal measures to ensure the sustained, safe, and secure use of space remain difficult. The critical obstacle for all three of the major institutional frameworks – COPUOS, ITU, and CD – on space governance is the desire to obtain consensus. The CD is particularly unable to reach agreements by the fact that consensus is required, even for procedural matters – a fact that is aggravated by the linkages in the long-standing agenda between

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[70]See http://www.eu2008.fr/webdav/site/PFUE/shared/import/1209_CAGRE_resultats/Code%20of%20Conduct%20for%20outer%20space%20activities_EN.pdf (accessed April 2010).

[71]"Working Paper On the Merits of Certain Draft Transparency and Confidence-Building Measures and Treaty Proposals for Space Security," Canada, Conference on Disarmament, CD 1865, 5 June 2009, http://www.unog.ch/80256EDD006B8954/(httpAssets)/C40D0B92E5F37A9CC12575FC003BCE37/$file/CD_1865_E.pdf (accessed April 2010).

[72]Ibid.

[73]"Statement on the Prevention of an Arms Race in Outer Space," Permanent Mission of Canada to the UN, 19 October 2009, http://www.unog.ch/80256EDD006B8954/(httpAssets)/C40D0B92E5F37A9CC12575FC003BCE37/$file/CD_1865_E.pdf (accessed April 2010). While Canada would be most interested in seeing its proposal adopted formally by the CD, in either voluntary or treaty form, Canadian diplomats say that the government is becoming increasingly frustrated with the never-ending impasse of the CD. Thus, it is conceivable that Canada may seek to push its proposal via other avenues – considering that Canada was a leader in the passage of the *Ottawa Convention* banning landmines (*Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction* of 1997), which was pursued as a free standing treaty outside of any multilateral forum.

nuclear disarmament, space security, and conventional disarmament issues, each having a different priority for different states.

From the struggles in all three fora, it is clear that there is a widespread reluctance among states to enact new legal restraints on space activities in any domain. Indeed, some states seem intent on avoiding the legal responsibilities that they arguably already have accepted. Thus, the development of any new treaty in the near-term is unlikely – whether it is designed to establish safety measures or arms control for space.

On the other hand, it is apparent that there is a gathering impetus for "soft law" action to mitigate the twin problems of space safety and security. This movement can be attributed to the fact that over the last decade more states have become "vested" in space, and thus now, understand the need for cooperative behavior in what is a "commons" environment. This momentum could be furthered by the push by the COPUOS Chairman to develop a UN space policy.[74] Such a policy could serve to build a better appreciation among UN organizations and Member States about the criticality of space operations to human security and development, and to increase space capacity in the developing world. A UN space policy could serve as yet another driver toward more urgent action to protect space assets and avoid conflict that could endanger the space environment for peaceful uses.

This advent of "soft law" approaches for space should not be surprising, in that the same phenomena took place in humankind's exploitation of the seas and the air. For example, in the maritime arena, the United States and Soviet Union, in 1972, signed the *Incidents at Sea Agreement* to set "rules of the road" for the actions of military ships and aircraft on the high seas so as to avoid accidents and accidental conflict.[75] This bilateral confidence-building agreement – which is not a treaty, and thus should be seen as an instrument of soft law – was aimed at applying, and amending, the *Convention on International Regulations for Preventing Collisions at Sea* also promulgated in 1972 – although, based on an earlier 1960 agreement on collision avoidance – by the International Maritime Organization for civil ships on the high seas.[76] The *Incidents at Sea Agreement*, which still stands, includes, for example, a prohibition on simulated attacks, as well as basic navigational operations, such as maintaining distance when conducting surveillance operations on ships of the other party.[77] In addition, military-to-military meetings were prescribed to discuss any incidents that did occur or concerns of either party. The original U.S.-Soviet agreement has been replicated by other states on bilateral and multilateral bases since that time.

In the arena of air operations, the International Civil Aviation Organization (ICAO) was created in 1944 under the *Convention on International Civil Aviation* signed in Chicago, and known as the *Chicago Convention*,[78] in order to establish

[74] Ciro A. Arévalo Yepes of Colombia is currently the Chairman of COPUOS and will serve in that capacity until 2010. See "Towards a UN Space Policy," 3 June 2009, 52nd Session of COPUOS, http://www.oosa.unvienna.org/pdf/limited/l/AC105_2009_CRP12E.pdf (accessed May 2010).

[75] *Agreement Between the Government of the United States of America and the Government of the Union of Soviet Socialist Republics on the Prevention of Incidents on or over the High Seas* (*Incidents at Sea Agreement*). See Federation of American Scientists, http://www.fas.org/nuke/control/sea/text/sea1.htm (accessed April 2010).

[76] *Convention on International Regulations for Preventing Collisions at Sea*, International Maritime Organization, http://www.imo.org/Conventions/contents.asp?doc_id=649&topic_id=257 (accessed April 2010).

[77] *Incidents at Sea Agreement.*

[78] "Chicago Conference – Introduction," International Civil Aviation Organization (ICAO), http://www.icao.int/cgi/goto_m.pl?/icao/en/chicago_conf/intro.html (accessed April 2010).

international air routes and harmonize a set of technical rules, including setting standards for flight worthiness and air traffic control procedures.[79] ICAO was established as a specialized agency of the UN Economic and Social Council. The convention was based on many of the principles enshrined in the 1919 *Paris Convention on Aerial Navigation*, agreed by 27 countries in the wake of World War I, including the concept of sovereign airspace and rights to peaceful overflights.[80] The *Chicago Convention* further granted each state the right to prevent, for military reasons, foreign aircraft from flying over certain delineated airspace; outlaws foreign aircraft carrying weapons, i.e., military aircraft, from flying over national territory; and allows states to prohibit photographic aerial reconnaissance over their territory.[81] The United States was the key state pushing for a new aviation convention, as both a way to incentivize trade in the post World War II era, and restore peace and security in Europe.[82] There are now 190 States signed as "contracting parties" to the *Chicago Convention* and that participate in ICAO activities.

Given developments in sea and air domains, there is cause for optimism about the near-term to mid-term development of a body of voluntary, and perhaps regulatory, rules for best practices, procedures, and behavior in space activities. In particular, the development of norms – through codes of conduct – for the use of space could lay the groundwork for more robust efforts to reduce risks and avoid conflict. Given that a trend toward an ASAT arms race is now becoming plausible, steps toward constraining this dangerous momentum should be a top priority for the established spacefaring states. It would therefore be incorrect to assert that the continued failure of the international community to find new legal pathways for space governance and conflict prevention means that the current multilateral institutions themselves are failures. While progress along these lines remains slow, there is progress being made in all three bodies on the space portfolio.

…it [is] abundantly clear that integrated multilateral approaches to space security are not a luxury, but a necessity.

There also is a growing recognition that there is a requirement for the three multilateral space governance bodies to work more closely together, to avoid duplication and working at cross purposes. For one thing, lack of coordination among COPUOS, ITU, and CD have made it relatively easy for states to practice "venue shopping" as a means of preventing undesired actions. For example, during the George W. Bush presidency, the United States insisted that any discussions of transparency and confidence-building measures be restricted to COPUOS, which has no remit over military space assets, in order to ensure no constraints were developed on its military space program, and that there was no opening for a "slippery slope" in the discussions toward PAROS. Likewise, Iran is now insisting that the Eutelsat interference issue remain inside ITU – which is largely made up of technical specialists and where

[79] International Civil Aviation Organization (ICAO), http://www.icao.int/cgi/goto_m.pl?icao/en/hist/history02.htm (accessed April 2010).

[80] Lloyd Duhaime, "Convention on International Civil Aviation, the Chicago Convention, 1994," 28 September 2009, http://duhaime.org/legalresources/internationallaw/lawarticle-667/convention-on-international-civil-aviation-the-chicago-convention-1944.aspx (accessed April 2010).

[81] "Convention Relating to the Regulation of Aerial Navigation," Department of Civil Aviation, Government of Thailand, http://www.aviation.go.th/airtrans/airlaw/1914.html (accessed April 2010).

[82] Ruwantissa Abeyratne, "The Role of Civil Aviation in Security Peace," *International Journal of Space Law*, 1 June 2002, http://www.highbeam.com/doc/1G1-96120687.html (accessed April 2010).

there are no mechanisms for enforcement – rather than brought to the COPUOS for discussion, which is more of a political body, and where the issue could be raised of a possible legal violation by Iran of its obligations under the *Outer Space Treaty* as well as the ITU Constitution.

However, it is becoming clearer to spacefaring states that it is impossible, and indeed, dangerous to attempt to create artificial barriers between civil, commercial, and military uses of space – in that all space assets share the same vulnerabilities and are fundamentally constrained by the laws of physics. As Canada noted in its October 2009 statement to the First Committee, there is a:

> ...growing importance of renewed efforts of UN institutions engaged in the "governance structure" of space, such as the Committee on the Peaceful Uses of Outer Space (COPUOS) and the International Telecommunications Union (ITU), to collaborate more effectively in addressing cross-cutting issues affecting the continued utilisation of outer space for peaceful purposes.[83]

It will be particularly important for the two bodies, COPUOS and ITU, to work more closely together as the GEO belt becomes more crowded, and if COPUOS begins to discuss "best practice guidelines" for operations in GEO – as the ITU already has developed a body of standards. It would be, at the least, a waste of time for COPUOS to attempt to "reinvent the wheel," and at worst, a problem for satellite operators if COPUOS attempts to override or unravel current practice under ITU regulations. There is some reason for concern, in that during the late 1990s, COPUOS and the ITU argued over defining the GEO belt – although, COPUOS's Legal Subcommittee had not established a definition, many delegations questioned the ITU's legal capacity to define GEO orbits for regulations.[84] One sign that COPUOS members are aware of the need for coordination came in the February 2010 report of the Science and Technical Subcommittee, which recognized the need for communication with the ITU and other organizations and the avoidance of duplication.

In addition, an effort to merge data from the ITU's frequency registry and the UN registry of space objects managed by OOSA could serve as a first step toward developing an international data base of orbital positions that will be critical not only for developing any variant of a space traffic management regime, but potentially for verifying any future space arms control agreement. It is unlikely that the international community will be satisfied with continuing to rely on space surveillance data provided by the United States military, if for no other reason than political suspicion.

Canada and Russia, as key players in the space security debate, are at the forefront of the growing push for better coordination between COPUOS and the CD in pursuit of TCBMs. Again, it is sensible that the two bodies establish better processes for sharing information and for cooperative efforts, given that any future TCBMs will by necessity affect the conduct of civil, commercial, and military space activities alike.

Further, in any future PAROS negotiations, experts from COPUOS, and OOSA, and the ITU could be useful in helping to elucidate technical aspects of treaty proposals,

[83]"Statement on the Prevention of an Arms Race in Outer Space," Permanent Mission of Canada to the UN, 19 October 2009, http://www.unog.ch/80256EDD006B8954/(httpAssets)/C40D0B92E5F37A9CC12575FC003BCE37/$file/CD_1865_E.pdf (accessed April 2010).

[84]Ingo Baumann, "Diversification of Space Law," in *Space Law: current problems and perspectives for future regulation,* Marietta Benko and Kai-Uwe Shrogel, eds., *Essential Air and Space Law* 2 (Eleven International Publishing, the Netherlands, 2005), p. 50.

particularly regarding verification. There is precedent within the CD for experts from specialized multilateral agencies to informally assist with forwarding arms control talks; for example, the International Atomic Energy Agency has been routinely interacting with the CD and member state delegations to explain how its nuclear safeguards regime might be translated into verification procedures for a future Fissile Materials Cutoff Treaty. There has been, by comparison, almost no interaction between the CD and COPUOS and ITU on any basis – even for basic information exchange about the activities of the latter two bodies that might have impact on CD deliberations.[85] The fact remains that what any one actor does in space has the potential to affect all others, whether positively or negatively. This fact alone should make it abundantly clear that integrated multilateral approaches to space security are not a luxury, but a necessity.

[85]COPUOS officials could help in educating CD diplomats, who are from foreign ministries and have little specialized knowledge about space activities, about the importance of protecting and sustaining the peaceful uses of space; and ITU officials could be similarly useful in explaining technical problems of avoiding RF interference, as well as helping to identify what technical data could be useful for both TCBMs and any form of a PAROS treaty.

European Approaches to Space and Security: Implications for Transatlantic Cooperation

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As complex security threats are increasing the need for international cooperation on Earth, the growing number of actors in space increasingly demands collaboration in space and security. This need is intensified by the unique environmental attributes of space. For example, debris from space assets can orbit the Earth for years, rendering large areas of orbital space unusable. Moreover, as space becomes more crowded, the lack of comprehensive international governance amplifies the chance of mishaps above Earth.

This paper examines and considers the prospects for space and security cooperation between the United States and Europe. It carries out this inquiry by focusing on different European approaches in this area. This issue is explored because the transatlantic partnership, with the North Atlantic Treaty Organization (NATO) as its institutional cornerstone, remains a durable and robust alliance. Also, the United States and Europe share many of the same values and interests over a long history of cooperation, and their partnership forms the core of multilateral endeavors. Furthermore, in the past 60 years, international cooperation and integration has taken place in Europe. More recently, Europe has become an emerging player in space and security through some innovative initiatives, and the European Union (EU) is playing a role in space as a result of the Lisbon Treaty.[1]

Transatlantic cooperation is necessary for addressing security challenges on Earth and it will be a crucial foundation for international cooperation in space and security. However, U.S. policy makers and space experts must understand how processes in Europe over the past 60 years have shaped what it is today. This insight can help provide realistic expectations of the direction Europe is heading in space and security.

This paper offers such a forecast. It begins by examining the historical development of alternative European and Atlantic security structures, thereby spelling out the principles and preferences that guide Europe in international relations. The paper then discusses current developments in European space and security cooperation before assessing the prospects for transatlantic cooperation in this area. Finally, the paper concludes with several policy recommendations for enhancing transatlantic cooperation in space and security.

Terms and Definitions

The term "space and security" refers broadly to the safety of human assets in space, such as satellites and spacecraft, and has two different dimensions. One aspect involves the threat to space assets posed by human-made space debris, space weather, Near-Earth Objects

[1] *Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community* (hereinafter *Treaty of Lisbon* or *Lisbon Treaty*), signed 13 December 2007, and entered into force 1 December 2009, http://europa.eu/lisbon_treaty/index_en.htm (accessed June 2010).

(NEOs), accidental collisions with other space assets, and unintentional radio interference. The other aspect involves the threat posed by intentional human disruption, such as radio jamming, anti-satellite weapons (ASATs) launched from Earth, and potential space-based weapons. A wide view of space and security addresses both of these hazards, and draws on concepts developed in international forums. The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), for example, seeks to ensure the "long-term sustainability" of outer space activities by mitigating both the human and environmental risks of space operations. The draft EU Code of Conduct, discussed further below, aims to "enhance the safety, security, and predictability of outer space activities for all" by establishing norms for human activities in space.[2]

Europe has become an emerging player in space and security… and the European Union is playing a role in space as a result of the Lisbon Treaty.

"Space weapons," in this paper, refers to destructive weapons in space that can attack targets on Earth, in the air, or in space. These might include space-based missiles, lasers, or a space fighter plane. Under this definition, no space weapons have been deployed yet. Although the term is broad, it is not all-encompassing. For example, the United States and China have already used missiles to destroy their own satellites in space, but these weapons were not designed explicitly to damage space objects nor were they deployed in space. Furthermore, the Space Shuttle or even satellites could hypothetically be used as "weapons" to collide with and disrupt other space assets. These all-inclusive definitions would imply that the deployment of space weapons has already occurred, and is not used in this paper.

Space weapon issues are chiefly addressed by the Outer Space Treaty (OST)[3] and the Conference on Disarmament (CD). The OST establishes, among other principles, that space shall be used "for the benefit and in the interests of all countries." Regarding weapons, the OST declares that states shall not "place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner." It does not, however, ban the deployment of conventional weapons in space – the "space weapons" mentioned above. Efforts to legally ban space weapons have taken place since 1985, with little progress, in the CD, which was established by the United Nations General Assembly in 1979 to deal with a wide range of multilateral disarmament issues. Most recently, the CD has discussed a draft *Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects* (PPWT), which would ban the deployment of weapons of any kind in space.[4]

An adequate discussion of "space and security" also needs to look at what Europe is

[2] *Council conclusions and draft Code of Conduct for outer space activities* (General Secretariat, Council of the European Union, 17 December 2008), http://www.stimson.org/space/pdf/EU_Code_of_Conduct.pdf (accessed June 2010).

[3] *Treaty on Principles Governing Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies*, United Nations Office of Outer Space Affairs, http://www.oosa.unvienna.org/oosa/SpaceLaw/outerspt.html (accessed June 2010).

[4] *Report of the Conference on Disarmament to the General Assembly of the United Nations* (Conference on Disarmament, 2009).

doing in this area. Within this context, and in addition to the safety of human assets in space, space and security refers to the use of space and space assets for security purposes on Earth. Thus far, space assets have been primarily used as force enhancers and strategic enablers. For example, orbital satellites make possible a range of capabilities for security forces, including precision-guided weapons, integrated communications, and accurate navigation. Satellites can provide intelligence on changes in terrain and weather, as well as enemy movements and operations. Space and security, as used herein, does not refer to hypothetical force application from space. Space weapons, if they were deployed, could be used to attack targets on Earth for security purposes, just as they could, in theory, be used in space to protect assets from enemies. As mentioned above, this paper does not maintain that space weapons have been deployed. Thus, force application could only be a theoretical aspect of space and security and is not covered herein.

Space and security issues are also tied to the concept of "militarization" in space. In this paper, militarization refers to military control of space assets for military purposes. For example, the United States military has deployed satellites for the purposes of force enhancement mentioned above. Thus, the United States has militarized space, although it has not deployed space weapons. However, this concept is often complicated by dual-use systems, which are space assets that can serve multiple purposes. For example, Global Positioning System (GPS) can help military units navigate hostile terrain and help civilian motorists navigate the Los Angeles freeway system. Communications satellites can serve both cell phone companies and security forces, while satellite imagery can help plan a military assault or construction of a city. Spacecraft can be used to explore space or, hypothetically, to attack other space assets or targets on Earth. Hence, the key aspect of militarization is military control for military purposes.

Transatlantic cooperation is necessary for addressing security challenges on Earth and it will be a crucial foundation for international cooperation in space and security.

"Europe" is another term that can have multiple meanings. Here, it refers to the region of Europe, as well as the sovereign states and institutions that exist therein. The EU is an organization of 27 member states. It is essentially supra-national and intergovernmental in economic issues, and intergovernmental in political and security issues. Within the EU, there are various institutions with different responsibilities, while member state governments retain their national sovereignty. The European Space Agency (ESA) is an intergovernmental organization of 18 member states, two of which are not in the EU, which seeks to coordinate and develop the space capabilities of its members. This paper differentiates between the EU, the various EU institutions, ESA, and the member states that are in each organization. These actors are increasingly seeking to cooperate on space and security issues, as illustrated by the Structured Dialogue that was established in 2007. This dialogue brings together EU institutions with space responsibilities, including the European Union Satellite Centre (EUSC) and the European Defence Agency (EDA), ESA, and relevant member state agencies from the organizations.[5]

[5] *Space and Security* (European Commission/European Space Agency, Joint Secretariat Paper, 2010).

For clarity, this paper considers Europe to fall within the borders of the Structured Dialogue, meaning states within the EU and ESA. Thus, developments and initiatives happening on a European level are meant to incorporate the Dialogue's participants. Debates over future EU membership, among others, indicate that Europe is an arbitrary term. Other countries, particularly those on the eastern boundaries of Europe, can legitimately claim to be European. Turkey, for example, is a member of NATO and a major contributor to the region's security. However, the Structured Dialogue involves the key actors in space and security initiatives in the region, and thus, delineates Europe in this paper.

Development of European and Atlantic Security Structures

At the end of the Second World War in 1945, Europe lay devastated. The battles of the preceding six years were more mobile and destructive than anything the world had seen before. Millions of soldiers and citizens alike had been lost to conflict and the privations of war, and the cities, infrastructures, and economies of Europe had been shattered. Moreover, a threat still loomed in the east. The Soviet Union, one of the victorious Allied powers in the war, represented an ideological rival to the United States and its allies. More importantly, the Soviet Union commanded a vast number of military forces, which were now positioned within striking distance of Western Europe.

Europe's leaders realized they needed a new way to ensure the security of their states. A military commitment from the United States was considered essential, and leaders on both sides of the Atlantic agreed that they needed to pool their limited resources in a collective defensive effort. Moreover, the new speed and destructiveness of war made an integrated military approach necessary, because only standing forces backed by plans for joint action could hope to be militarily effective. In particular, U.S. officials "favored an integrated approach because it offered the promise of combining the relatively small armed forces of the European allies within a larger collective effort that would make more efficient use of the Europeans' resources, but without jeopardizing economic recovery in Europe. The Europeans welcomed an integrated approach because it offered the prospect of a permanent claim on American resources."[6]

Thus, NATO was formed in April 1949. It originally consisted of 10 European states in addition to the United States and Canada. Article Five of the North Atlantic Treaty states that an attack against one of the members in Europe or North America is an attack against them all; each member, in coordination with the others, will take whatever action it deems necessary to restore and maintain security in the North Atlantic area.[7] The treaty also establishes a council to oversee NATO, as well as goals of collective defense and the preservation of peace and security.

NATO was not the only European institution created following World War II. In addition to the Soviet threat, there were residual fears in Europe, especially in France, over a rearmed Germany. Accordingly, the French pushed for the creation of a European Defence Community (EDC), which would help ensure that German rearmament would be structurally controlled. The EDC was developed alongside the European Coal and Steel Community (ECSC), which was designed to control the war-making capacity of Germany. The logic

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[6] Wallace Thies, *Why NATO Endures* (Cambridge University Press, 2009).

[7] *The North Atlantic Treaty*, 4 April 1949, http://www.nato.int/cps/en/natolive/official_texts_17120.htm (accessed June 2010).

behind these organizations was that "binding the countries of Europe closely together in integrated institutions would make war impossible between them."[8] Defense was thus being used as a mechanism to advance integration; there were also debates taking place about developing a European political community.

The EDC Treaty was signed in May 1952 with the support of the United States, which saw the "EDC as essential to give NATO a stout and dependable heart."[9] However, the British refrained from joining the treaty, mainly because they still felt they had a broad range of national interests and were hesitant to become involved in a supranational organization on the European continent. The United States did not press the issue for fear of delaying the EDC. However, there were doubts as to whether France could manage Germany by itself. Consequently, the French rejected the EDC treaty when it was seen to lack firm commitments from Britain and the United States. The treaty's failure raised uncertainties about the political will within Europe to contribute to the common defense. Most significantly, the lack of European unity threatened to reduce the United States commitment to the continent, which was partly predicated on a European willingness to join together and contribute to their collective good.[10]

As the European Union begins to deploy space assets for an increasing number of security-related functions, European officials… have expressed the need for measures to protect those systems.

In order to preserve the United States presence and facilitate controls on German rearmament, Britain arranged a series of agreements that created the Western European Union (WEU) in 1954. The WEU was formed from the Western Union, itself a defensive alliance founded in 1948 between France, Britain, Belgium, the Netherlands, and Luxembourg. Germany and Italy became members of the new organization; Britain also pledged several divisions and a Tactical Air Force to the continent. Unlike the supranational EDC, the WEU was an intergovernmental actor; it functioned as a "facilitating mechanism" to enable NATO to play the leading defense role in Europe. Instead of deterring an external threat, the WEU served as a "reconciler of differences between allies."[11]

To some states, like Britain, the formation of the WEU showed the inability of European states to agree on a defense structure without U.S. guidance. In economic matters, however, European integration continued from the foundations of the ECSC. In 1957, the Treaty of Rome established the European Economic Community (EEC), an organization of six European states designed to foster economic cooperation and integration. Six additional states later joined the EEC, including Great Britain. In 1992, the Treaty of Maastricht was signed by the EEC's members, creating the EU from the original organization. Maastricht established three pillars of the EU. The first was the European Community, which incorporated the EEC and dealt with economic matters. The common market of the EEC became the EU single market, which facilitates the free flow of goods, capital,

[8]G. Wyn Rees, *The Western European Union at the Crossroads* (Westview Press, 1998).
[9]Edward Fursdon, *The European Defence Community: A History*, (Macmillan, 1980).
[10]G. Wyn Rees, *The Western European Union at the Crossroads* (Westview Press, 1998), p. 8.
[11]Ibid., p. 9.

people, and services within the EU. This single market also acts as a customs union, which applies a common external tariff on all goods entering the market. In 2002, twelve of the EU's member states began using a common currency, the euro, essentially completing a 45 year long process of economic integration.

In the first pillar, the EU acted as a supranational body; its decisions were binding on its member states and did not always require unanimity. The Council of the EU, which brings together the ministers of each member state, had the ultimate authority in these legislative areas, as it did in all areas falling under EU competence. The European Council, which brings together the heads of state from each EU member, is the highest configuration of the council and the EU's ultimate decision making body. However, the European Commission had the responsibility for proposing legislation in economic areas, and the council gave it primary responsibility for implementing legislation. The commission is made up of 27 commissioners, one from each member state, who are supposed to act independently on behalf of the EU as a whole.

The development of European SSA capabilities has been viewed as an important first step toward protecting European space assets.

The Maastricht Treaty's second pillar was the Common Foreign and Security Policy (CFSP), and the third was Police and Judicial Cooperation in Criminal Matters (PJCC). In these areas, the council had ultimate responsibility for all decisions. In contrast with the first pillar, these pillars were intergovernmental; decisions required unanimity and were not binding on member states. The CFSP and PJCC were designed to coordinate the policies of the EU's member states, aligning them as closely as possible, while allowing for national autonomy over sensitive security matters. The CFSP included the European Security and Defence Policy (ESDP), which was created to harmonize EU military and defense policies.

As with nascent European security structures in the 1940s and 1950s, the development of the ESDP has been marked by tension between collective security and national sovereignty. Furthermore, there has been a divide within the EU about the ideal direction of the ESDP. Some states, led by France, have wanted to build-up the ESDP as an independent European alternative to NATO. Other states, led by Great Britain, have preferred to develop the ESDP within the transatlantic framework of NATO. In an attempt to address some of the institutional and jurisdictional questions of the EU-NATO relationship, the Berlin-plus agreement of 2003 enables the EU to use NATO structures, mechanisms, and assets to execute military operations if NATO declines to act.[12]

Some European security missions are carried out by the Organization for Security and Cooperation in Europe (OSCE), which evolved from the Conference on Security and Cooperation in Europe (CSCE). The CSCE began in 1975, when 35 heads of state from North America and Europe, including General Secretary Brezhnev from the Soviet Union, met and signed the "Final Act," which included ten normative principles to guide international relations. These principles included the peaceful settlement of disputes, nonintervention in internal affairs, respect for

[12] Gulnur Aybet, "The European Security and Defense Policy: Capabilities and Institutions," in Yannis Stivachtis, ed., *The State of European Integration* (Ashgate Publishing, 2007).

human rights, and fulfillment of obligations under international law.[13] The CSCE consequently established a link between the political-military aspects and the human dimensions of security. It also developed confidence-building measures (CBMs) in the realm of military security, and called for cooperation in economic, scientific, cultural, and educational fields.

Following the collapse of the Soviet Union, the heads of state of the CSCE met in 1992. The original intent of the leaders was mainly to create temporary, ad-hoc missions to deal with conflicts as they arose. However, by this time, the CSCE had become the "principal venue for negotiating, verifying, and discussing the enforcement of the major non-nuclear arms control measures on the Eurasian continent."[14] It had also developed a broad set of instruments for use in conflict management throughout the territory of its member states in Eurasia. Thus, at the 1994 Budapest Summit, the CSCE became the OSCE, a fully institutionalized regional security organization. While the OSCE developed a permanent secretariat, it remained a political organization, which was thought to be more flexible than a collective, legal institution. The Budapest Summit also produced a Code of Conduct on Politico-Military Aspects of Security, which created a regional normative framework for all aspects of military activity, including civil-military relations and the conduct of warfare.[15]

Although it has limited resources and is often overlooked, especially in the United States, the OSCE has managed to persist and accomplish a number of objectives due to several unique attributes. The OSCE responded more directly than other European security institutions to the specific threats that emerged with the collapse of the Soviet Union, such as ethno-political conflict and violence as states divided along ethnic lines. Now consisting of 56 members, it is the only pan-European security organization with universal membership.[16] The OSCE's greatest assets include its ability to strengthen democratic institutions in transitional societies, thus alleviating potential conflicts, and its capacity to respond rapidly to crises.

Nevertheless, NATO remains the chief military and defense institution in Europe, with responsibility for the continent's territorial defense. It continues to exist 60 years after its creation, and 20 years after the demise of the Soviet Union, the main security threat that prompted its formation. NATO has endured, and will continue to endure, because it is an alliance of liberal democracies that contains self-healing tendencies. First, there is an attraction felt by democracies to working closely with each other; moreover, the internal workings of democracies enhance their suitability as long-term allies, both due to their emphasis on consultation and cooperation, and their continual changeover of political leaders.[17] Thus, NATO's member states have managed to work through various crises without breaking up the alliance. While some observers claim that the current NATO mission in Afghanistan is a critical test for its future existence, it will probably only determine whether or not NATO will carry out future missions beyond its borders.

Thus far, transatlantic cooperation in space and security areas has been limited.

[13] P. Terrence Hopmann, *Building Security in Post-Cold War Eurasia: The OSCE and US Foreign Policy* (United States Institute of Peace, 1999).
[14] Ibid., p. 12.
[15] Ibid., p. 14.
[16] Ibid., P. 5.
[17] Wallace Thies, *Why NATO Endures* (Cambridge University Press, 2009), p. 294.

After its creation, the WEU also remained involved in European security issues in three ways: as a channel of intra-European communication and conflict resolution, as part of the debate about U.S. leadership on the continent, and as an element in the evolution of European integration.[18] In June 1992, at the Hotel Petersberg in Germany, the WEU laid out three types of security tasks it planned to undertake: humanitarian operations, peacekeeping, and the employment of combat forces in crisis management.[19] These "Petersberg Tasks" were adopted by the new ESDP in 1997. Shortly after, the WEU began to transfer its capabilities and functions to the EU. After the Lisbon Treaty entered into force on 1 December 2009, the member states of the WEU collectively decided to close the organization. WEU activities are planned to cease by June 2011.

There continues to be a major capabilities gap between the United States and Europe, both in general defense and in space.

The Lisbon Treaty marks another major step forward in EU integration. It is designed to streamline some of the decision-making processes in the EU and to give the EU greater coherence and capabilities, especially in international relations. This development has been partly motivated by the EU's relative weakness in foreign and military affairs. While the EU is an economic power rivaling the United States, it remains far behind its transatlantic partner in defense capabilities. Under the Lisbon Treaty, qualified majority voting (QMV) has been extended to 40 policy areas, meaning the Council of the EU and European Council can make decisions without unanimity. The rule of "co-decision" has become the regular legislative procedure. This puts the European Parliament on equal footing with the European Council for most legislation areas, notably including the budget. The parliament is the only directly-elected EU institution, and it is intended to represent the citizens of the member states. The European Commission remains the only EU institution that can initiate proposals for legislation. In addition, its Vice-President serves as the High Representative of the EU for Foreign Affairs and Security Policy and chairs the foreign affairs configuration of the Council of the EU. Furthermore, the ESDP has become the Common Security and Defence Policy (CSDP), which establishes the principle of enhanced cooperation for groups of states that want to collaborate on security issues. Autonomy in national defense decisions is kept intact, however.[20] Notably, the CSDP takes on both a civil and a military dimension, recognizing the importance of a broad-based approach to today's security issues.[21]

The Lisbon Treaty makes a number of other changes as well. Significantly, it officially establishes space as an area of shared competence between national governments and the EU institutions in Brussels. Space is also one of the new areas covered by QMV, as well as co-decision. Specifically, the treaty states that the EU "may promote joint initiatives, support research and technological development, and coordinate the efforts needed for the exploration and exploitation of

[18]G. Wyn Rees, *The Western European Union at the Crossroads* (Westview Press, 1998), p. 10.
[19]*Petersberg Declaration, Part II* (Council of Ministers, Western European Union, 1992).

[20]"The Treaty of Lisbon," *EurActiv Network*, 29 January 2010, http://www.euractiv.com/en/future-eu/treaty-lisbon/article-163412 (accessed March 2010); and *Your Guide to the Lisbon* Treaty (Directorate-General for Communication, European Commission, 2009).
[21]Pierre Lemoine, "Civil-military approach: A blank page," *Europolitics*, 17 November 2009.

space." It may also establish "any appropriate relations" with the ESA. [22]

In practice, there remain many questions over how the Lisbon Treaty will impact EU affairs. Baroness Catherine Ashton, the High Representative, is still struggling to set up the EU's new diplomatic corps, the European External Action Service (EEAS). In doing so, she must manage the demands of the council's external relations department, the Commission's Directorate-General for External Relations, and the member states' diplomatic services for positions and influence.[23] In addition, the European Parliament is seeking to ensure that it has adequate oversight of the EEAS. Furthermore, the Lisbon Treaty has not yet created a coherent EU. The Lisbon Treaty created the position of President of the European Council, a politician who is elected for renewable terms of two-and-a-half years. The President chairs EU summits, although ministerial meetings continue to be chaired by the country holding the six-month rotating EU presidency.[24] The President of the European Commission, who heads and represents that institution, is another key decision maker, in addition to the leaders from all 27 member states. In the ongoing crisis in the euro zone, these leaders have struggled to organize a unified EU response, and it is unclear who will do so in the future. Finally, it is not yet certain how the Lisbon Treaty affects the implementation of EU legislation. Due to rules which give it more oversight, the European Parliament may become more willing to delegate implementation to the European Commission. At the same time, the parliament will have more work to do in examining measures drafted by the commission, and will probably spend much more time scrutinizing the implementation of EU policy and law.[25]

… there is an interoperability problem between U.S. and European forces, which hampers space and security cooperation.

European Space and Security Cooperation

European cooperation in space has reflected the broader process of European integration, although it has largely taken place outside the formal EU framework until recently. Realizing that national projects would not be able to compete with the United States and the Soviet Union, European scientists in the 1950s and 1960s pressed their governments to establish organizations for space cooperation. Originally, there were two European space organizations – the European Launch Development Organisation (ELDO) and the European Space Research Organisation (ESRO). ELDO and ESRO were merged in 1975 to form ESA, which is now an intergovernmental organization of 18 member states, two of which, Norway and Switzerland, are not EU members. The ESA Charter states that its purpose is "to provide for, and to promote, for exclusively peaceful purposes, cooperation among European States in space research and technology and their space applications, with a view to their being used for scientific purposes and for operational space applications systems."[26]

[22] *Treaty of Lisbon*, Article 142, http://europa.eu/lisbon_treaty/index_en.htm (accessed June 2010).
[23] "Implementing the Lisbon Treaty: how does Europe tie up the loose ends," *Burson-Marsteller Insight*, 2010.
[24] Ibid.
[25] Ibid.
[26] European Space Agency, 14 June 2007, http://www.esa.int/SPECIALS/About_ESA/SEMSN26LARE_0.html (accessed November 2009).

In recent years, ESA officials have commonly interpreted "peaceful purposes" somewhat loosely, allowing for non-aggressive activities, such as military-support architectures and peacemaking missions.[27] This interpretation has enabled EU-ESA cooperation in security areas. The first ever European Space Policy (ESP), released in 2007, is a joint document of the European Commission and the Director General of ESA; it was compiled in consultation with the member states of both organizations and other interested stakeholders. The ESP states that "Europe needs an effective space policy to enable it to exert global leadership in selected policy areas in accordance with European interests and values." Among other objectives, its strategic mission seeks "to meet Europe's security and defence needs in regard to space." The ESP also stresses the need for establishing a European Space Program and coordinating national and European level space activities, increasing synergy between defense and civil space programs and technologies, and developing a joint international relations strategy in space. For specific applications, the ESP lists satellite navigation, Earth observation, satellite communications, and security and defense. In the last area, it notes that "space system needs for planning and conducting civilian and military crisis management operations overlap." While "military capability will continue within the remit of Member States… Sharing and pooling the resources of civilian and military space programmes, drawing on multiple use technology and common standards, would allow more cost-effective solutions." Furthermore, the ESP states that the EU will lead in "identifying and bringing together user needs" and setting policy objectives, while the ESA will primarily develop space technologies and systems.[28]

… Europe generally prefers to use "soft power" in international politics… as opposed to hard military power.

Michael Taverna accordingly observes there is "growing pressure within the EU to harness space for bolstering security and defense capabilities, combined with a trend among EU states toward greater military space cooperation."[29] The military use of space remains a sensitive issue, however. Several EU and ESA member states have their own military space programs and national leaders have been reluctant to establish similar programs at the European level.[30] This hesitance reflects the desire of member states to retain control over their defense policies and military programs, which has complicated the development of the CSDP.

Instead, ESA has been asked by the European Council, Commission, and Parliament to develop dual-use systems that can fulfill security functions. A European Parliament resolution of 2008, for example, calls for encouraging "synergies between civilian and security developments in the field of space."[31] Highlighting the contentiousness of this area, the Parliament's own press release on the

[27] Agnieszka Lukaszczyk, Laurence Nardon and Ray Williamson, "Towards Greater Security in Outer Space: Some Recommendations," *Assessing the Current Dynamics of Space Security* (French Institute of International Relations and Secure World Foundation, 2009), http://www.swfound.org/siteadmin/images/files/file_384.pdf (accessed June 2010).

[28] *European Space Policy,* Communication from the Commission to the Council and the European Commission, European Parliament, 2007.

[29] Michael Taverna, "Aggregating Space-Based Security and Defense," *Aviation Week and Space Technology*, 28 October 2009.

[30] Peter de Selding, "European Parliament Calls for Civil-Military Space Collaboration," *Space News*, 21 November 2008; and Taylor Dinerman. "ESA: The Odd Man Out." *The Space Review*, 1 December 2008, http://www.thespacereview.com/article/1260/1 (accessed June 2010).

[31] *European Space Policy: How to bring space down to earth*, European Parliament Resolution, 2008.

resolution proclaimed that the "Parliament emphasizes that the use of space must serve exclusively non-military purposes, rejecting any direct or indirect military use."[32] At the same time, it maintained that "uses made of Galileo, EGNOS [European Geostationary Navigation Overlay Service] and GMES [Global Monitoring for Environment and Security] by any military users must be consistent with the principle that these are civilian systems under civilian control." The confused nature of this statement implies parliament approval of using space assets for security purposes, despite its assurance that EU space programs will not be militarized.

The Galileo and GMES projects are two key examples of dual-use systems at the European level. Galileo, when active, will provide navigation services similar to GPS. Its two primary contributors are the European Commission's Transportation Directorate and ESA. Galileo will provide services of several different qualities; most notably, the Public Regulated Service (PRS) will provide data for users, mainly governmental, who require service continuity and completely secure access. The Galileo Supervisory Authority (GSA) has been created to oversee the project and prevent any hostile or unauthorized use of its services. Thus, while it remains under civilian control, Galileo's security functions are unambiguous.

Similarly, GMES has evolved from an observational system to monitor environmental security to one that monitors environment and security. A working group of 2002, made up of representatives from 11 EU member states, determined that GMES could address four areas of European security: environmental and technological crisis prevention and rapid reaction, conflict prevention and treaty verification, Petersberg mission support, and European border surveillance.[33] GMES is also a joint initiative between the EU and ESA.

Other space and security initiatives are also underway, both at the European level and between smaller groups of states. The EU Satellite Centre, which originally belonged to the WEU, supports CSDP decision-making through analysis of satellite imagery, although this imagery has mostly been purchased from commercial providers. The European Defence Agency (EDA), created in 2004 to support and sustain ESDP capabilities, is also active in assuring that the next generation of military, or dual-use reconnaissance, satellites is built as a network rather than independently. Six countries, including France and Germany, have already formed a group to design the Multinational Space-Based Imaging System (MUSIS) to assure that future reconnaissance systems can be used by all members. These states are also working on a Common Operational Requirement, known by its French acronym BOC, with the ambition to start "a high-level cooperation process aiming at solidifying, and possibly guaranteeing, longer-term multilateral military space cooperation."[34] BOC is indicative of a bottom-up approach to space and security in Europe,

… space and security is an area with potential for deeper transatlantic collaboration.

[32]Peter de Selding, "European Parliament Calls for Civil-Military Space Collaboration," *Space News*, 21 November 2008.

[33]Xavier Pasco, *A European Approach to Space Security* (Center for International and Security Studies at the University of Maryland, 2006).

[34]Ibid., p. 20.

as opposed to one originating from the EU institutions.[35]

As the EU begins to deploy space assets for an increasing number of security-related functions, European officials and space experts have expressed the need for measures to protect those systems. A panel of space and security experts organized by the European Commission noted that Europe "needs to consider the range of protection measures needed to ensure successful operation of both civil and military satellite systems, including defensive anti-jam countermeasures. Part of the requirement for protection of assets includes the ability to monitor what is happening in space in order to ensure that we understand whence might originate sources of potential threat."[36]

A broadly based conference in October of 2009 on the "The Ambitions of Europe in Space," which included remarks from President Barroso of the European Commission and Director General Dordain of ESA, reached similar conclusions. The conference proceedings state that European "space assets and infrastructure are indispensible for our economy and security, and we need to protect them."[37] To help achieve this goal, ESA is developing a space situational awareness (SSA) system, which will provide services in three main areas: surveillance and tracking of objects in orbit, monitoring of space weather, and detection of NEOs. SSA will provide "rapid and precise information to satellite operators, and to a wide range of civil, industrial, and government users."[38] A meeting of June 2009 involving the commission, the council, and EU member states with relevant space surveillance capabilities concluded that SSA "should be based on a distributed, multilayer network approach. It should build on existing European and national capabilities and assets."[39] Notably, SSA is the first European space initiative to consider dual-use dimensions from the outset. ESA will gather civilian SSA user requirements and design the technical architecture of a potential European capacity, and the EDA is currently drafting military requirements for the system.[40]

The development of European SSA capabilities has been viewed as an important first step toward protecting European space assets. Within European circles, there has been no discussion of deploying countermeasures against potential human threats in space, such as space weapons. Instead, the EU has been seeking to ensure space and security largely through diplomatic efforts and establishing rules of the road. In December 2008, the European Council adopted a draft *Code of Conduct for outer space activities*. The Code emphasizes three principles to guide an approach to space and security: freedom of access to space for all for peaceful purposes, preservation of the security and integrity of space objects in orbit, and due consideration for the legitimate defense interests of states.[41] It also refers to transparency and confidence-building

[35] This may prove to be useful due to the sensitive nature of military cooperation on space issues, particularly at the EU level.

[36] Mike Dillon (rapporteur), *Report of the Panel of Experts on Space and Security*, European Commission, 2005.

[37] "The Ambitions of Europe in Space," *Ambitions of Europe in Space Conference.* 2009.

[38] European Space Agency, *ESA's space hazard programme profiled online*, 18 May 2010, http://www.esa.int/esaMI/SSA/SEMVLPT889G_2.html (accessed May 2010).

[39] European Commission / European Space Agency, *Space and Security*, Joint Secretariat Paper, 2010.

[40] European Commission / European Space Agency, General Secretariat of the Council of the European Union, Spanish Presidency, "Conclusions of the Co-Chairs," *Conference on Space and Security*, 2010.

[41] Council of the European Union, *Draft Council conclusions on the draft Code of Conduct for outer space activities*, General Secretariat, European Council, 2008.

measures, similar to past arms control agreements, which are designed to alleviate anxieties over the potential deployment of weapons in space. The council is using the draft code as a basis for consultations with other countries.

Although the code strongly affirms the principle of no harmful interference against space objects, it does not explicitly mention weapons in space, and notably allows for the consideration of national defense interests. While this may partly be due to difficulties in defining space weapons, the code also seems designed to be acceptable to a wide range of states, including the United States. It is a realistic alternative to a binding legal document against space weapons, which has proven to be complicated and difficult to negotiate due to political resistance and technical complexities. While the code is inherently incapable of preventing deployment of space weapons by itself, it is an important diplomatic initiative in the debate over space and security.

A March 2010 conference on space and security brought together policy makers from several organizations, including ESA member states, the EU, and the EDA. The conference re-affirmed the "relevance of space to security users as a tool with the potential to address specific needs, in particular that of timely response." Echoing earlier proposals, recommendations were made on how GMES could support environmental protection efforts, border and maritime surveillance, and the work of the nascent EEAS. The conference raised the importance of SSA for space and security, but also noted "the complexity of integrating both civil and military requirements." Its conclusions stated that the "EU Council and European Commission, together with potential SSA contributors, will have to define the governance model and the related data policy for an operational European SSA system." In addition, the conference highlighted the importance of national assets as components of European space systems. The conference conclusions referenced the ESP in stressing a need for the EU, ESA, and their member states to "increase synergies between their security and defence space activities and programmes."[42]

Implications for Transatlantic Cooperation in Space and Security

Thus far, transatlantic cooperation in space and security areas has been limited. For example, NATO forces have been mostly reliant on U.S. space assets, while EU forces – and many member state forces – have lacked many of the technological benefits of space systems. Yet, there has been some cooperation, as well as discussion on future joint endeavors. NATO has developed allied space-based telecommunications through a program called NATO Satcom Post-2000. This program will ideally define how future cooperation between allied information systems will work, and establish common technical standards. Establishing Satcom was difficult, however, as NATO governments had trouble agreeing on their choice of wave frequencies – the United States wanted a high-frequency standard, while most of the other members preferred one with a lower capacity.[43]

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[42] European Commission / European Space Agency, General Secretariat of the Council of the European Union, Spanish Presidency, "Conclusions of the Co-Chairs," *Conference on Space and Security*, 2010; and European Space Agency, *Conference highlights deepening connection between space and security*, 11 March 2010, http://www.esa.int/esaMI/SSA/SEMOFO9KF6G_2.html (accessed March 2010).

[43] Xavier Pasco, "Ready for take-off? European defence and space technology," in Carl Bildt, Mike Dillon, Daniel Keohane, Xavier Pasco and Tomas Valasek, eds., *Europe in Space* (Centre for European Reform, 2004), http://www.cer.org.uk/pdf/p572_space_pol_eu.pdf (accessed June 2010).

U.S. defense officials have also expressed openness to cooperating on SSA.[44] One U.S. official of the Department of Defense asserted that "any endeavor by Europe to enhance [SSA] will only increase our ability to conduct safe and responsible operations in space... we look forward to continued exchanges on a range of technical, architectural and related issues." The official added that the United States hosted a U.S.-ESA workshop in June 2008 that addressed transatlantic cooperation on SSA.[45] Discussions between U.S. and European officials on possible SSA data sharing have been ongoing, and have sought to address evolving SSA security policy concerns.[46] At a conference hosted by the New Defence Agenda, Gilles Maquet of Eurospace identified early warning systems as another area for potential cooperation.[47] Karl von Wogau, a member of the European Parliament, made a similar proposal in a parliament resolution: "EU and NATO are urged to launch a [strategic] dialogue on space policy and missile defence, especially on complementarity and interoperability of systems for satellite communications, space surveillance, and early warning of ballistic missiles, as well as the protection of European forces by a theatre missile defence system."[48]

… technical coordination, as well as rules of the road… may govern the security dimensions of space. The European Union could be a driver in this kind of development.

Despite talk of future collaboration, as well as a long history of working together in many areas, there are several issues which pose challenges to U.S.-European cooperation in space and security. There continues to be a major capabilities gap between the United States and Europe, both in general defense and in space. In 2009, the United States spent $43.5 billion on military space, where the Department of Defense's space budget was $26.5 billion, and the budgets for the National Reconnaissance Office and National Geospatial-Intelligence Agency were $15 billion and $2 billion respectively.[49] In contrast, it is estimated that Europe as a whole spends between $750 million to $1.4 billion annually on military space.[50] Europe's more limited military space budget severely restricts Europe's ability to acquire advanced military space assets.

The ongoing crisis in the euro zone will likely complicate this situation. In early May, the EU and the International Monetary Fund (IMF) funded a massive loan package to rescue Greece from bankruptcy. A few days later, they established a mechanism worth around €750 billion to rescue failing EU member states in the future. The measures were unpopular in Germany, which was the biggest contributor to the funds. At the same time, states throughout Europe began to implement

[44] *Aviation Week & Space Technology* of 19 January 2009, noted that reports had surfaced that the United States was putting pressure on Europe to sidetrack or change SSA projects in Europe. This report was confirmed as well by ESA's Director General Dordain through personal correspondence with the author.

[45] Michael Taverna, "ESA plans quick kickoff for space situational awareness and other programs, despite alleged U.S. pressure," *Aviation Week & Space Technology*, 19 January 2009.

[46] "Conversation with Ken Hodgkins," *Aerospace America*, July-August 2009, pp. 16-19.

[47] John Chapman, *Space and Security in Europe* (New Defence Agenda, 2004).

[48] Karl von Wogau, *On the Contribution of Space Assets to ESDP*, Committee on Foreign Affairs, European Parliament, 2008.

[49] *The Space Report 2010* (Space Foundation, 2010).

[50] Futron, "INTEL: Global Military Space," *MilSat Magazine*, September 2009.

austerity programs to reduce their debts.[51] Moreover, the expanded powers of the European Parliament under the Lisbon Treaty should make the EU more accountable to its citizens, although recent voter turnout for parliament elections has been low. Faced with potential cuts in other areas, like social welfare, European citizens are unlikely to support additional security space spending, at the European or national levels.

Due to these budgetary limitations, there is an interoperability problem between U.S. and European forces, which hampers space and security cooperation. John Sheldon notes that the United States "is hardly going to rein back its continued exploitation of military space in order to ensure that European allies can operate effectively alongside it."[52] Interoperability problems were also cited by several of the experts at the New Defence Agenda conference mentioned above. Additionally, a report to the ESA Director General, commonly known as the "Wise Men Report," stated that increased space and security investment would establish Europe's "credentials both as a credible alternative to the United States for the world and as a credible partner for cooperation with the United States."[53]

While improved European space capabilities are essential for increased cooperation with the United States, they could also fuel calls for greater European autonomy in space and security. This paradox is more complex than the capabilities gap itself, and is tied to a deeper transatlantic divide. The call for European autonomy has typically been led by France; France has advocated a stronger CSDP as an alternative to the United States and NATO. Former French President Jacques Chirac argued that unless Europe develops its own satellite capabilities, it will remain little more than a "vassal" of the United States.[54] The desire for space independence has led to some European-level initiatives, such as Galileo and the nascent SSA systems. And, "Europe can no longer assume a fortuitous coincidence of interest with the USA" and needs to develop its own capabilities. Moreover, the EU cannot be guaranteed access to member state systems "in support of possible or actual deployments of European multinational units or coalition forces under all circumstances."[55] To support the range of security functions it wants to carry out, the EU increasingly feels it should have constant, assured access to a variety of space assets.

The debate over European autonomy is related to a deeper issue – the often differing attitudes of the United States and Europe towards both space policies and security policies. These differences stem from U.S. and European approaches to security after World War II. While the United States policed Europe and most of the world with military power, Europe focused on economic integration and development, and institution building. Alluding to this tradition, an ESA working group on Space and Human Security maintained that "a European space policy should encompass the European way of approaching security problems."[56] The

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[51]"EU seals deal to shield euro from speculators," 10 May 2010, http://www.euractiv.com/en/financial-services/eu-sealed-plan-shield-euro-speculators-news-493956 (accessed May 2010).

[52]John Sheldon, "Transatlantic Military Space Cooperation: Addressing the Capabilities Gap," *Astropolitics* 3 (2005): 297-303.

[53]Carl Bildt, Jean Peyrelevade, and Lothar Spath, *Towards a Space Agency for the European Union,* Report to the ESA Director General, European Space Agency, 2000.

[54]Daniel Keohane, "Introduction," in Carl Bildt, Mike Dillon, Daniel Keohane, Xavier Pasco and Tomas Valasek, eds., *Europe in Space* (Centre for European Reform, 2004), http://www.cer.org.uk/pdf/p572_space_pol_eu.pdf (accessed June 2010).

[55]Mike Dillon (rapporteur), *Report of the Panel of Experts on Space and Security,* European Commission, 2005, p. 38

[56]*Basic Information Concerning Space and Security,* Working Group Report, European Space Agency, 2007.

European way consists of several principles: effective multilateralism with an emphasis on strengthening the international order, institutions, and rule of law; promoting a stable international and regional environment for Europe; and cooperation with partners, both directly and through institutions. Thus, Europe generally prefers to use "soft power" in international politics – power combining diplomacy, cooperation, and economic and political action – as opposed to hard military power. Europe also tends to view security rather broadly, encompassing issues, such as economic and environmental security, in contrast with the more traditional military approach, which has often been taken by the United States.[57]

… the United States and Europe must seek to address the problems that might hamper transatlantic cooperation in space and security, and together take the lead on multilateral approaches in this area.

Although the election of President Obama has changed the tone of U.S. foreign policy to include multilateral approaches, the United States is the world's superpower by all measures, especially military might. The United States also has a variety of commitments overseas, many of which it must fulfill unilaterally. Hence, the United States outlook on security is from the perspective of the world's sole military superpower – it keeps the international community, and its homeland, safe by wielding this strength. Accordingly, "U.S. space technology is military oriented due to military strategy, which is increasingly based on the concept of information dominance, while European space technology is more civilian oriented and dual-use."[58] Similarly, the United States' vision of space is "increasingly dominated by military priorities, while the EU emphasizes the use of space technologies for disaster relief" and other humanitarian missions outlined by the Petersberg tasks, as well as civil security interests.[59]

Different transatlantic views of space and security have led to disputes over various initiatives, most notably the Galileo project. The United States was concerned that EU civilian control over the navigation system might lead to security vulnerabilities. In particular, defense officials worried that potential adversaries could utilize Galileo's signals for attacks against U.S. and allied forces. U.S. apprehensions were alleviated when the EU established the GSA, which was tasked with regulating Galileo and preventing its unauthorized use.

Hesitance in Europe to militarize space at the European, EU, or ESA levels has also led to different transatlantic approaches toward space and security. Proposals in France have advocated ensuring the protection of national capabilities and satellites, and continuing work on SSA. Eventually, initial systems would become more operational and more European, but would stop short of developing weapons to be used for space defense.[60] At the same time, diplomatic efforts would ideally establish rules of the road to prevent the deployment of space weapons. Furthermore, at

[57] Wolfgang Rathgeber and Nina-Louisa Remuss, *Space Security: A Formative Role and Principled Identity for Europe* (European Space Policy Institute, 2009), http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2016.pdf (accessed June 2010).

[58] Ibid.

[59] Ibid., p. 46.

[60] Philippe Henry. "The militarization and weaponization of space: Towards a European space deterrent," *Space Policy* (May 2008): 61-66.

the New Defence Agenda conference, Jack Metthey of the European Commission noted that the EU focus is on security and not defense – in the view of the European Parliament, this rules out the possible militarization of space and use of offensive weapons.[61]

While the United States has not displayed support for a binding legal treaty banning all space weapons, it has also shown self-restraint in deploying them. Concomitantly, the militarization of space will continue to accelerate in the United States. This could complicate future joint efforts between the United States and Europe, at least at the European level. As stated earlier, the space capabilities gap raises additional problems, leading Sheldon to conclude that transatlantic space cooperation will "probably be modest rather than grandiose."[62]

… the United States and Europe can set the norms for future human activity beyond Earth's atmosphere to ensure the secure and sustainable use of space.

Despite these challenges, space and security is an area with potential for deeper transatlantic collaboration. As mentioned earlier, U.S. officials have shown interest in cooperating on SSA. SSA is the first European space initiative to be acknowledged as dual-use from the beginning, and officials are working to determine how the military will use its capabilities. While specific questions remain as to how SSA will operate in Europe, an effective multilayer system could serve as a model for international cooperation leading to a global network. Further, the EU's draft Code of Conduct is an innovative way to address the issue of space weapons outside the CD and would not impose any binding legal restrictions on U.S. space activities.

In the past, Europe has developed institutions to constrain the use of force and ensure security. This tradition may lead the EU, along with its member states and ESA, to promote and develop multilateral initiatives for improving space and security. Some organizations and initiatives are already underway. The Inter-Agency Space Debris Coordination Committee (IADC), for example, was launched in 1993 to address the growing problem of space debris in Earth orbits. And, the International Telecommunications Union (ITU) regulates the radio-frequency spectrum and satellite orbit resources to prevent harmful radio interference between countries. Nonetheless, there is still much room for international collaboration for space governance. For example, with an increasing number of actors aspiring for and reaching space, traffic management is a key potential area for multilateral cooperation.

Xavier Pasco notes that technical coordination, as well as rules of the road, could eventually lead to some new space regime, which may govern the security dimensions of space.[63] The EU could be a driver in this kind of development. Past European initiatives, such as the OSCE, have

[61]John Chapman, *Space and Security in Europe* (New Defence Agenda, 2004). Presumably, Metthey meant the use of any weapons in space; a recent European Parliament resolution specifically urges international actors to restrain from using "offensive equipment" in space, including ground-based ASATs. See Karl von Wogau, *On the Contribution of Space Assets to ESDP*, Committee on Foreign Affairs, European Parliament, 2008, p. 14.

[62]John Sheldon, "Transatlantic Military Space Cooperation: Addressing the Capabilities Gap," *Astropolitics* 3 (2005): 298.

[63]Xavier Pasco, *A European Approach to Space Security* (Center for International and Security Studies at the University of Maryland, 2006), p. 41.

focused on transparency, confidence-building, and international cooperation to ensure collective security, and will certainly inform future designs. The Lisbon Treaty, once it is fully implemented, could facilitate the EU's role as a leader in international space and security cooperation. Indeed, the treaty was developed for this kind of purpose. The EEAS, in particular, was created to give the EU more strength and coherence in international affairs. Yet, battles over jurisdiction within the EU, especially between the EU institutions, must be resolved before the EEAS can be effective.[64]

Policy Recommendations

Despite the challenges that complicate transatlantic space cooperation, the United States and Europe continue to be natural partners. They both face a number of complex security threats today, which will require international collaboration. Emerging security concerns in space are no different. The unique environmental attributes of space will increasingly demand multilateral approaches. Consequently, the United States and Europe must seek to address the problems that might hamper transatlantic cooperation in space and security, and together take the lead on multilateral approaches in this area.

A high-level dialogue on space issues could be a useful step toward improved transatlantic cooperation. Transatlantic dialogues already exist on a range of other issues, and could serve as a model for space discussions. In 2007, for example, the United States and the EU created the Transatlantic Economic Council (TEC) to oversee the dismantling of transatlantic economic barriers. Key officials from the United States' administration and the European Commission have been assigned to head the TEC, giving it focus and executive leadership. At the same time, exchanges have taken place between lower level officials on technical issues. An initiative like this for space could have tangible benefits. Yet, due to other concerns, like the ongoing financial crisis, there might not be enough political traction to launch such a dialogue at this time. The lack of clear leadership on space issues, in both the United States and Europe, presents another challenge. In the United States, a Senior Interagency Group for space within the National Security Council would help address this problem, and in the EU, a top adviser on space issues could be created under the new High Representative for Foreign Affairs and Security Policy.

The United States and Europe must also address issues of interoperability. For the EU, ESA, and their member states, this will require additional defense spending, especially for space and security budgets. Funding in this area in Europe will not be able to match the United States, even at the European level. Moreover, the euro zone crisis will make it difficult to increase allocations in the short-term. Nonetheless, there is much room for improvement. The United States, in turn, must continue to be more open and encouraging towards European ambitions for space independence. Security concerns, such as those over Galileo, are legitimate, but need to be addressed through direct, conventional channels. Potential disagreements over space systems between NATO and the CSDP can be mitigated by determining when, where, and how each actor will operate. Fortunately, the Berlin plus agreement already models how NATO and the EU can share assets for security missions. This agreement should now be modified, or a new agreement should be

[64] If the EU can take the lead in this area, it should find a willing partner on the other side of the Atlantic. Given that the Obama Administration has expressed a preference for multilateral approaches in international politics, European-led, multilateral initiatives in space and security could gain traction in the United States.

made, to determine how NATO and the EU will utilize their overlapping and complementary space systems.

Finally, the draft EU Code of Conduct should be adopted by all spacefaring states in North America and Europe. The Code should also be extended to other major actors in space. This approach, focusing on rules of the road instead of binding treaties, is a practical way of addressing the interests of all parties involved. While it establishes principles of behavior that the EU would like to see normalized, it does not legally preclude the United States from taking any actions in space that it feels are necessary for security. Furthermore, the United States and the EU should consider what new multilateral space initiatives might be feasible and desirable, such as one that manages space traffic. Such endeavors could lead to improved coordination and cooperation in the future. Most importantly, they can provide a framework for the United States and the EU to work together in conjunction with other countries. Broad international collaboration will be increasingly important as states like China expand their space programs, and the United States and EU will be able to deal with these other actors more effectively by coordinating their own efforts.

Conclusion

The development of alternative European and transatlantic security structures after World War II established and reinforced several notions in Europe: a preference for institutions for constraining the use of force, the benefits of pooling resources, and the advantages of international cooperation. On the other hand, the history of European integration has also shown the difficulty of merging national defense structures. In space, Europe cooperates to a great extent. While Europe is increasingly developing dual-use systems for space and security, there continues to be great sensitivity over militarizing space at the European, EU, or ESA level. The European approach to space, as well as a gap in capabilities between the United States and Europe, raises challenges for transatlantic cooperation in space and security.

Nonetheless, space and security is an area with potential for U.S.-European collaboration. What is more, some inventive space and security projects are slowly taking shape at the European level. If the EU can fully implement the Lisbon Treaty and increase its effectiveness in international politics, it could become a leader in multilateral initiatives in this area. The United States could, and should, support this type of role for Europe in space and security. Together, the United States and Europe can set the norms for future human activity beyond Earth’s atmosphere to ensure the secure and sustainable use of space.

India in Space: Factors Shaping the Indian Trajectory

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By launching its space probe to the Moon, Chandrayaan-1, on 22 October 2008, India joined the United States (U.S.), Japan, Europe, Russia, and China in this accomplishment. The principal goal of the probe was to conduct mapping of the lunar surface, and among the scientific payloads it carried two were from the United States and three from the European Space Agency (ESA). This was a unique mission as it was an attempt to map high-resolution, 3-D topography of entire Moon, get mineral composition of surface, and investigate the availability of water and Helium-3. Chandrayaan-1 operated until August 2009, coming to an abrupt end after 312 days, as opposed to the intended two years. Despite the setback, Chandrayaan-1 did achieve 95 percent of its planned objectives, and made the significant discovery of water ice molecules on the lunar surface.[1]

Chandrayaan-1 is a historic milestone for the Indian space program, aimed at laying the groundwork for further space expeditions. It was a landmark project for the Indian Space Research Organization (ISRO), which had launched dozens of satellites since its founding in 1969, but had never before sent an object beyond Earth's orbit. The Indian government has already approved the follow-on Chandrayaan-2 mission, a collaborative venture with Russia. The data relayed by Chandrayaan-1 about the nature of Moon's surface, will pave the way for the soft landing of the rover that Chandrayaan-2 is scheduled to take to the lunar surface.

For India, the lunar probe is yet another testament to the progress it has made in the last few years as an economic and technological power. The mission is a sign of India's growing strategic ambition, and an indication of the importance it gives to space exploration. The superpowers had dominated space for much of the space age, and now emerging powers, such as China and India, are joining them. Space accomplishments translate into greater technological standing and strategic clout, as well as an index of high-technology capability. Moreover, space is an important element of power projection and the lunar

...India intends to use space for planetary research and for economic purposes.

[1]See Chandrayaan, Lunar Mission by Indian Space Research Organization, see http://www.chandrayaan-i.com/index.php/chandrayaan-1.html (accessed April 2010). Chandrayan-1 was placed into lunar orbit at an altitude of 100 kilometers. Though it did not complete its two years in orbit, it provided a large volume of data from its sensors, such as terrain mapping camera, hyper-spectral imager, and moon mineralogy mapper. The moon mineralogy mapper confirmed the existence of water ice on the Moon, and analysis of the data acquired detected more than 40 water ice-filled craters in the lunar north pole.

mission is part of an effort to assert Indian prowess in space.

This paper examines the drivers of the Indian space program. Factors at the structural, domestic, and individual levels shaped the trajectory of the Indian space program. Their relative importance vis-à-vis each other influence Indian aspirations in the realm of space for both civil and military use.

Evolution of the Indian Space Program

The Indian space program started with launching of sounding rockets in 1963. At that time, the purpose was to focus on scientific investigations of the upper atmospheric and ionospheric phenomena above the geomagnetic equator. India's first sounding rocket was launched with the help of the National Aeronautics and Space Administration (NASA), which provided a Nike-Apache rocket along with other hardware and training aids. It took more than a decade's time after this launch to put the first Indian satellite in Earth orbit. Aryabhatta was India's first satellite, named after an Indian mathematician of the 5th century of the Common Era. It was launched with the help of the former Soviet Union on 19 April 1975 from Kapustin Yar, a Russian rocket launch and development site.[2] Since then, India demonstrated that it could send an indigenous satellite to orbit by using an indigenous rocket. This was the launch of satellite, Rohini 1, with the Satellite Launch Vehicle (SLV) from its own launch site located at Sriharikota on 18 July 1980.

India's space program started under the aegis of Department of Atomic Energy in 1962 with creation of Indian National Committee for Space Research (INCOSPAR). The mandate to the committee was to oversee all aspects of space research in the country. Work began on the establishment of the Thumba Equatorial Rocket Launching Station (TERLS) in 1962. India's former Prime Minister Indira Gandhi dedicated TERLS to the United Nations (UN) on 2 February 1968. On that occasion, INCOSPAR Chairman, Vikram Sarabhai, articulated India's goal in space. He stated that India's program is civilian, with a focus on the application of space technology as a tool for socioeconomic development of the country. The basic aim of India's space program was described as a program capable of using space technologies in the vital areas of development, such as communications, meteorology, and natural resource management.[3]

ISRO was formed under the Department of Atomic Energy in 1969, and was subsequently brought under the Department of Space in 1972. A Space Commission was also established in 1972, which reports directly to the Prime Minister. The Department of Space along with ISRO operates four independent projects: (1) the Indian National Satellite Space Segment Project; (2) the National Natural Resource Management System (NNRMS); (3) the National Remote Sensing Agency (NRSA); and (4) the Physical Research Laboratory (PRL). The Department of Space sponsors research in various academic and research institutions under a program called RESPOND, the sponsored research. This program allows ISRO to interact with various educational institutes and outsource research efforts.[4]

[2]The Soviet Union and India negotiated in August 1971 an agreement, signed on 10 May 1972, in regard to a joint effort to launch a satellite.

[3]U. Sankar, *The Economics of India's Space Programme* (New Delhi: Oxford University Press, 2007), pp.1-2.

[4]India Space Program Research, India Department of Space, Science Advancement, http://www.indianchild.com/india_space_research.htm, http://indianspacestation.com/index.php?view=article&catid=35:articles&id=106:respond-program-by-isro&format=pdf (both accessed April 2010).

Presently, ISRO has various operating divisions throughout the country. These divisions deal with space systems, propulsion, communications, telemetry and tracking, research, space launch, and other facets of the space program. The major achievements of the space program have been in the area of the domestic design, production, and launching of remote sensing and communications satellites. Over the years, ISRO established a strong infrastructure for remote sensing and communications satellite systems with launcher autonomy. In 1992, ISRO established its commercial outlet, the Antrix Corporation.[5] This organization markets space and telecommunications products of ISRO.

Initially, the Indian space program focused on experimental, low-capability projects that allowed Indian scientists to gain experience in the construction and operation of satellites and launch vehicles. ISRO built the Bhaskara Earth observation satellites, a communication satellite, the APPLE satellite, and conducted four test flights of the SLV-III satellite launch vehicle between 1979 and 1983.[6] The Bhaskara satellites were launched with help from the former Soviet Union. Even though only two of the four test flights of SLV were successful, this program was followed by a more advanced program, the Augmented Satellite Launch Vehicle (ASLV).

Indian armed forces understand the relevance of space technologies to address 21st century security threats.

From the mid-1980s, India focused on more capable, mission specific systems. ISRO started designing and developing the Polar Orbiting Satellite Launch Vehicle (PSLV), and its successor, the Geosynchronous Satellite Launch Vehicle (GSLV). These launch vehicles were required to launch the indigenously developed Indian Remote Sensing (IRS) satellite, and a meteorology and telecommunications Indian National Satellite (INSAT). PSLV commenced its operational launches in 1997, and since then, it has been a reliable launch vehicle with ten consecutive successful flights through April 2007.[7] On 2 September 2007, India successfully launched an INSAT geostationary satellite with the GSLV. This launch proved India's capabilities to put satellites weighing 2,500 kilograms (kg) into geostationary Earth orbit (GEO). The first two stages of GSLV I and II are derived from PSLV.

ISRO is developing as well a more advanced GSLV version, GSLV III, which is an entirely new launch vehicle that is not derived from PSLV or previous GSLVs. In April 2002, the Indian government approved $520 million U.S. dollars for development of GSLV III with the capability to launch 4,500 kg satellite to geo-synchronous transfer orbit (GTO) with growth potential towards 5,000 kg payload capability.[8] However, ISRO's GSLV program suffered a setback in April 2010 with the failure of GSLV D3. This launch vehicle was carrying a communication satellite called GSAT-4 with a mass of 2,220 kg. The main feature of this mission was the employment of the first Indian made cryogenic engine. The failure of the cryogenic engine underlined that India will have to wait for a number of years to realize its dream of sending 5,000 kg of various satellites to space.[9]

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[5]Antrix is a Sanskrit word meaning Space.

[6]Dinshaw Mistry, "India's Emerging Space Program", *Pacific Affairs* 71:2 (Summer, 1998): 153.

[7]Ibid. Also, see "ISRO Does an Italian Job," *Hindustan Times*, 23 April 2007.

[8]See ISRO, http://www.isro.org/Launchvehicles/GSLVMARKIII/mark3.aspx (accessed April 2010).

[9]"India's ambitious quest to achieve total independence in cryogenic technology for launching satellite launch vehicles

The Indian space program has followed the path in space envisaged by Sarabhai in the 1970s of socioeconomic applications for the country. Investments have revolved around remote sensing and multi-purpose application satellites, and related launching technologies. Yet today, India is looking beyond Sarabhai's vision of harnessing space just for economic and social development. India's lunar probe, Chandrayaan, and ISRO's proposal to undertake human lunar missions are examples of how India seeks to expand upon its national space endeavors.[10] Of note, is that during the 1970s, Sarabhai argued that India does not have the fantasy of competing with the economically advanced nations in the exploration of the Moon, the planets, or to engage in human spaceflight.

In addition to Chandrayaan, India has formulated a road map to send a human mission to the Moon by 2020. This added dimension of undertaking human space missions needs to be viewed not as a policy shift per say, but as a natural progression in developing space capabilities. India also plans to send satellites to study Mars. With the successful launch and mission of Chandrayaan, India, for the first time, has entered into an arena of deep space exploration. ISRO managed to keep the cost factor very low for this effort. It looks certain that this mission is not a "one-off mission," and Indian investments in this area are likely to increase in the near future. As stated earlier, the Indian government approved a second robotic lunar mission, Chandrayaan-2, at a cost of around $100 million U.S. dollars.[11] ISRO is planning to put its first Indian astronaut into orbit by 2014-2016, depending on whether the government approves ISRO's budget needed for this effort (see Table 1 below).

At the end of the first decade of the 21st century, India's satellite program is headed towards following a multi-pronged strategy. In addition to social causes, India intends to use space for planetary research and for economic purposes. To conduct all these activities, focus areas for Indian space efforts include: remote sensing, meteorology, communication, education, navigation, and astronomy and planetary missions.

Military Space Program

Sarabhai had articulated in the early 1970s that India's space program is civilian in nature. Also, the development of the Indian civil space program was not born out of military programs, like ballistic missile programs. Rather, civil space efforts focused on satellite development and establishing satellite launch capabilities for civil purposes.[12]

However, satellite technology, being inherently dual-use in nature, has applicability for military purposes. For example, a one meter (m) resolution Technology Experiment Satellite (TES) was launched by ISRO in 2001. It was stated by the then ISRO Chairman, K. Kasturirangan, that the satellite was meant for "civilian use consistent with

suffered a setback with the indigenous cryogenic engine in a Geosynchronous Satellite Launch Vehicle (GSLV-D3) failing to ignite and the vehicle tumbling into the sea." See *The Hindu*, 15 April 2010, http://beta.thehindu.com/news/national/article398070.ece?homepage=true (accessed April 2010).

[10] K.S. Jayaraman, "India's Space Agency Proposes Manned Spaceflight Programme," *Space News*, 10 November 2006.

[11] P. Sunderrajan, "Cabinet clears Chandrayaan-2," *The Hindu*, 19 September 2008.

[12] For an overview of recent trends in Indian Missile Capability, see Harsh V. Pant and Bharath Gopalaswami, "India's Emerging Missile Capability: The Science and Politics of Agni-III," *Comparative Strategy* 27:4 (August-September 2008): 376-387.

our security concerns."[13] Such high resolution imagery has obvious military utility. In the recent past, India also launched Cartosat 1, Cartosat 2, and Cartosat 2A high resolution satellites with 2.5 m, 1 m, and 0.8 m resolutions respectively. These satellites are for cartographic purposes, as well as for urban and rural development. Such satellites offer India the capability of intelligence-gathering, keeping an "eye on the region surrounding the country.

Geographically, India's location at the base of continental Asia astride the Indian Ocean places it at a vantage point in relation to maritime trade. India has a strong stake in the security and stability of these waters since a large percent of Asian oil and gas supplies is shipped through the Indian Ocean.[14] Presently, the security of such supplies depends on multilateral initiatives that have been sanctioned by the UN. Indian navy and cost-guard play a role within the ambit of the UN *Law of the Sea Convention*. The use of space could clearly help India in this role.

Indian armed forces understand the relevance of space technologies to address 21st century security threats. The Indian Air Force (IAF) is planning to integrate space-based applications into conventional strategies and operations. The IAF is already using space for telecommunications, reconnaissance, navigation, targeting, and other operations. The IAF is adopting a focused and fast-tracked approach to harness space effectively to provide synergy with all facets of its operational roles.[15] For the last few years, the IAF has been advocating and preparing for the establishment of a tri-service aerospace command to protect both the territorial and space assets of India. Today, India understands that many modern day defense options rely heavily on space-based sensors, and for better coordination and timely dissemination of surveillance, reconnaissance, and tracking information.[16]

India has no policy towards weaponization of space, yet Indian armed forces require the assistance of the space assets to undertake various operations, in air, land, and sea. Keeping in view such military space requirements, particularly with the backdrop of the anti-satellite test conducted by China during January 2007, India has established a "Space Cell" under the command of the Integrated Defence Services (IDS) Headquarters. IDS acts as a single organization for integration among the armed forces, the Department of Space, and ISRO. India maintains that such a body is required due to "offensive counter space systems and an improved array of military space systems emerging in India's neighborhood."[17]

Drivers of Indian Space Program

Following below is a discussion of the main drivers that have influenced the trajectory of India's space program. They can be broadly

[13] See Joe Katzman, "India's Emerging Military Satellite System," 10 August 2005, http://www.windsofchange.net/archives/007318.php (accessed April 2010).

[14] From the lecture delivered by Shri M.M. Pallaum Raju, Minister of State for Defence, Government of India. See "P.C. Lal Memorial Lecture," organized by the Air Force Association, 19 March 2007, New Delhi, India.

[15] D.C. Kumaria, "Leveraging Space Capabilities for India's Defence", *Air Power Journal* 1:2 (October-December 2006): 86-87.

[16] From the lecture delivered by Shri M.M. Pallaum Raju, Minister of State for Defence, Government of India. See "P.C. Lal Memorial Lecture," organized by the Air Force Association, 19 March 2007, New Delhi, India.

[17] See "Now, space cell to keep an eye on China's plans," *The Times of India*, 11June 2008, http://timesofindia.indiatimes.com/India/File_Now_space_cell_to_keep_an_eye_on_Chinas_plans/articleshow/3118491.cms (accessed April 2010).

examined under three levels: (1) structural, (2) domestic, and (3) individual. At the structural level, the changing global balance of power and growing competition among spacefaring states is analyzed' at the domestic level, the economic and political factors, as well as the technological development and bureaucratic momentum shaping Indian space policy, are examined; and at the individual level, the role of key personalities in shaping the Indian space priorities is assessed.

International Structural Factors

With the recent rise in India's economic and political power, India is more ambitious in defining its priorities in space than it has ever been in the past. India's space policy is responding not only to India's own attempt at emerging as a major global actor, but also to the space efforts of other powers. With other powers, such as China and Japan, deciding to explore the lunar surface with humans, India has also joined the "bandwagon." India has a technologically sophisticated space program, which is now addressing the challenges of human spaceflight and exploration. Towards this end, India is cooperating with a number of states and U.S.-Indian space cooperation is beginning to grow substantially.

India has only recently started the military dimension of its space program, and as the space race among major powers gains momentum, it will become pivotal for Indian military planners. With China viewing conflict in space as an integrated part of military operations, India is gradually coming to terms with the possibility of the weaponization of space.[18] For long, the Indian government has resisted the demand of its military to establish an aerospace command by arguing that it did not want to trigger greater militarization of space or the possibility of arms race in space among regional powers. But gradually, India is realizing that whether it likes it or not, the military use of space is pervasive among world powers, and there is little India can do to stop it. Also, by supporting the already deployed U.S. missile defense system, India seems to have casted its vote towards the militarization, and perhaps weaponization, of space with the missile defense system being a first step towards an anti-satellite capability.

India has a two-tiered missile defense system, the Prithvi Air Defence (PAD) missile for high altitude interception, and the Advanced Air Defence (AAD) Missile for lower altitude interception. Several successful tests for this system have already been conducted, and these systems will become operational in two to three years. Also, according to the Defence Research and Development Organisation, Indian defense scientists are readying a weapons system to neutralize enemy satellites operating in low-Earth orbit (LEO).

India's space policy is responding not only to India's own attempt at emerging as a major global actor, but also to the space efforts of other powers.

It was the Chinese test of an anti-satellite weapon (ASAT) in 2007 that led the Indian establishment to take more seriously the military uses of space. China successfully used a ground-based missile to hit and destroy

[18]For a detailed account of writings discussing China's views of war in space as an integrated part of military operations, see Kevin Pollpeter, "The Chinese Vision of Space Military Operations" in *China's Revolution in Doctrinal Affairs: Emerging Trends in the Operational Art of the Chinese People's Liberation Army*, James Mulvenon and David M. Finkelstein, eds. (CNA Corporation, December 2005).

one of its weather satellites. In effect, China demonstrated an effective ASAT capability comparable to the United States technology from the mid 1980s and Russian systems from about the same time. The test reinforced China's status as a military space power; equal to the United States and Russia, but more significantly key U.S. space systems are now at risk in any future conflict with China.[19]

As a consequence, suggestions are now being made that the United States should start investing in offensive counter-space capabilities.[20] The Bush Administration tacitly asserted the United States right to space weapons and has continued to oppose the emergence of treaties or other measures restricting them. For the United States, any arms control regime in outer space would constrain its military options, and it wants to retain its military operational flexibility.

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In early 2008, the United States Navy's missile interceptor successfully struck a dying spy satellite of the United States in LEO over the Pacific Ocean. With this missile strike, the United States categorically signaled that its missile defenses can be used to counter strategic ASATs. An interceptor designed for missile defense was used for the first time to attack a satellite, and as such, showcased how the emerging missile defense arsenal could be reprogrammed to counter an unexpected threat, which in this case was deadly rocket fuel aboard a dead satellite. This will no doubt strengthen the hands of the supporters of the missile defense system in which the United States has already made significant investments. This test was as a major success for the United States Missile Defense Agency, in so far as it amounted to an unprecedented use of components of the military's missile defense system designed to shoot down hostile ballistic missiles in flight, not satellites.

It is instructive that this strike by the United States came days after China and Russia proposed a global treaty banning weapons in space in the UN Conference on Disarmament, as well as rising Russian opposition to the United States placement of missile defense interceptors in Eastern Europe. The United States has opposed this treaty effort arguing that the proposed draft is largely directed at U.S. military technology, as it allows China and Russia to fire ground-based missiles into space or use satellites as weapons. There is also reluctance on the part of China and Russia on clearly defining a space weapon as they too want to keep their options flexible.

The Europeans are presenting their own challenge to U.S. supremacy in space. The first satellite in the European Union's (EU's) Galileo satellite navigation program was launched in 2005 rivaling the United States Global Positioning System (GPS). The Galileo project is a $4 billion U.S. dollar enterprise whereupon Europe hopes to end its reliance on the GPS system. Apart from demonstrating Europe's technological prowess, Galileo's launch also signaled European desire to enhance its own space capabilities, rather than depend on the United States. Not surprisingly, the United States military had been extremely critical of Galileo, calling it unnecessary and a potential security threat during wartime as its signals might interfere with next-generation GPS signals intended for use by the United

[19]Ashley Tellis, "Punching the U. S. Military's "Soft Ribs": China's Anti-satellite Weapon Test in Strategic Perspective," *Carnegie Endowment, Policy Brief* 51, June 2007.
[20]Ashley Tellis, "China's Military Space Strategy," *Survival* (Autumn 2007): 41-72.

States military. Though this dispute was later resolved when the EU and the United States agreed to make Galileo compatible with GPS, it underlined the unease with which the United States views any attempt to challenge its supremacy in space.

American plans to militarize space have come into sharp relief in recent years. In 2004, the United States Air Force issued a *Counter Space Operations* document that discussed both defensive and offensive counter space operations.[21] Prior to this, in the 1996 Clinton Administration's National Space Policy for example, a more pacific use of space was emphasized, including satellite support for military operations, arms control, and non-proliferation pacts. Regardless, space capabilities provide vital support to American power projection. The United States military has invested enormous sums in the research, development, and procurement of satellites for intelligence-gathering, communications, and navigation, and that investment is widely regarded to great benefits for U.S. warfighting.

The unilateral withdrawal of the United States from the Anti-Ballistic Missile (ABM) Treaty in 2002 and its pursuit of an open-ended ballistic missile defense program already point towards future U.S. plans to address the challenges of space as a new battlefield. In fact, a commission headed by the former U.S. Secretary of Defense, Donald Rumsfeld, had recommended in 2001 that the military should "ensure that the President will have the option to deploy weapons in space."[22] It is towards this end that the Pentagon launched the XSS-11 orbital micro-satellite, which is designed to disturb other states' military reconnaissance and communication satellites.

Despite financial, technological, and diplomatic hurdles, U.S. efforts to gain space superiority will continue, and the rest of the world will have to find ways and means to respond to this challenge. It is in this broader global context that India, as a major space power, is trying to re-define its priorities in space.

Since inception of its space program, India has been supported by the United States, erstwhile Russia and the European countries, in various areas, from providing launching facilities, to helping with technology transfer, and to sending astronauts to space. At the same time, the United States imposed sanctions on the Indian space program from 1987 to 2004 because of subsequent change in U.S. policies due to India's nuclear and missile posture.[23]

Since 2004, the Indian space program is receiving support from all major space powers. The United States is likely to play the

[21] *Counter Space Operations*, Air Force Doctrine Document 2-2.1, 2 August 2004, http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_2_1.pdf (accessed April 2010).

[22] The report of the Rumsfeld Commission to Assess the Ballistic Missile Threat to the United States, http://www.fas.org/irp/threat/missile/rumsfeld/toc.htm (accessed April 2010).

[23] The United States and India began space cooperation in the 1960s with sounding rockets, which expanded to transfer of technology for launch vehicle development and sharing of satellite data. However, concerns about the global proliferation of ballistic missiles led the United States to establish the Missile Technology Control Regime (MTCR) in 1987 to coordinate national export licensing measures on missiles and related technology, including technology for space launch vehicles that might contribute to the development of military systems. MTCR targeted emerging missile programs, including those of India, and led to restrictions on U.S. technology transfers to India's space launch vehicle programs. In 1992, U.S.-India space relations further deteriorated when the United States objected to an agreement between the Russia and India for the sale to India of cryogenic rocket engines and the technology to produce them. In 1998, the Indian nuclear tests led the Clinton Administration to impose sanctions, restrictive export licensing requirements, on ISRO and other Indian entities involved in space and missile programs. Since January 2004, U.S.-India space cooperation was re-established to facilitate greater commercial space cooperation, and cooperation in space exploration and the launching of satellites.

policy of using India to balance China in the region, and India is likely to exploit the situation.[24] Already, India has collaborated with the United States for its first Moon mission, and the Manmohan Singh-Bush joint statement agreement of 18 July 2005 indicates that in the arena of space India-U.S. collaborations are likely to strengthen.[25]

India's has worked and is working with various members of ESA on a host of space issues. India is also engaging Russia on various space ventures, and the joint collaboration reached by both states on Chandrayaan-2 is a case in point. India is not collaborating with China in space; however, China has given certain encouraging signals to India towards collaboration. Wu Ji, identified as Director of the Center for Space Science and Applied Research, Chinese Academy of Sciences, mentioned the possibility of space cooperation during his visit to India in 2006, while accompanying Chinese President Hu Jintao.[26] Today, both states understand that collaboration could allow them to take advantage of existing capacity on both sides. Given the rivalry that animates Sino-Indian ties, and absent any near-term cooperation, India intends to match Chinese advances in space.

[24]On the changing regional balance of power in the Asia-Pacific, see Harsh V. Pant, "The Emerging Balance of Power in the Asia-Pacific," *The Royal United Services Institute Journal* 152:3 (June 2007).

[25]See Joint Statement Between President George W. Bush and Prime Minister Manmohan Singh, 18 July 2005, http://georgewbush-whitehouse.archives.gov/news/releases/2005/07/20050718-6.html (accessed April 2010). For high-technology and space, it was declared that the two countries will: provide for joint research and training; build closer ties in space exploration, satellite navigation, and launch, and in the commercial space arena through mechanisms, such as the United States-India Working Group on Civil Space Cooperation; and build on the strengthened nonproliferation commitments between the two states to remove Indian organizations from export control restrictions.

[26]Bruce Einhorn, "Chindia - Cooperation in the Space Race?" *Business Week*, 21 November 2006.

Domestic Factors

ISRO has not faced problems in securing resources, and has tended to receive steady governmental support. This is one area where a "bottom-up" approach has been found in regard to the growth of the space program. It is ISRO that normally decides what projects to undertake and how to proceed. The government has so far been supportive of most of ISRO's plans. The value of ISRO's overall assets today is approximately $25 billion U.S. dollars.[27] ISRO spends 85 percent of its $1 billion U.S. dollar annual budget on development-related missions, and the remaining 15 percent on advanced research and development (R&D), and on missions, such as Chandrayaan. Table 1 highlights the distribution of funds.

Table 1. Distribution of Funds for the Indian Space Program. *Source: ISRO, http://www.isro.org (accessed April 2010).*

Rupees in Crores [one Indian Rupee in Crores equals $0.224 million U.S. dollars as of April 2010].			
	ACTUALS 2006-2007	**REVISED ESTIMATES 2007-2008**	**BUDGET ESTIMATES 2008-2009**
Space Technology	1668.37	2017.00	2611.52
Space Applications	284.46	299.77	375.28
Space Sciences	228.36	321.60	268.37
INSAT, Operational	376.77	573.57	404.81
Administration	430.70	78.15	414.09
Total	**2988.66**	**3290.09**	**4074.07**

A major limitation, which India's space program is likely to face, is the availability of a trained workforce. This becomes evident from the fact that many young scientists recruited by ISRO are leaving jobs because of the much higher remuneration offered by

[27]K. Kasturirangan, "The Emerging World Space Order" in *Space Security and Global Cooperation*, Ajey Lele and Gunjan Singh, eds. (Academic Foundation: New Delhi, India 2009), p. 33.

private companies. ISRO is not able to attract the best people from the Indian universities, and in the year 2006, more than 50 percent of newly inducted scientists left ISRO.[28] Also, a major part of the existing aging workforce is likely to retire in years to come. ISRO expects to address this shortfall by outsourcing research and undertaking major recruitment drives to replenish the workforce. In order to find a long-term solution to this problem, ISRO has established an institute at Thiruvanandapuram, India for workforce training. However, these efforts will not address workforce issues completely. This is mainly because many India students are attracted to Information Technology as a profession for more than a decade, and the trend is likely to continue. Rocket scientists have limited options of joining government jobs, which do not offer attractive pay salaries.

Apart from human resources, ISRO is not expected to face any major resources problems, like non-availability of materials required for hardware production.[29] Though at present, India is not capable of integrated circuitry manufacturing. Yet, it is expected that India will overcome this deficiency, which in turn will benefit the space sector.

Political Changes

Since independence, India's science and technology policies have more or less remained unchanged irrespective of the political ideology of the government in power. It needs to be emphasized that actually it is not the political party, but the political leadership that plays a significant role towards giving support to new technologies. The history of various political parties in power shows that the programs of national importance, which have security implications, do not get entangled in party politics. India's nuclear test in 1998, Pokhran II, exemplifies this.

For the Indian space program, scientists and ISRO officials have largely shaped the trajectory and have been able to muster the requisite support from the government. The benefits of India's space program are well demonstrated, and in view of this, it is unlikely that any major changes would take place in policies and budgetary support depending on the political party in power. However, some degree of dependence on the United States still exists and is likely to exist, and as such, the emergence of political tensions between India and the United States would have an effect on the Indian space program.[30]

ISRO has not faced problems in securing resources, and has tended to receive steady governmental support.

Other political issues facing the national space program include bureaucratic and programmatic factors. Successes in the space sector tend to be short-lived, and at times, failures are more highlighted. ISRO's recent failure in regard to its commercial venture, the W2M satellite, could have some negative impact on its international reputation when it was trying to develop a niche for itself in the communications satellite field. Any more failures could bring in the bureaucratic cautiousness in this area.

[28] In 2006, ISRO hired 354 new scientists, but 187 trained ones left the organization by 2007. See "ISRO bleeds as scientists leave," *The Times of India*, 6 September 2007, http://timesofindia.indiatimes.com/India/ISRO_bleeds_as_scientists_leave/articleshow/2341361.cms (accessed April 2010).

[29] Personal correspondence with ISRO scientists.

[30] It has not been clearly articulated by ISRO for obvious reasons; however, personal correspondence with ISRO scientists second this concern.

India's space program is placed directly under the Prime Minister, and thus, is relatively free of bureaucratic delays despite programmatic issues that may arise. A broad look at the development of science and technology within the country in general, and the programs of major technological organizations, like Defence Research and Development Organisation (DRDO) and ISRO, during last decade shows that political, bureaucratic, and financial support for projects are not problems.

A major limitation, which India's space program is likely to face, is the availability of a trained workforce.

This observation is further reinforced by the facts that the technocrat community within India has established itself, and ISRO is a success story, which has brought prestige and foreign exchange to the country. Also, given indigenous capabilities for satellite and launch vehicle development, ISRO is unlikely to acquire any large-scale technology from other states, and hence, bureaucratic constraints, which usually exist in regard to technology transfer, are not an issue at play.

Technological Factors

Within next 20 years, technologies, like biotechnology, nanotechnology, and robotics and cognitive technology, are expected to revolutionalize the space sector. These technologies are expected to bring light weight materials to the space sector, which will largely impact the structural design of satellites and components. In addition, computing capabilities will increase in years to come, and power sources will be carrying more capacity with reduced mass.

These technological factors could be viewed at two levels: indigenous development and transfer of technology. After the success of the India-U.S. nuclear deal, it is unlikely that transfer of technology could become a major issue in years to come.[31] Apart from the United States, India is expected to have good relations in space with states like France, United Kingdom, Israel, and Russia. Current trends indicate that India's future programs could constitute various joint projects, either at bilateral or multilateral levels. Many spacefaring nations are likely to prefer joint projects in years to come because of the cost factor and gestation period required for indigenous development of technology. On the other hand, technologies, which could have direct or indirect military relevance, are not shared in cooperative programs and projects. Such technologies would demand indigenous development.

Individual Level Factors

Science and technology leadership in India is driven by various key individuals. Vasant Sathe played a key role during the 1980s to bring color television to India; Rajiv Gandhi was instrumental for the information technology revolution; and Sam Pitrotoda for the revolution in communications. More specific to space, Homi Bhaba, Vikaram

[31] The United States Congress, on 1 October 2008, gave final approval to an agreement facilitating nuclear cooperation between the United States and India. The deal is seen as a watershed in U.S.-India relations and introduces a new aspect to international nonproliferation efforts. First introduced in the joint statement released by President Bush and Indian Prime Minister Manmohan Singh on 18 July 2005, the deal lifts a three-decade U.S. moratorium on nuclear trade with India. It provides U.S. assistance to India's civilian nuclear energy program, and expands U.S.-India cooperation in energy and satellite technology. For details on US-India civilian nuclear energy cooperation agreement, see Harsh V. Pant, "The US-India Nuclear Pact: Policy, Process and Great Power Politics," *Asian Security* 5:3 (September 2009):273-295.

Sahrabhai, APJ Abdul Kalam, K. Kasturirangan, and Madhavan Nair played key roles towards providing science and technology leadership.

Bhaba is regarded as a visionary in the field of science in modern India. He did pioneering work towards peaceful development of atomic energy. Bhabha established the Atomic Energy Commission of India in 1948. His other areas of interest include research on cosmic rays and quantum theory. Apart from being a scientist, he was an able administrator and played a significant role towards developing a world class automatic energy research center in India. Bhaba was succeeded in 1966 by Vikram Sarabhai as the Chairman of the Atomic Energy Commission. Known as father of Indian space program, Sarabhai was the first Chairman of INCOSPAR, which was created after Sputnik was launched into the space in 1957. Sarabhai established the first launching site in the country, TERLS.

...the Indian space program is civilian in nature, and India is yet to articulate a strategic approach. This will make it difficult to reconcile civilian and military priorities in space.

India's 11th President, A.P.J. Abdul Kalam, who assumed office on 25 July 2002, is a scientist. Before assuming the office of the President, he had held various scientific positions, and is often referred to as the "Missile Man of India" – he was the Project Director of India's first indigenous SLV. He has a unique distinction of working both on India's missile program and on India's satellite program. Kalam also spearheaded the campaign of motivating children and young scientists to involve themselves in undertaking various scientific challenges. In many ways, Kalam succeeded in motivating an entire generation to look constructively towards issues of science and technology.

Kasturirangan, presently a Member of Parliament, steered India's space program for over nine years as Chairman of ISRO. He led various space programs successfully, including PSLV and in conceiving India's Moon mission. Kasturirangan largely succeeded in placing India as a preeminent spacefaring nation. His successor, who recently retired, Madhavan Nair, played a significant role in developing ISRO's future roadmap with plans for deep space missions and proposals to put an Indian on the Moon within a decade's time.

Conclusions

India's lunar mission is a statement of the nation becoming more ambitious in defining its priorities in space, and in the coming years, the civilian aspects of the Indian space program can be expected to gather further momentum. The military aspects will also get greater attention of the government, in light of competition among spacefaring nations. Also, greater cooperation in space will emerge with the United States, Europe, and Japan, though with respect to China, the relationship will remain inherently competitive.

India's efforts in space will continue to be hampered by an absence of a coherent national space policy. This is the case because the Indian space program is civilian in nature, and India is yet to articulate a strategic approach. This will make it difficult to reconcile civilian and military priorities in space. The current roadmap of ISRO demonstrates firm resolve to move in a particular direction, yet India is taking only tentative steps in so far as the military dimension of its space policy is concerned.

Konstantin Tsiolkovsky, the "father of space travel" wrote in 1911: "Earth is the cradle of humanity, but humanity cannot stay in the cradle forever." The world is on the threshold of a new age of space exploration, as well as militarization of space, and possible weaponization of space. India, with its achievements in its own space program, is in a unique position to be a major player in the drama of space. The trajectory of India's space efforts demonstrate that India is getting ready to use its space capabilities for not just expanded civil and commercial use, but also for force multiplication and power projection.

"Astronaut Envy?" The U.S. Military's Quest for a Human Mission in Space

Roger D. Launius
National Air and Space Museum

Before the beginning of the space age in 1957, the Department of Defense (DOD) of the United States sought to gain the mission and the technologies to carry out human operations in space. Even after 1958, when President Dwight D. Eisenhower made the decision to assign the human spaceflight mission to the newly created National Aeronautics and Space Administration (NASA), DOD champions continued to argue for a role for military astronauts. The military pursued several flight projects in the 1960s, achieved flight status for military astronauts on classified missions on the Space Shuttle in the 1980s, and has continued to advocate a human military mission in space as the twentieth century came to an end. All this happened despite an exceptionally weak rationale for military astronauts in space. While the DOD commitment to human spaceflight has moderated in the post-cold war era, there remains some who seek this activity as a military mission. This essay reviews the history of the military quest for human spaceflight, and suggests that a human military presence in space will come as other humans settle beyond Earth as has long been the case in terrestrial exploration and settlement. It points to the continuing difficulty of developing a rationale for human spaceflight, a difficulty that has come to a head in the early twenty-first century as the Space Shuttle is retired and plans for future vehicles remain unclear.

When the administration of President Barak Obama took office in January 2009, American human spaceflight efforts were at a crossroads. In the aftermath of the Columbia accident on 1 February 2004, the Bush administration had taken the decision that the venerable Space Shuttle, flown since 1981, had grown unsafe and needed replacement. It set 2010 as the date of shuttle retirement and directed NASA to pursue a follow-on technology. This would help create technologies necessary to return to the Moon and eventually travel to Mars.[1]

The result was the Constellation program established in 2005 as an effort to use modified Space Shuttle hardware to go beyond Earth orbit, with the Moon as a target. By 2009, however, it had become highly uncertain whether that goal could be realized. The new administration realized that the Constellation program had run into technological and budgetary problems and took action to end it in February 2010.[2]

In this context, the way forward for NASA's human spaceflight efforts remains unclear. Moreover, the American military's periodic enchantment with human spaceflight vehicles

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[1]Frank Sietzen Jr. and Keith L. Cowing, *New Moon Rising: The Making of the Bush Space Vision* (Apogee Books, 2004); Craig Cornelius, "Science in the National Vision for Space Exploration: Objectives and Constituencies of the 'Discovery-Driven' Paradigm," *Space Policy* 21 (February 2005): 41-48; Wendell Mendell, "The Vision for Human Spaceflight," *Space Policy* 21 (February 2005): 7-10; and Thor Hogan, *Mars Wars: The Rise and Fall of the Space Exploration Initiative* (Washington, DC: NASA SP-2007-4410, 2007).

[2]Office of Science and Technology Policy/National Aeronautics and Space Administration Fact Sheet, "A Bold New Approach for Space Exploration and Discovery," 1 February 2010, copy in possession of author.

remains unsettled. The Air Force has proposed in the past that it pursue its own human spacecraft; and some on the fringe believe that it already has a capability that is unknown to the general public.[3] How has the United States military viewed the human spaceflight mission since the origins of the space and its role in it? Has this changed over time and why? What possibilities for the future might exist for a human military presence in space?

Origins of the Military Human Spaceflight Effort

Well before the beginning of the space age, the DOD had angled for the mission of placing humans in space for tasks ranging from space-based reconnaissance, to navigation, to communications, and to early warning. Over time, especially as it has become increasingly obvious that the national security mission is effectively conducted by robotic spacecraft, it has come to be called, rather crassly, "astronaut envy." Thus, in the early 1950s, Wernher von Braun, working for the Army Ballistic Missile Agency in Huntsville, Alabama, proposed a massive space station with more than fifty military personnel aboard to undertake Earth observation for reconnaissance and as an orbiting battle station. Von Braun believed this could be used for nuclear missile strikes against the Soviet Union.[4] He could not get anyone in authority in the Eisenhower administration to adopt his plan, though some senior officials in the DOD did see a role for military astronauts.

After a series of studies and high level deliberations, in 1957 the United States Air Force (USAF) proposed the development of a piloted orbital proposal designated "Man-in-Space Soonest" (MISS).[5] Initially dismissed before the launch of Sputnik, afterwards Air Force leaders invited Edward Teller and other leading members of the scientific/technological elite to reconsider the issue of human spaceflight as a national security objective. Teller's group concluded that the Air Force could place a human in orbit within two years, and urged the department pursue this goal. Teller understood, however, that there was essentially no military reason for undertaking this mission and chose not to tie his recommendation to any specific rationale, instead falling back on a belief that the first nation to do so would accrue national prestige and advance, in a general manner, science and technology.[6]

Early in 1958, Lieutenant General Donald L. Putt, the USAF Deputy Chief of Staff for Development, informed Director of the National Advisory Committee for Aeronautics (NACA), Hugh L. Dryden, that the Air Force intended to pursue "a research vehicle program having as its objective the earliest possible manned orbital flight, which will

[3]William B. Scott, "Two-Stage-to-Orbit 'Blackstar' System Shelved at Groom Lake?" *Aviation Week & Space Technology*, 5 March 2006, http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/030606p1.xml (accessed 19 February 2010).[4]Wernher von Braun, "Crossing the Last Frontier," *Collier's*, 22 March 1952, pp. 24–29, 72–74; and Michael J. Neufeld, "Space Superiority: Wernher von Braun's Campaign for a Nuclear-Armed Space Station, 1946–1956," *Space Policy* 22 (February 2006): 52-62.

[4]Wernher von Braun, "Crossing the Last Frontier," *Collier's*, 22 March 1952, pp. 24–29, 72–74; and Michael J. Neufeld, "Space Superiority: Wernher von Braun's Campaign for a Nuclear-Armed Space Station, 1946–1956," *Space Policy* 22 (February 2006): 52-62.

[5]The Man-in-Space-Soonest program called for a four-phase capsule orbital process, which would first use instruments, to be followed by primates, then a pilot, with the final objective of landing humans on the Moon. See David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Air Force Space Command, 1997), p. 75.

[6]Loyd S. Swenson, James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, DC: NASA SP-5201, 1966), pp.73–74.

contribute substantially and essentially to follow-on scientific and military space systems." Putt asked Dryden to collaborate in this effort, but with the NACA as a decidedly junior partner.[7] Even though Dryden agreed, by the end of the summer of 1958, Putt found the newly created NASA leading the human spaceflight effort for the United States, with the Air Force being the junior partner.[8]

Throughout the first part of 1958, Air Force officials pressed for leadership of MISS. As the most experienced in developing space technology, the Air Force expected to lead any space program for the United States. Specifically, it believed hypersonic space planes and lunar bases would serve national security needs. To help make this a reality, the Air Force requested $133 million for the MISS program and secured approval by the Joint Chiefs of Staff.[9] However, a series of disagreements between Air Force and NACA officials disturbed the picture. These difficulties reverberated all the way to the Office of the President, prompting a review of the roles of the two organizations.[10] Hugh Dryden complained in July 1958 to the President's Science Advisor, James R. Killian, about the lack of clarity on the part of the Air Force. He asserted:

> The current objective for a manned satellite program is the determination of man's basic capability in a space environment as a prelude to the human exploration of space and to possible military applications of manned satellites. Although it is clear that both the National Aeronautics and Space Administration and the Department of Defense should cooperate in the conduct of the program, I feel that the responsibility for and the direction of the program should rest with NASA.

He urged that the president state a clear division of responsibility between the two organizations on the human spaceflight mission.[11]

As David N. Spires and Rick W. Sturdevant have pointed out, the MISS program became derailed within the DOD because of funding concerns:

> Throughout the spring and summer of 1958 the Air Force's Air Research and Development Command had mounted an aggressive campaign to have ARPA [Advanced Research Projects Agency] convince administration officials to approve its Man-in-Space-Soonest development plan. But ARPA balked at the high cost, technical challenges, and uncertainties surrounding the future

[7]Lt. Gen. Donald L. Putt, USAF Deputy Chief of Staff, Development, to Hugh L. Dryden, NACA Director, 31 January 1958, Folder #18674, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, DC.

[8]NACA to USAF Deputy Chief of Staff, Development, "Transmittal of Copies of Proposed Memorandum of Understanding between Air Force and NACA for joint NACA-Air Force Project for a Recoverable Manned Satellite Test Vehicle," 11 April 1958, Folder #18674, NASA Historical Reference Collection.

[9]The breakdown for this budget was aircraft and missiles—$32M, support—$11.5M, construction—$2.5M, and R&D—$87M. See Memorandum for ARPA Director, "Air Force Man-in-Space Program," 19 March 1958, Folder #18674, NASA Historical Reference Collection.

[10]Maurice H. Stans, Director, Bureau of the Budget, Memorandum for the President, "Responsibility for "Space" Programs," 10 May 1958; Maxime A. Faget, NACA, Memorandum for Dr. Dryden, 5 June 1958; Clotaire Wood, Headquarters, NACA, Memorandum for files, "Tableing [sic] of Proposed Memorandum of Understanding Between Air Force and NACA For a Joint Project For a Recoverable Manned Satellite Test Vehicle," 20 May 1958, with attached Memorandum, "Principles for the Conduct by the NACA and the Air Force of a Joint Project for a Recoverable Manned Satellite Vehicle," 29 April 1958; and Donald A. Quarles, Secretary of Defense, to Maurice H. Stans, Director, Bureau of the Budget, 1 April 1958, Folder #18674. All in NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[11]Hugh L. Dryden, Director, NACA, Memorandum for James R. Killian Jr., Special Assistant to the President for Science and Technology, "Manned Satellite Program," 19 July 1958; Folder #18674, NASA Historical Reference Collection.

direction of the civilian space agency.[12]

By the summer of 1958, political leaders in Washington viewed the human spaceflight mission more useful as an international prestige program than as a national security initiative.

By the time that Dwight D. Eisenhower signed the National Aeronautics and Space Act of 1958 into law, he had decided to split the human space mission from military leadership, and he formally assigned the coveted human spaceflight mission to NASA. Thereafter, the MISS program was folded into what became Project Mercury. In early November 1958, the DOD acceded to the president's desire that the human spaceflight program be a civilian effort under the management of NASA. For its part, NASA invited Air Force officials to appoint liaison personnel to the Mercury program office at Langley Research Center in Hampton, Virginia, and they did so.[13]

The… objective for a manned satellite program is the determination of man's basic capability in a space environment as a prelude to the human exploration of space and to possible military applications of manned satellites…

The decision to make human spaceflight the sole responsibility of NASA, a very public non-military organization, proved prescient. It might even be considered a brilliant geopolitical decision, possible because of civilian leadership of the military, a foundational pillar of the American military. Eisenhower helped cement that pillar by this and other decisions helping to inexorably weave it into the military culture.

By de-coupling it from the DOD, the president exponentially reduced the confrontational aspect of the space race in its most dramatic element. With NASA officially charged with the peaceful exploration of space, and with human spaceflight as a core element of that mission, a space race could exist without fear of national survival. Numerous international agreements stated this fundamental truth from the decisions of the United Nations (UN) in the latter 1950s to the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space* in 1967.[14]

Regardless of who was to manage the human spaceflight program, American officials recognized that time was of the essence in undertaking the human space missions. The compelling nature of this aspect of the space race pushed NASA to pursue the Mercury orbital program. Roy Johnson, director of Advanced Research Projects Agency (ARPA)

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[12]David N. Spires and Rick W. Sturdevant, "…to the very limit of our ability…: Reflections on Forty Years of Civil-Military Partnership in Space Launch," in Roger D. Launius and Dennis R. Jenkins, eds., *To Reach the High Frontier: A History of U.S Launch Vehicles* (University Press of Kentucky, 2002), p. 475.

[13]Memorandum for Dr. Silverstein, "Assignment of Responsibility for ABMA Participation in NASA Manned Satellite Project," 12 November 1958; Abe Silverstein to Lt. Gen. Roscoe C. Wilson, USAF Deputy Chief of Staff, Development, 20 November 1958; and Hugh, L. Dryden, Deputy Administrator, NASA, Memorandum for Dr. Eugene Emme for NASA Historical Files, "The "signed" Agreement of 11 April 1958, on a Recoverable Manned Satellite Test Vehicle," 8 September 1965, Folder #18674. All in NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[14]United Nations General Assembly Resolution 1721 (XVI), adopted on 20 December 1961; *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, Signed at Washington, London, Moscow, 27 January 1967.

for the DOD, noted in September 1958 that competition with the Soviet Union precluded taking a cautious approach to human spaceflight and advocated additional funding to ensure its timely completion. As he wrote to the Secretary of Defense and the NASA Administrator:

> I am troubled, however, with respect to one of the projects in which there is general agreement that it should be a joint undertaking. This is the so-called "Man-in-Space" project for which $10 million has been allocated to ARPA and $30 million to NASA. My concern over this project is due (1) to a firm conviction, backed by intelligence briefings, that the Soviets next spectacular effort in space will be to orbit a human, and (2) that the amount of $40 million for FY 1959 is woefully inadequate to compete with the Russian program. As you know our best estimates (based on some 12-15 plans) were $100 to $150 million for an optimum FY 1959 program.
>
> I am convinced that the military and psychological impact on the United States and its Allies of a successful Soviet man-in-space "first" program would be far reaching and of great consequence.
>
> Because of this deep conviction, I feel that no time should be lost in launching an aggressive Man-in-Space program and that we should be prepared if the situation warrants, to request supplemental appropriations of the Congress in January to pursue the program with the utmost urgency.[15]

Johnson agreed to transfer a series of space projects from ARPA to NASA, establishing protocols for cooperating in the development of equipment that would be used in the human spaceflight program.[16]

To aid in the conduct of this program, ARPA and NASA created a committee, the Joint Manned Satellite Panel, on 18 September 1958. Holding its first meeting on 24 September, this panel established goals and strategy. Chaired by NASA's Robert Gilruth, but also including such key figures as Max Faget and George Low, the panel focused on a wide range of technical requirements. Under this panel's auspices final specifications for the piloted capsule emerged in October 1958, as did procurement of both a modified Redstone, for suborbital flights, and Atlas boosters for orbital missions.[17]

Through this process, NASA gained a firm grasp of what soon became known as the Mercury program. Between the creation of NASA in 1958 and 1963, a little less than five years, this first human space program was completed at a cost of $384 million. This may have been the best bargain ever in human spaceflight, in no small measure because its goals were uncomplicated. Although lagging behind the original schedule, NASA's Mercury program succeeded in proving the possibility of safe human spaceflight and in demonstrating

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[15] Roy W. Johnson, Director, ARPA, DOD, Memorandum for the Administrator, NASA, "Man-in-Space Program," 3 September 1958, Folder #18674, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[16] Roy W. Johnson, Director, ARPA, DOD, Memorandum for the Administrator, NASA, "Man-in-Space Program, 19 September 1958, with attached Memorandum of Understanding, "Principles for the Conduct by NASA and ARPA of a Joint Program for a Manned Orbital Vehicle," 19 September 1958, Folder #18674, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[17] Minutes of Meetings, Panel for Manned Space Flight, 24, 30 September, 1 October 1958; NASA, "Preliminary Specifications for Manned Satellite Capsule," October 1958; and Paul E. Purser, Aeronautical Research Engineer, NASA, to Mr. R. R. Gilruth, NASA, "Procurement of Ballistic Missiles for use as Boosters in NASA Research Leading to Manned Space Flight," 8 October 1958, with attached, "Letter of Intent to AOMC (ABMA), Draft of Technical Content," 8 October 1958, Folder #18674. All in NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

U.S. technological competence during its Cold War rivalry with the Soviet Union.

At the conclusion of the Mercury effort, Walter C. Williams noted that "in the period of about 45 months of activity, some 25 flights were made..." He then commented on what the United States learned in completing Mercury:

> I think we learned… about spacecraft technology and how a spacecraft should be built, what its systems should be, how they should perform, where the critical redundancies are required. I think we learned something about man-rating boosters, how to take a weapons system development and turn it into a manned transportation system. I think… we found primarily… that this was a matter of providing a malfunction detection system or an abort system, and, also, we found very careful attention to detail as far as quality control was concerned. I think that some of the less obvious things we learned – we learned how to plan these missions and this takes a lot of detail work, because it's not only planning how it goes, but how it doesn't go, and the abort cases and the emergency cases always took a lot more effort than the planned missions... We learned what is important in training crews for missions of this type. When the crew-training program was laid down, the program had to cover the entire gamut because we weren't quite sure exactly what these people needed to carry out the missions. I think we have a much better focus on this now. We learned how to control these flights in real time. This was a new concept on a worldwide basis. I think we learned, and when I say we, I'm talking of this as a National asset, not NASA alone, we learned how to operate the world network in real time and keep it up. And I think we learned a lot in how to manage development programs of this kind and to manage operations of this kind.[18]

Christopher C. Kraft, senior flight controller, agreed: Mercury "changed quite a few concepts about space, added greatly to our knowledge of the universe around us, and demonstrated that Man has a proper role in exploring it. There are many unknowns that lie ahead, but we are reassured because we are confident in overcoming them by using Man's capabilities to the fullest."[19]

The Military's Continued Interest in Human Spaceflight

The DOD, while certainly an important supporting organization in Mercury, remained committed to achieving an independent human spaceflight capability. "If we concede that man can go into space for peaceful missions," stated a USAF white paper in 1961, "we must admit that man can go into this same environment for military purposes. It is the Air Force view that many will be required to go into space to perform tasks that will be important to our national security."[20] From this position flowed a series of decisions aimed at creating what the DOD called the Manned Military Space Program (MMSP). Several immediate programs resulted and the Air Force noted: "Fully coordinated, cooperative and where appropriate, joint effort between the Air Force and the NASA is required in order that the content and objectives of the MMSP are properly defined

[18]Walter C. Williams, Deputy Director, NASA Manned Spacecraft Center, "Project Review," 3 October 1963, NASA Historical Reference Collection.

[19]Christopher C. Kraft, "A Review of Knowledge Acquired from the First Manned Satellite Program," NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[20]United States Air Force, "White Paper on the Air Force Manned Military Space Program," Military Records Center, National Archives and Records Administration.

within the framework of the total national space program."[21]

Accordingly, several programs were aimed towards realizing a human military space program. The first was a cooperative program with NASA to fly the X-15 research aircraft. Several flights reached above 50 nautical miles in altitude (about 93 kilometers), the USAF recognized point at which space began. The highest military flight was by pilot Robert White at 314,750 feet (59 miles or 96 kilometers). The Air Force awarded four of its pilots in the program—William Knight, Michael Adams, Joe Engle, and Robert Rushworth—astronaut wings. This upset NASA officials, and for 40 years, NASA did not recognize any of its X-15 pilots as astronauts, although NASA pilot Joe Walker had exceeded 62 miles (the official definition of where space begins at 100 kilometers). In 2005, NASA recognized all the NASA pilots – Walker, John McKay, Bill Dana – who had exceeded the 50 mile altitude as astronauts, and the USAF had always recognized theirs.[22]

In addition, USAF pursued the X-20 Dyna-Soar, a military space plane to be launched atop a newly developed space launch vehicle. The Air Force believed that the X-20 would provide long range bombardment and reconnaissance capability by flying at the edge of space and skipping off the Earth's atmosphere to reach targets anywhere in the world. Begun on 15 October 1957, although the program may be traced directly to the Bomi (skip-glide space bomber project) and Robo glider (manned hypersonic bomber) programs of the early 1950s; the Air Force intended to use the Titan IIIC to launch its space plane.[23] This winged, recoverable spacecraft did not possess as large a payload as NASA's capsule-type spacecraft and was always troubled by the absence of a clearly defined military mission. Several problems were apparent. First, the difficulty of defining the military mission separate from that of NASA proved a challenge. At some level, there were many possibilities and it was difficult to separate them from those of NASA. Second, the technical capabilities of Dyna-soar made determining on a specific mission out of the many envisioned very difficult.

Accordingly, in September 1961 Defense Secretary Robert S. McNamara questioned whether Dyna-Soar represented the best expenditure of funds. This resulted in numerous studies of the program, but in 1963 McNamara cancelled the program in favor of a separate human spaceflight program, the Manned Orbiting Laboratory (MOL). This military space station, known as Gemini-B, would be launched into orbit aboard a Titan IIIM vehicle that used seven-segment solids and was human-rated that went by the name of Blue Gemini. As an example of the seriousness with which the Air Force pursued the MOL program, the third Titan IIIC test flight boosted a prototype aerodynamic mockup of the MOL laboratory into orbit. It was as close as MOL would come to reality. The new military space station plan ran into numerous technical and fiscal problems, and

United States leaders supported the Space Shuttle not on its merits, but on the image it projected.

[21] Ibid.

[22] Dennis R. Jenkins, *Hypersonics Before the Shuttle: A Concise History of the X-15 Research Airplane* (Monographs in Aerospace History, NASA SP-2000-4518, 2000), pp. 61, 67, 117.

[23] As the weight and complexity of Dyna-Soar grew, it quickly surpassed the capabilities of the Titan II and was switched to the Titan III. Just before the program was canceled it looked like weight growth had outclassed even the Titan IIIC and plans were being made to use Saturn IBs or other boosters.

in June 1969 the Secretary of Defense, Melvin R. Laird, informed Congress that MOL would be canceled.[24]

Military space policy analyst Paul Stares summarized the fallout from the loss of the X-20 and MOL programs upon the Air Force during the 1960s:

> With the cancellation of the Dyna-soar and MOL, many believed in the Air Force that they had made their “pitch” and failed. This in turn reduced the incentives to try again and reinforced the bias towards the traditional mission of the Air Force, namely flying. As a result, the Air Force’s space activities remained a poor relation to tactical and strategic airpower in its organizational hierarchy and inevitably in its funding priorities. This undoubtedly influenced the Air Force’s negative attitude towards the various ASAT modernization proposals put forward by Air Defense Command and others in the early 1970s. The provision of satellite survivability measures also suffered because the Air Force was reluctant to propose initiatives that would require the use of its own budget to defend the space assets of other services and agencies.[25]

Even so, the next major effort involved persuading NASA to alter its Space Shuttle concept and to include a military mission in its planning scenarios in the 1970s.[26]

The Department of Defense and NASA’s Space Shuttle

After Apollo, the human element of the United States civil space program went into a holding pattern as nearly a decade passed. During that time, the space program moved from its earlier heroic age to one that may be characterized as a “routinization” of activities, perspectives, and processes; it was an institutionalizing of critical elements from a remarkably fertile heroic time into something much more mundane not at all unlike that analyzed by longshoreman philosopher Eric Hoffer in *The True Believer*.[27]

During the 1970s, the Space Shuttle became the “sine qua non” of NASA, intended as it was to make spaceflight routine, safe, and relatively inexpensive. Although NASA considered a variety of configurations, some quite exotic, it settled on a stage-and-one-half partially reusable vehicle with an approved development price of $5.15 billion. On 5 January 1972, President Nixon announced the decision to build a Space Shuttle. He did so for both political reasons and for national prestige purposes. Politically, it would help a lagging aerospace industry in key states he wanted to carry in the next election, especially

[24]Roy F. Houchin III, “Air Force-Office of the Secretary of Defense Rivalry: The Pressure of Political Affairs in the Dyna-Soar (X-20) Program, 1957-1963,” *Journal of the British Interplanetary Society* 50 (May 1997): 162-68; Matt Bacon, “The Dynasoar Extinction,” *Space* 9 (May 1993): 18-21; Roy F. Houchin III, “Why the Air Force Proposed the Dyna-Soar X-20 Program,” *Quest: The Magazine of Spaceflight* 3 (Winter 1994): 5-11; Terry Smith, “The Dyna-Soar X-20: A Historical Overview,” *Quest: The Magazine of Spaceflight* 3 (Winter 1994): 13-18; Roy F. Houchin III, “Interagency Rivalry: NASA, the Air Force, and MOL,” *Quest: The Magazine of Spaceflight* 4 (Winter 1995): 40-45; Donald Pealer, “Manned Orbiting Laboratory (MOL), Part 1,” *Quest: The Magazine of Spaceflight* 4 (Fall 1995): 4-17; Donald Pealer, “Manned Orbiting Laboratory (MOL), Part 2,” *Quest: The Magazine of Spaceflight* 4 (Winter 1995): 28-37; and Donald Pealer, “Manned Orbiting Laboratory (MOL), Part 3,” *Quest: The Magazine of Spaceflight* 5, No. 2 (1996): 16-23.

[25]Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945-1984* (Cornell University Press, 1985), p. 242.

[26]Dwayne A. Day, “Invitation to Struggle: The History of Civilian-Military Relations in Space,” in John M. Logsdon, gen. ed., *Exploring the Uniontown: Selected Documents in the History of the U.S. Civil Space Program, Volume II, External Relationships* (NASA SP-4407, 1996), pp. 233-70.

[27]Eric Hoffer, *The True Believer: Thoughts on the Nature of Mass Movements* (Harper & Row, 1951), pp. 3-23, 137-55. See also, Max Weber, “The Pure Types of Legitimate Authority,” in *Max Weber on Charisma and Institution Building: Selected Papers*, ed. S. N. Eisenstadt (University of Chicago Press, 1968), p. 46.

in California, Texas, and Florida.[28] Supporters – especially Caspar W. Weinberger, who later became Reagan's defense secretary – argued that building the shuttle would reaffirm America's superpower status and help restore confidence, at home and abroad, in America's technological genius and will to succeed.

This was purely an issue of national prestige. As Weinberger wrote in August 1971, not approving the shuttle "would be confirming in some respects, a belief that I fear is gaining credence at home and abroad: that our best years are behind us, that we are turning inward, reducing our defense commitments, and voluntarily starting to give up our superpower status, and our desire to maintain world superiority." Weinberger appealed directly to the prestige argument by concluding, "America should be able to afford something besides increased welfare, programs to repair our cities, or Appalachian relief and the like." In a handwritten scrawl on Weinberger's memo, Richard Nixon indicated "I agree with Cap."[29]

The prestige factor belies a critical component. United States leaders supported the Space Shuttle not on its merits, but on the image it projected. That included NASA, whose leaders viewed it central to the agency's long-term welfare, but also some key figures in the DOD who recognized the Space Shuttle as a means of finally reaching the goal of military personnel going into space for military purposes. That military mission, as it came to coalesce around the new Space Shuttle in the 1970s, took as its raison d'être the deployment of reconnaissance and other national security payloads into low-Earth orbit (LEO). As such, the DOD and the intelligence community insisted that the shuttle's orbiter be designed so that it had a cross-range maneuvering capability to meet requirements for lift-off and landing at the same location after only one orbit. This would enable great flexibility in deploying those space assets into orbit, while masking their trajectories from the Soviet Union. Moreover, the payload bay of the Space Shuttle, so often viewed as excessive for most mission requirements, needed its 15 (4.6 meters) x 60 (18.3 meters) feet dimensions to satisfy DOD and intelligence community planners that it would accommodate national security payloads. Without those design modifications to support the military space program, the DOD would have probably withheld monetary and political support from the project. In essence, NASA embraced a military mission for the Space Shuttle program as a means of building a coalition in support of an approval that might not have been approved otherwise. In return, military astronauts would fly on classified missions in LEO. Most of those missions were for the purpose of deploying reconnaissance satellites but what else might have been accomplished on them is unknown in the non-classified world.[30]

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[28]George M. Low, NASA Deputy Administrator, Memorandum for the Record, "Meeting with the President on January 5, 1972," 12 January 1972, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C. The John Erlichman interview by John M. Logsdon, 6 May 1983, NASA Historical Reference Collection, emphasizes the political nature of the decision. This aspect of the issue was also brought home to Nixon by other factors such as letters and personal meetings. See Frank Kizis to Richard M. Nixon, 12 March 1971; Noble M. Melencamp, White House, to Frank Kizis, 19 April 1971, both in Record Group 51, Series 69.1, Box 51-78-31, National Archives and Records Administration, Washington, DC.

[29]Caspar W. Weinberger, Memorandum for the President, via George Shultz, "Future of NASA," 12 August 1971, White House, Richard M. Nixon, President, 1968-1971, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[30]Dwayne A. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," in John M. Logsdon, gen. ed., *Exploring the Uniontown: Selected Documents in the History of the U.S. Civil Space Program, Volume II, External Relationships* (NASA SP-4407, 1996), p. 264; Alfred C. Draper, Melvin L. Buck, and William H. Goesch, "A Delta Shuttle Orbiter," *Astronautics & Aeronautics* 9 (January 1971):

It might be easy to underestimate the national security implications of the Space Shuttle decision and the desire of some in the DOD to gain a military astronaut foothold that facilitated it. But, this goal seems to be critical to DOD support. Caspar Weinberger was the key to the movement of the Space Shuttle through the White House, and he believed the shuttle had obvious military uses and profound implications for national security. "I thought we could get substantial return" with the program, he said in a 1977 interview, "both from the point of view of national defense, and from the point of view [of] scientific advancement which would have a direct beneficial effect."[31] He and others also impressed on the president the shuttle's potential for military missions. John Erlichman, Nixon's senior advisor for domestic affairs, even thought it might be useful to capture enemy satellites, a mission that would require military astronauts in effect "lassoing" those satellites during extra-vehicular activities (EVAs) and bringing them into the shuttle payload bay for return to Earth.[32] The Soviet Union, which built the Buran in the 1980s and flew it without a crew only one time, pursued a shuttle project as a counterbalance to the United States program solely because they were convinced that the United States shuttle was developed for military purposes. As Russian space watcher James Oberg concluded: "They had actually studied the shuttle plans and figured it was designed for an out-of-plane bombing run over high-value Soviet targets. Brezhnev believed that and in 1976 ordered $10 billion of expenditures. They had the Buran flying within ten years and discovered they couldn't do anything with it."[33]

…key figures in the DOD… recognized the Space Shuttle as a means of finally reaching the goal of military personnel going into space for military purposes.

After a decade of development, on 12 April 1981, the Space Shuttle *Columbia* took-off for the first orbital test mission. It was successful and after only the fourth flight in 1982, President Ronald Reagan declared the system "operational." In keeping with plans developed in the Carter administration of the latter 1970s, the Space Shuttle would thereafter carry all U.S. government payloads; military, scientific, and even commercial satellites could all be deployed from its payload bay.[34] To prepare for this, in 1979, Air Force Secretary Hans Mark created the Manned Spaceflight Engineer program to "Develop expertise in manned space flight and apply it to Department of Defense space

26-35; Charles W. Mathews, "The Space Shuttle and its Uses," *Aeronautical Journal* 76 (January 1972): 19-25; John M. Logsdon, "The Space Shuttle Program: A Policy Failure," *Science* 232 (30 May 1986): 1099-1105; Scott Pace, "Engineering Design and Political Choice: The Space Shuttle, 1969-1972," M.S. Thesis, MIT, May 1982; and Harry A. Scott, "Space Shuttle: A Case Study in Design," *Astronautics & Aeronautics* 17 (June 1979): 54-58;

[31]Caspar W. Weinberger interview by John M. Logsdon, 23 August 1977, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[32]Jacob E. Smart, NASA Assistant Administrator for DOD and Interagency Affairs, to James C. Fletcher, NASA Administrator, "Security Implications in National Space Program," 1 December 1971, with attachments, James C. Fletcher Papers, Special Collections, Marriott Library, University of Utah, Salt Lake City, UT; James C. Fletcher, NASA Administrator, to George M. Low, NASA Deputy Administrator, "Conversation with Al Haig," 2 December 1971, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, D.C.

[33]James Oberg, "Toward a Theory of Space Power: Defining Principles for U.S. Space Policy," p. 5, 20 May 2003, copy of paper in possession of author.

[34]The standard work on the shuttle and its operational history is Dennis R. Jenkins, *Space Shuttle: The History of the National Space Transportation System, the First 100 Missions* (Dennis R. Jenkins, 2001, 3rd Edition),

missions." In all, between 1979 and 1986 this organization trained 32 Navy and Air Force officers as military astronauts.[35]

Even so, the shuttle soon proved disappointing. By January 1986 there had been only 24 shuttle flights, although in the 1970s NASA had projected more flights than that for every year. Critical analyses agreed that the shuttle had proven to be neither cheap nor reliable, both primary selling points, and that NASA should never have used those arguments in building a political consensus for the program. The space shuttle's much-touted capabilities had not been realized. It made far fewer flights and conducted far fewer scientific experiments than NASA had publicly predicted.[36] Its national security possibilities, however, remained intact. The DOD flew missions as needed to deploy its assets and conduct other activities in Earth orbit with military astronauts.

Through the middle part of the 1980s, the DOD remained committed to supporting it for military purposes. The Air Force paid for the construction of the *Discovery* orbiter, and began building Space Launch Complex (SLC) 6 at Vandenberg Air Force Base, California, in 1979 (having been approved in 1974) for the launch of polar orbital flights. Furthermore, it negotiated with NASA an annual launch rate of 40 missions from the Kennedy Space Center with 20 from Vandenberg. This proved a ridiculous number of launches, but it pointed up the optimism of human spaceflight program as envisioned at the dawn of the Space Shuttle program.[37]

Any plans the DOD might have harbored for human spaceflight were dashed with the loss of *Challenger* during launch on 28 January 1986.[38] One of the results of this was the removal from the shuttle of all commercial and national security payloads and the reinvigoration of the expendable launch vehicle production lines. It became another instance of the DOD seeking a military human mission that eventually went awry.

This quest for military astronauts did not end there. In 1986, the DOD established a formal Military Man in Space (MMIS) Program to oversee efforts to ensure that a human military presence remained in space. They then undertook several experiments aimed at demonstrating the utility of humans in orbit in observation. As only two examples of military astronaut activity, Terra View took place on a shuttle flight where military astronauts observed the ground and reported observations of military interest. Additionally, in Terra Scout, Astronaut LTC Jim Voss and Payload Specialist CW3 Tom Hennen, aboard STS-44 in November 1991, used the Spaceborne Direct View Optical System (SPADVOS) to view terrestrial targets.[39] Since the beginning of the Space Shuttle flight program, the DOD has flown a myriad of payloads on the vehicle.

Also, in the 1980s, DOD began work, along with NASA, on a single-stage-to-orbit (SSTO) vehicle for military purposes. If there is a

[35]USAF Fact Sheet 86-107, "Manned Spaceflight Engineer Program," 1986; Michael Cassutt, "The Manned Spaceflight Engineer Program," *Spaceflight*, January 1989, p. 32.

[36]Roger D. Launius, "The Space Shuttle—Twenty-five Years On: What Does it Mean to Have Reusable Access to Space?" *Quest: The History of Spaceflight Quarterly* 13, No. 2 (2006): 4-20.

[37]Dwayne A. Day, "Invitation to Struggle: The History of Civilian-Military Relations in Space," in John M. Logsdon, gen. ed., *Exploring the Uniontown: Selected Documents in the History of the U.S. Civil Space Program, Volume II, External Relationships* (NASA SP-4407, 1996), pp. 265-66.

[38]By far, the best work on the *Challenger* accident is Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (University of Chicago Press, 1996).

[39]"Army Space Reference Text," chapter 9, http://www.fas.org/spp/military/docops/army/ref_text/chap09.htm (accessed 19 February 2010); "Astronauts begin Military Observation Experiences (aboard the Space Shuttle Atlantis)," *Defense Daily*, 27 November 1991.

"holy grail" of spaceflight it is the desire for reusable SSTO technology, essentially a vehicle that can take-off, fly into orbit, perform its mission, and return to Earth landing like an airplane. This is an exceptionally difficult flight regime with a myriad of challenges relating to propulsion, materials, aerodynamics, guidance, and control. Fueled by the realization the Space Shuttle could not deliver on its early expectations, DOD leaders pressed for the development of a hypersonic space plane. With the beginning of the administration of Ronald Reagan, and its associated military buildup, Tony DuPont, head of DuPont Aerospace, offered an unsolicited proposal to the Defense Advanced Research Projects Agency (DARPA) to design a hypersonic vehicle powered by a hybrid integrated engine of scramjets and rockets. DARPA program manager Bob Williams liked the idea, and funded it as a "black" program code-named "Copper Canyon" between 1983 and 1985. The Reagan administration later unveiled it as the National Aerospace Plane (NASP), designated the X-30. Reagan called it "a new Orient Express that could, by the end of the next decade, take-off from Dulles Airport and accelerate up to twenty-five times the speed of sound, attaining low earth orbit or flying to Tokyo within two hours."[40]

The NASP program initially proposed to build two research craft, at least one of which should achieve orbit by flying in a single stage through the atmosphere at speeds up to Mach 25. The X-30 would use a multicycle engine that shifted from jet to ramjet and to scramjet speeds as the vehicle ascended burning liquid hydrogen fuel with oxygen scooped and frozen from the atmosphere.[41] After billions spent, NASP never progressed to flight stage. It finally ended in 1994, trapped as it was in bureaucratic politics and seemingly endless technological difficulties.[42]

Yet, elements of the DOD remain committed to this mission to the present. Throughout the 1990s, a succession of studies argued for the potential of military personnel in space. One 1992 study affirmed:

> It is absolutely essential for the well being of today's space forces as well as the future space forces of 2025, that DOD develop manned advanced technology space systems in lieu of or in addition to unmanned systems to effectively utilize military man's compelling and aggressive warfighting abilities to accomplish the critical wartime mission elements of space control and force application. National space policy, military space doctrine and common sense all dictate they should do so if space superiority during future, inevitable conflict with enemy space forces is the paramount objective. Deploying military man in space will provide that space superiority and he will finally become the "center of gravity" of the U.S. space program.[43]

Another analysis found 37 reasons why military personnel in space would be required

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[40]Ronald Reagan, "State of the Union Address," 4 February 1986, see http://www.c-span.org/executive/transcript.asp?cat=current_event&code=bush_admin&year=1986 (accessed 29 December 2009).

[41]Larry Schweikart, "Command Innovation: Lessons from the National Aerospace Plane Program," in Roger D. Launius, ed., *Innovation and the Development of Flight* (Texas A&M University Press, 1999), pp. 299-322.

[42]Carl H. Builder, "The NASP as a Time Machine," RAND Internal Note, August 1989, copy in possession of author; Roger Handberg and Joan Johnson-Freese, "NASP as an American Orphan: Bureaucratic Politics and the Development of Hypersonic Flight," *Spaceflight* 33 (April 1991): 134-37; Larry E. Schweikart, "Hypersonic Hopes: Planning for NASP," *Air Power History* 41 (Spring 1994): 36-48; and Larry E. Schweikart, "Managing a Revolutionary Technology, American Style: The National Aerospace Plane," *Essays in Business and Economic History* 12 (1994): 118-32.

[43]Daniel L. Hansen, "Exploration of the Utility of Military Man in Space in the Year 2025," NASA report 1992STIN, 9318267H, March 1992.

in the future, ranging from problem-solving and decision-making, to manipulation of sensors and other systems. It concluded that "A military space plane could play a key role in helping the United States Air Force transform itself from an air force into an aerospace force."[44] Yet another study found: "Our National Security Strategy must take full advantage of the full political, economic, and military power of this nation to be successful. That means soldiers, sailors, and airmen able to operate in every region of the world critical to national security, whether it is on land, at sea, in the air, or in space. A strategy built on anything less is incomplete and shortsighted."[45] The rationale for a military astronaut rests largely on the human flexibility of offering judgment, experience, and decision-making capabilities not present with machines. "There is no way that a price tag can be placed on such characteristics as flexibility or serendipity because the essence of these attributes is the ability to capitalize on the unanticipated or unknown," concluded one study.[46] According to some reports, DOD developed a space plane named "Blackstar" and began flying missions as early as 1990.[47] Notwithstanding these speculations, it is obvious the decision made initially by Eisenhower to split the civil and military space programs and to assign the human mission to the civil side remains difficult for some in the DOD to accept. It represents one instance, among many, in which a continuum between cooperation and competition has taken place in the interrelationships between the civil, military, and national reconnaissance space programs.

A military space plane could play a key role in helping the United States Air Force transform itself from an air force into an aerospace force.

Is There a Military Human Spaceflight Mission on the Horizon?

There has been both cooperation and competition between the civil and military space programs over the years relative to the role of humans in space. In a succession of recent studies ranging from the Air Force Science Board's "New World Vista" in 1995 to the Rumsfeld commission's 2001 analysis of national security space issues, the DOD persistently sought to find a role for humans in space.[48] While this has waned somewhat, there remains sporadic expressions of interest from military officials in favor of the development of systems for military human missions in space.[49] Indeed, as robotic technologies have improved, the trend has been away from placing humans in harm's way in favor of other options. The rise of unmanned aerial

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[44] Maj. David M. Tobin, "Man's Place in Space-Plane Flight Operations: Cockpit, Cargo Bay, or Control Room?" *Airpower Journal* 13 (Fall 1999): 50-65, quote from p. 62.

[45] Lt. Col. Joseph A. Carretto Jr., "Military Man in Space: Essential to National Strategy," Executive Research Project, Industrial College of the Armed Forces, National Defense University, NDU-ICAF-95-S3, April 1995, p. 47.

[46] Air Force Space Command study, "The Utility of Military Crews in Space," 1985, quoted in Theodore Wierzbanowski, "Manned vs. Unmanned: The Implications to NASP," AIAA-90-5265 paper, presented at AIAA Second International Aerospace Planes Conference, 1990, Orlando, FL, p. 10.

[47] William B. Scott, "USAF's Top Secret Two-Stage-to-Orbit Manned 'Blackstar' System," *Aviation Week & Space Technology*, 5 March 2006, http://www.aviationnow.com/avnow/news/channel_awst_story.jsp?id=news/030606p1.xml (accessed 19 February 2010).

[48] United States Air Force Scientific Advisory Board, *New World Vistas: Air and Space Power for the 21st Century* (USAF Scientific Advisory Board, 1995); and Donald H. Rumsfeld, et al., *Report of the Commission to Assess United States National Security Space Management and Organization* (Government Printing Office, 2001).

[49] See, for example, John Tirpak, "In Search of Spaceplanes," *Air Force Magazine*, December 2003.

vehicles (UAV) piloted from the remote sites in the 1990s was driven by the desire to limit crew exposure to harm, while increasing loiter time over target areas. The success of UAVs in carrying out missions that had formerly required flight crews has emboldened DOD executives to advance this type of technology for all future weapons systems.[50] In such an environment, whatever desires that still exist in favor of piloted military space vehicles have less possibility of achieving this goal than even a few years earlier. At a sublime level, human military pilots appear to be a twentieth century and not a twenty-first century priority.

…the military may create a Space Corps of Engineers. Its forces may expand to every location where humanity establishes a presence... It may serve as the peacekeepers and the law enforcers.

This is especially the case because rationales supporting human spaceflight are overall quite controversial even as they are sometimes passionately held – mostly resting on arguments of national prestige, rather than practical applications – and there does not seem to be much possibility of this changing in the near-term.[51] Of course, one could make the observation that since the end of the Cold War many of the historic policy options, of which the assignment of the United States human spaceflight mission to NASA is one, needs to be revisited. Reassigning that mission, or a portion of it, to the DOD might become a possibility should the space agency suffer another disaster on the order of the *Challenger* and *Columbia* shuttle accidents, or if enemies pursued a human presence in space, although this is unlikely in terms of policy options.

More likely, is a scenario in which military astronauts will enter space in a manner similar to what soldiers excelled at throughout the first century-and-a-half of the United States republic: exploring, extending, and protecting the frontier. The United States Army explored the American West, kept order on the frontier, and opened the region to colonization. The frontier army pushed the line of occupation far beyond the settlements that would have resulted otherwise. It raised crops, herded cattle, cut timber, quarried stone, built sawmills, and performed the manifold duties of pioneers in addition to its peacekeeping mission. It also restrained lawless traders, pursued fugitives, ejected squatters, maintained order, and served as the primary interface with the Native Americans. In this latter role, it was more benevolent than remembered in popular conception. This was largely peaceful work, with the military catalyzing the processes of territorial expansion and national development. The military outposts on the frontier also served as cash markets for early settlers and as centers of exploration, community building, and cultural development. In the past, the military accomplished these tasks in the American West; in the future, it might well do so in space.[52] This is a far different approach to "military men in space" than has been argued for thus far, but once there is a true space frontier the military will be required to be

[50]Michael J. Hirschberg, "To Boldly Go Where No Unmanned Aircraft Has Gone Before: A Half-Century of DARPA's Contributions to Unmanned Aircraft," AIAA 2010-158, 48th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition, Orlando, Florida, 4-7 January 2010.

[51]Roger D. Launius, "Compelling Rationales for Spaceflight? History and the Search for Relevance," in Steven J. Dick and Roger D. Launius, eds., *Critical Issues in the History of Spaceflight* (NASA SP-2006-4702, 2006), pp. 37-70.

[52]For an outstanding explanation of this process, see Francis Paul Prucha, *The Sword of the Republic: The United State Army on the Frontier, 1783-1846* (Macmillan, 1969).

there just as in the past. How far into the future this might take place is an open question, but it will undoubtedly happen if the United States continues to pursue human space exploration and development.

This would amount to a significant a role for the United States military in space as any other that might be envisioned. In the nineteenth century, it conducted exploration, as with the Lewis and Clark Expedition, and its civil engineering efforts, led by the United States Corps of Topographical Engineers and the United States Army Corps of Engineers, proved remarkably significant in opening the West.[53] In the twenty-first century, the military may create a Space Corps of Engineers. Its forces may expand to every location where humanity establishes a presence, especially on the Moon. It may serve as the peacekeepers and the law enforcers. It may preserve American interests against any who might seek to subvert them. Withal, the military presence may well help to open a frontier beyond Earth in the same way that it did on the North American continent earlier. But before those possibilities emerge, there remains only a modest likelihood of the need for military personnel in space.

Conclusions

At the time when the United States is reconsidering its next steps in the human exploration and development of space, it bears considering this possibility for the future of military astronauts. What will take place in the near-term is very much a matter of yet to be resolved. Federal entities will certainly play a key role. Will they, however, continue to dominate or are there heightened prospects for commercial activities first in LEO and ultimately beyond? If it is the latter, then the prospects for military human space missions expand exponentially as a means of keeping order in this new regime.

This may become the new future for space exploration if Congress accepts the Obama Administration's approach. If it does, the false starts of the past could be replaced by what is envisioned as "A new era of Innovation and Discovery." This new direction and change is more than just semantics. It proposes a major shift in the way in which the United States government approaches human spaceflight. Simply put, it represents a paradigm shift in space exploration. In this new approach, NASA will return to its roots as a research and development organization to develop the transformational technologies, while private industry will operate the systems built. Turning LEO over to commercial entities, as in the classic 1968 feature film *2001: A Space Odyssey*, could allow the withdrawal of government operators out of this arena, allowing them to concentrate on regulatory, military, and oversight roles. In this environment, there is an important place for the peacekeeping function of a frontier, a natural mission for the DOD requiring a human spaceflight capability.[54]

[53]This story is magnificently told in the Pulitzer Prize-winning book by William H. Goetzman, *Exploration & Empire: The Explorer and the Scientist in the Winning of the American West* (Random House, 1966).

[54]I made this case in Roger D. Launius and G. Michael Green, "New Vision for NASA," *Florida Today*, 14 February 2010.

Eisenhower Center Program Summaries

Space Situational Awareness Workshop

Summer Space Seminar

Asia, Space, and Strategy Workshop

National Space Forum

Transatlantic Space Cooperation Workshop

Eisenhower Center Program Summaries

Compiled by Eligar Sadeh

Space Situational Awareness Workshop

The goal of the Space Situational Awareness (SSA) Workshop is to bring together stakeholders interested in space situational awareness. This includes practitioners, users of data, representatives of industry and the military, the scientific community, international organizations, and the satellite-tracking community. These stakeholders discuss how needs are changing with SSA, what improvements in SSA capabilities can be achieved in the near-term to medium-term, and how various stakeholder communities might better interact to draw on each other's strengths.

The first workshop was held in 2006. It was co-sponsored by the World Security Institute's Center for Defense Information. A workshop report can be found at: http://www.cdi.org/PDFs/SSAConference_screen.pdf.

The second workshop was hosted by Inmarsat in 2007 and was co-sponsored by the World Security Institute's Center for Defense Information and the Secure World Foundation. A summary of the discussions that took place at the workshop held in 2007 was published in *Space and Defense* 2:1 (2008) – "Improving Our Vision II: Building Transparency and Cooperation Workshop on Space Situational Awareness Data Sharing."[1]

The third workshop was held in 2009. This workshop was hosted by Intelsat and was co-sponsored by the World Security Institute's Center for Defense Information, the Secure World Foundation, and the George C. Marshall Institute. A summary of the 2009 workshop was published in *Space and Defense* 3:2 (2009) – "Space Situational Awareness Workshop."

Areas of focus at the 2009 workshop included:

- National and international perspectives on SSA.
- Challenges of the space environment.
- Governance issues related to safe and responsible behavior in the space environment.
- State of SSA data sharing and the United States Commercial and Foreign Entities (CFE) Program.
- Concepts and capabilities for improved SSA data sharing.
- New opportunities in SSA.

Summer Space Seminar

The Eisenhower Center for Space and Defense Studies organizes the Summer Space Seminar to advance two principal goals: (1) to foster an education and interest in the interdisciplinary areas of space with the intent to develop space professionals; and (2) to develop a network of relations across civil, commercial, and military space professionals that will likely emerge from the participants. The first Summer Space Seminar was held in 2007.

This seminar exposes participants to the breadth and depth of space activities in the civil, commercial, and military areas. The relationships among these areas are explored

[1] For copies of *Space and Defense*, see http://web.mac.com/rharrison5/Eisenhower_Center_for_Space_and_Defense_Studies/Journal.html (accessed May 2010).

across a number of perspectives – participants are exposed to the technology and science of space activities, followed by discussions on the political, legal, economic, and social aspects that influence the development and application of the various civil, commercial, and military space activities. The emphasis is on exchanges among the participants.

The Summer Space Seminar is directed toward bringing together a broad group of future space professionals to lay a foundation for a future space policy community in the military, civilian government, and private sectors. Participants in the program include students from the United States Air Force Academy, U.S. Naval Academy, U.S. Military Academy, George Washington University, and the Massachusetts Institute of Technology.

The seminar serves as a useful forum for further professional development given that several of the participants worked, or are currently employed, as space professionals. During the seminar, a great deal of learning and socialization takes place among the participants to meet the goal to inform and to build connections between future space professionals.

Asia, Space, and Strategy Workshop

In 2006, the Eisenhower Center for Space and Defense Studies held its first Asia, Space, and Strategy Workshop. This effort brought together U.S., Canadian, and European experts and policy makers from the military, civilian government, universities, think-tanks, and private sectors to discuss the implications of current and future Chinese space policy and to investigate areas of possible Sino-U.S. cooperation in space. Beginning in 2007, an invitation was extended to include Chinese academics in the discussions. Chinese participation has increased each year since then, with four attendees from China at the 2009 workshop in Vancouver, Canada.

The fourth workshop of 2009 was broadened to include other space powers in the Asia-Pacific region. For the first time in the workshop series, representatives from Australia and Japan took part. The workshop focused on common interests that spacefaring countries of the Pacific Basin have in the creation of a stable, predictable, and mutually beneficial environment in space.

Workshop topics in 2009 ranged from: economic and political goals for the use of space; improving the safety and stability of the space environment; deterrence and defense concepts; and arms control and verification. Implications of the 2009 workshop were published in a series of articles in a special issue of *Space and Defense* 2:3 (2009) on *China, Space, and Strategy.*

National Space Forum

The Eisenhower Center for Space and Defense Studies organized and held its fourth annual National Space Forum from 1-2 September 2009 in Washington, DC. Panels at the Forum discussed security issues and space.

Specific topics of discussion included:

- An assessment of security challenges and threats in the space domain.
- The role of space deterrence in national policy.
- The potential for new approaches to arms control and verification.
- The improvement of international cooperation with allies in Asia and Europe.
- The role that China plays in space.
- The implementation of national space policy in the Obama Administration.

The Forum concluded with discussions on how to integrate often competing interests into a more cohesive policy and, more importantly, to improve the chances that such a policy can be effectively implemented. Forum panels represented a number of points of view from security, civil, and commercial space. Proceedings of the National Space Forum 2009 were published in *Space and Defense* 3: 2.

Transatlantic Space Cooperation Workshop

In 2008, the Eisenhower Center for Space and Defense Studies established the Transatlantic Space Cooperation Workshop. This workshop series brings together a community of scholars and experts from the United States and Europe, including the European Union (EU), European Space Agency (ESA), and NATO, to share lessons learned, debate, and network on joint priorities in civil, security, and commercial space.

The first workshop was held in Brussels, Belgium in June 2008. Participants in this workshop examined U.S., European, and EU security space priorities and considered NATO's space role. Discussions began with an opening panel where senior U.S., EU, and NATO officials briefed participants on current security space priorities before participants explored issues more in-depth. The goal of the workshop was to educate senior leadership from the United States, EU, and NATO on philosophies and strategies for collective space security and deterrence in the 21st Century. The workshop was successful in initiating dialogue on harmonizing transatlantic security space strategies.

The second workshop was held in Berlin, Germany during September 2009. The 2009 workshop fostered dialogue regarding the potential for greater cooperation across the Atlantic to make the most efficient use of capabilities where possible across civil, security, and commercial space. A summary of the 2009 workshop was published in *Space and Defense* 3:2 (Winter 2009).

Issues discussed at the 2009 workshop included:

- Developments over the past year in transatlantic space cooperation.
- Joint priorities in protection of critical space infrastructure.
- Transatlantic cooperation on Earth observations for security and stability.
- Future avenues for advancing transatlantic cooperation.

Notes for Contributors to *Space and Defense*

Space and Defense seeks contributions that further inquiry and intelligently inform space policy issues. Contributions are welcome from: academic scholars and policy analysts at think tanks and research institutes; senior management and policy officials from international and governmental agencies and departments relevant to space issues; military officers and operators in relevant units, commands, and in staff colleges and service academies; senior management and policy officials from major aerospace corporations relevant to space issues; and scientists and engineers interested or involved in space policy issues.

The journal welcomes submissions of scholarly, independent research articles and viewpoint essays. There is no standard length for articles, but 7,500 to 10,000 words, including notes and references, is a useful target for research articles, and viewpoint essays should be in the range of 2,500 to 5,000 words. The opinions, conclusions, and recommendations expressed or implied within *Space and Defense* are those of the contributors and do not reflect those of the Eisenhower Center for Space and Defense Studies, the Air Force Academy, the Air Force, the Department of Defense, or any other agency of the United States Government.

Articles submitted to *Space and Defense* should be original contributions and not under consideration for any other publication at the same time. If another version of the article is under consideration by another publication, or will be published elsewhere in whatever format, authors should clearly indicate this at the time of submission. When appropriate, all articles are required to have a separate abstract of up to 250 words that describes the main arguments and conclusions of the article. Details of the author's institutional affiliation, full address, and other contact information should be included in a separate file or cover sheet.

Contributors are required to submit all articles electronically by e-mail attachment as a Microsoft word file (.doc or .docx format). Contributors should not submit PDF files. All manuscripts submitted to *Space and Defense* need to be double-spaced with margins of 1inch or 2.5 cm, and all pages, including those containing only diagrams and tables, should be numbered consecutively. It is the author's responsibility to ensure when copyrighted materials are included in a manuscript that the appropriate copyright permission is received by the copyright holder.

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Providing the manuscript meets editorial standards, i.e., relevant to aims and scope, analytical rigor, spelling, grammar, properly referenced, and suitable length, the academic editors will first undertake a review of the submission. If required, the author(s) will be invited to make any changes and corrections as a result of the review by the academic editors. For viewpoint essays, the process stops here and a publication decision is made.

On the basis of the peer reviews for research articles, the academic editors will make a final decision for publication. If required, the author(s) will be required to make additional changes and corrections as a result of the external peer review.

Tables and Figures

All maps, diagrams, charts, and graphs should be referred to as figures and consecutively numbered and given appropriate captions. Captions for each figure should be submitted on the same page as the figure to avoid confusion. Tables should be kept to a minimum and contain only essential data. Each figure and table must be given an Arabic numeral, followed by a heading, and be referred to in the text. Figures and tables are not to be embedded in the text. Each table and figure should be clearly labeled. In the text, make sure and clearly explain all aspects of any figures or tables used.

Style

Authors are responsible for ensuring that their manuscripts conform to the style of *Space and Defense*. The editors will not undertake retyping of manuscripts before publication. Please follow the Chicago Manual of Style.

Listed below are some additional style and writing guides:

- Dates in the form: 1 January 2009.
- Headings (bold title case and centered).
- Subheadings (italic title case and centered).
- Acronyms/abbreviations should always be spelled out in full on first use in the text.
- The 24-hour clock is used for time, e.g., 0800, 1300, 1800.
- Use percent rather than % except in figures and tables.
- For numbers, spell out numbers less than 10.
- Make use of 21^{st} style where appropriate.
- Keep capitalization to a minimum.
- Concise paragraphs and sentences are desirable.
- Avoid a paper that is just descriptive; rather engage in analytical rigor and assessment.
- Avoid policy recommendations in the analysis part of paper; leave this, if applicable, for a separate section at the end of the paper.
- Define all new terms used in paper.
- Avoid hyphenated words when possible.
- Avoid the use of passive voice when possible.

Footnotes

Footnotes need to be numbered consecutively with a raised numeral in the text. Please make use of the Insert-Preference-Footnote function of Word. Please do not use endnote style or scientific notation. Footnotes should be in full bibliographic style with first name, last name format for authors.