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Mailing Address
Eisenhower Center for Space and Defense Studies
HQ USAFA/DFPS
2354 Fairchild Drive, Suite 6L16
US Air Force Academy, Colorado 80840

REFLECTIONS ON SINO-US SPACE COOPERATION

DEAN CHENG

Introduction

Since 2006, the US Air Force Academy's Eisenhower Center for Space and Defense Studies has sponsored an annual workshop examining the strategic impact and implications of China's space program. This workshop series has blossomed into a Track-II process, with participants from the People's Republic of China (PRC), and unofficial US government presence.

A key focus of many of the discussions during these workshops has been the prospects for Sino-US cooperation in space. This issue has gained prominence since the 2007 PRC ASAT test, and the US subsequent 2008 American destruction of a malfunctioning satellite. Sino-US space cooperation is seen as potentially serving a confidence-building function, allowing the two sides to familiarize themselves with each other.

This paper will examine some of the proposals laid out in these workshops for proposal, and discuss the potential pitfalls that confront them. It will then make some suggestions about how cooperation might be fostered.

Approaches to Cooperation

In the most general terms, there are four levels of cooperation: sharing data; establishing common standards; planning missions jointly; and undertaking missions jointly. Each of these involves measures that might be undertaken either bilaterally, between the PRC and the United States, or multilaterally, as part of larger, multinational efforts.

Neither the levels nor the approaches are mutually exclusive. That is, there is significant room for overlap between levels, just as there may be instances of both bilateral and multilateral cooperation for each level.

Levels of Cooperation

The four levels of cooperation involve a steadily greater level of interaction between the two sides. At the same time, each subsequent level of cooperation also entails greater disclosure, and increasingly involves not only revealing types of data, but also decision-making processes.

Sharing data. Most promising may be the possibility of sharing the data derived from space. With the increasing quantity and quality of data derived from space that is available commercially, it was suggested by some of the participants in the Eisenhower Center workshops that data-sharing may be a means of facilitating cooperation between the US and the PRC.

Indeed, there is already some degree of data sharing already, in both bilateral and multilateral contexts. For example, the United States is on record as sharing debris data with the PRC prior to any manned Chinese launches. Some of this already occurs. The US, for example, has provided collision avoidance analysis to the PRC prior to several of its manned launches, including the Shenzhou-VI.[1]

In a more multilateral context, there are already several venues where the US and the PRC are both members. These include the

[1] "Chinese Experts Welcome US Offer of Warning Datum for Spacecraft Launch," Xinhua (October 16, 2005). http://english.peopledaily.com.cn/200510/16/eng20051016_214641.html.

World Meteorological Organization (WMO), to which both nations provide data from their respective meteorological satellites. In addition, the United States, the PRC, and the European Space Agency have all decided to allow unrestricted access to their respective Earth observation data and archives.[2] Thus, the US can now examine Chinese data from its CBERS (China-Brazil Earth Resources Satellite) system, while the PRC may examine the range of LANDSAT data. While this may not constitute direct sharing of data, each state can access the information that the other provides.

Similarly, the United States decided years ago to make the GPS signal readily accessible. While it initially only provided a downgraded signal, today, the more accurate signal is made available. While not specifically aimed at China (or any other nation), this again suggests that there is ample room for sharing data.

Less sanguine observers would not, however, that such cooperation is nonetheless extremely limited. Both nations, for example, are also party to the UN Convention on the Registration of Objects Launched into Outer Space, as well as the Outer Space Treaty.[3] Compliance by both states (as well as others) to the UN Registration, however, has been described in the past as "spotty."[4]

Establishing common standards and baselines. A potentially deeper level of interaction would be cooperation in the creation of common technical standards or baselines. This level of cooperation would create not only equipment and procedures that were compatible, but would also begin to expose scientists, technical staff, and administrators from each side to the other.

To some extent, this has occurred in some areas of satellite services. Companies manufacturing GPS receivers, for example, are all accessing the same GPS signal; therefore, to some extent they must work to a common standard (at least in terms of their receivers). That does not mean, however, that the receivers are mutually compatible, only that they rely upon a common signal source and format. Cooperation at this level would, in fact, encourage not just accessibility but compatibility.

Establishing common standards and baselines, however, would require each side providing the other with information on how each side designs their systems, and, to some extent, how those systems operate. Greater cooperation might require more detailed discussion of operating procedures. All of this may be seen as offering a potential venue for espionage.

It was this type of concern in the Loral and Hughes scandals that ultimately ended American use of Chinese commercial space launchers. In the wake of two launch failures involving APSTAR II atop a Long March-2E and Intelsat 708 aboard a Long March-3B, the

[2] Group on Earth Observations, "GEO Announces Free and Unrestricted Access to Full LANDSAT Archive," Press Release (November 20, 2008). http://www.earthobservations.com/documents/pressreleases/pr_0811_bucharest_landsat.pdf.

[3] United Nations Office for Outer Space Affairs, *United Nations Treaties and Principles on Outer Space and Related General Assembly Resolutions*, Addendum "Status of International Agreements Relating to Activities in Outer Space as at [sic] 1 January 2008 (Vienna, Austria: Office for Outer Space Affairs, 2008), pp. 9, 15.

[4] Christopher Noble, "US, China, G7 Countries Flout Satellite Registry," Space.com (August 16, 2001). http://www.space.com/news/satellite_orbits_010816.html.

American partners, Hughes Space and Communications International, Inc., and Space Systems/Loral respectively, assisted in the subsequent investigations. In each case, the companies helped identify shortcomings, involving both design flaws as well as failures in analytical methodology. This assistance was seen as contributing significantly to improvements in not only China's space systems, but China's nuclear missile forces.[5]

These worries have likely escalated in the intervening decade. Recent concerns about cybernetic intrusions, especially American fears about Chinese electronic espionage, might well discourage the creation of common standards and baselines, since it would disclose aspects of the data formats and codes that operate equipment.

Joint mission planning. This level of cooperation would involve establishing a common objective for the two (or more) parties, with each side contributing its own spacecraft. The best example is probably the Disaster Monitoring Constellation (DMC). The DMC is comprised of satellites from five nations (Algeria, Nigeria, PRC, Turkey, the UK). These operate together as a single constellation. Thus, it constitutes more than simply a matter of sharing information, but instead involves operating together in order to provide prompt support to international disaster monitoring.

Another example of joint mission planning, this time in a bilateral sense, is the Apollo-Soyuz Test Project (ASTP). The ASTP was cited at the Eisenhower Center workshops as a possible model for Sino-US space cooperation, with some suggesting a Shuttle-Shenzhou mission. In the ASTP, the US and USSR agreed to a mission involving a rendezvous and docking, with each nation using its own spacecraft. To undertake the mission required not only making sure that the docking systems were compatible, but that each side understood the other's flight procedures. Consequently, not only were there repeated exchanges of flight crews, but there were also repeated sessions involving both nations' flight controllers mission control centers and their respective communications links.[6] It should be noted that the ASTP ultimately involved nearly four years of planning and exchanges, suggesting that joint mission planning will be an extensive, and extended, process.

Joint missions. There are several different ways in which one could conduct joint missions. The use of components from one nation, placed aboard the bus of another nation, might be one means. The deployment of European instruments aboard a Chinese bus, as occurred with the "Doublestar" program, would be an example of a multilateral joint mission.[7] The creation of common standards and baselines would facilitate the process of creating such joint missions, by making equipment compatible without requiring extensive modification.

Joint cooperation in human space activities is seen by many as non-zero-sum in nature, providing mutual benefits to all the

[5] US House of Representatives, *Report of the Select Committee on US National Security and Military Commercial Concerns with the People's Republic of China* (Washington, DC: Regnery Publishing, 1999), pp. 219-279.

[6] Charles Redmond, "The History of Apollo-Soyuz." http://history.nasa.gov/apollo/apsoyhist.html, and Edward Ezell and Linda Ezell, *The Partnership: A History of the Apollo-Soyuz Test Project* (Washington, DC: NASA, 1978). Electronic Table of Contents can be found at: http://www.hq.nasa.gov/office /pao/History/SP-4209/toc.htm.

[7] "Doublestar Summary," European Space Agency (January 25, 2005). http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=31490, and British National Space Centre, "Double Star" (March 17, 2008). http://www.bnsc.gov.uk/5620.aspx.

cooperating states. This is usually envisioned as joint crewing of a spacecraft, drawing astronauts from different nations. The current situation aboard the International Space Station could be characterized as a form of joint mission, conducted multilaterally. The prospect of manned missions conducted jointly by the US and the PRC has been of particular interest to the workshop participants.

This is by no means an exhaustive survey of potential levels of cooperation. Indeed, recent developments suggest that there may be a host of new potential venues for cooperation. The growth, for example, of "new space," in the form of non-government space efforts, poses intriguing new challenges to both the American and Chinese space programs. The "new" space sector, including space tourism, is less subject to governmental intervention or restrictions. At the same time, at least theoretically, it may well be focused wholly on the capitalization. With the growing Chinese economy, it is not clear what impact non-governmental Chinese funding might have on the prospects for "new space."

Obstacles to Cooperation

In considering the potential for cooperation, the discussions undertaken at the three workshops have served to highlight the very real obstacles to cooperation that exist between the PRC and the United States. At its most basic, cooperation between the two sides has to operate within the political realities that mark the Sino-American relationship. There are a number of outstanding issues that separate the two, from their respective political ideologies, to such issues as human rights, trade policy, and the status of Taiwan that make ***any*** improvements in relations a delicate process.

An especially prominent obstacle to greater cooperation of any sort are the mutual suspicions over security issues. US-Chinese military-to-military contacts, for example, have varied greatly, reflecting the vagaries in the general tenor of Sino-American relations—and space was no exception. In October 2006, the commander of the US Strategic Command (STRATCOM), Marine General James Cartwright, expressed interest in engaging the PLA on such space issues as collision avoidance and perceptions of attacks on satellites. He hoped to raise these topics in discussions with his counterpart, General Jing Zhiyuan, commander of the Chinese Second Artillery force (which is responsible for China's nuclear forces). Indeed, Jing's visit had been discussed as part of the same April 2006 Hu-Bush summit that had led to NASA Administrator Griffin's visit.[8] As of the end of 2008, however, Jing had still not visited the United States, despite repeated invitations.

The security issue is especially prominent in the multilateral arena, which directly affects prospects for space cooperation. Although both the US and the PRC are members of the UN Outer Space Committee (also known as the Committee on the Peaceful Uses of Outer Space or COPUOS) and the Ad Hoc Committee for Preventing an Arms Race in Outer Space (PAROS) within the UN Conference on Disarmament, little movement has occurred in either body. Significant differences of opinion on the utility of a new arms control agreement (proposed by the PRC and Russia, and opposed by the United States), coupled with complicating linkages to such issues as limits on new fissile materials, have led to few new space-related developments in these multilateral security arenas.

[8] Shirley Kan, *US-China Military Contacts: Issues for Congress*, RL-32496 (Washington, DC: Congressional Research Service, 2008), p. 25.

Beyond these broad strategic political concerns that affect all aspects of relations between Beijing and Washington, are a number of factors that are specifically likely to affect US Chinese space cooperation. These include issues of technological disparities and non-parallel government structures and space organizations, as well as deeper differences rooted in fundamental approaches to negotiations, as well as cultural and historical differences that color both sides' views.

Organizational and Technical Asymmetries

At the most basic level, one of the key obstacles to increased Sino-American space cooperation is the disparity in space-related experience. The United States has placed over a thousand objects into orbit; by contrast, the PRC has only orbited a hundred. In the realm of human spaceflight, the disparity is even greater. The United States has nearly fifty years of experience with manned missions; the PRC, as of 2008, had thus far engaged in only three actual crewed flights.

Paralleling the differences in experience, there are also differences in technological capability. Chinese systems often have a shorter lifespan than their Western counterparts. The Chinese Fengyun-2 geostationary weather satellites, for example, had projected lifespans of only two years; by contrast, the US GOES (Geostationary Operational Environmental Satellite) has a projected lifespan of 5 years, but often exceeds that (GOES-10, for example, was launched in 1997, and exhausted its fuel in 2006). Chinese literature does suggest that the latest generation Fengyun weather satellite and Dongfanghong-4 communications satellite will have life-spans approaching those of their Western counterparts.

These differences complicate any effort at cooperation, since it is not clear what the United States would necessarily gain from cooperating with the PRC, at least in terms of technology and experience.

This is further complicated by the integrated nature of the Chinese space program. Any cooperation between the two states, from the American perspective, should not result in a transfer of militarily significant technology to the PRC. Indeed, it was precisely charges to this effect, leveled against the Loral and Hughes Aerospace corporations, which brought a halt to US use of Chinese launchers for commercial and civilian purposes. As the Cox Commission Report notes, "the guidance system used on the Long March-2C, Long March-2E, and Long March-3 rockets is also used on the CSS-4 intercontinental ballistic missile."[9] The commonality of systems between Chinese civilian space launch vehicles and current Chinese missile systems means that any cooperation between the two nations' space programs, even in ostensibly civilian or commercial areas, could well lead to improvements in China's offensive missile capabilities. According to some of the Chinese participants in the Eisenhower Center workshops, they had been unaware of this concern.

Nor is the integration of Chinese civilian and military space capabilities limited to issues of dual-use systems. Broadly speaking, there is no bright dividing line between Chinese military and civilian space authorities, either. That the Chinese should have a closely integrated civilian and military space sector is not surprising. When Deng Xiaoping came to power in 1978, he set forth the general

[9] US House of Representatives, *Report of the Select Committee on US National Security and Military Commercial Concerns with the People's Republic of China* (Washington, DC: Regnery Publishing, 1999), p. 215.

Chinese guideline (*zong fangzhen*) of "civil-military combined, wartime-peacetime combined, give preference to military goods, have the civilian nurture the military" [(*junmin jiehe, pingzhan jiehe, junpin youxiang, yi min yiang jun*)]. This general guideline remains a cornerstone in China's efforts to foster broad national development.

Deng's call for close civil-military integration is echoed in the PRC's 2006 space white paper. This paper (and its 2000 predecessor) issued by China's State Council, the highest governmental body in the People's PRC, was specifically cited by Chinese delegates to the 2008 workshop as essential for understanding China's space program. The paper notes that a key principle underlying the development of China's space industry is that it is "a strategic way to enhance its economic, scientific, technological, and ***national defense strength***, as well as a cohesive force for the unity of the Chinese people."[10]

Nowhere is this more evident than in the management of the Chinese space infrastructure. On the one hand, the Chinese claim that their space facilities are managed by yet another subordinate organization to COSTIND, the China Satellite Launch and Tracking Control General (CLTC). This is the entity that has generally contracted with foreign space organizations for commercial or civilian space launches, such as the Brazilian space agency for the launch of CBERS-2. [11]

Other Chinese reporting, however, suggests that it is the military, in the form of the General Armaments Department (GAD), that has authority over China's launch facilities and mission control centers. The GAD is one of the four General Departments that administers the Chinese People's Liberation Army (PLA). Established in April 1998, it is responsible for development of military equipment for the entire PLA.[12] Moreover, the GAD also controls the military academy that, according to PLA writings, is the main institution responsible for training the personnel that staffs China's space-related facilities, including launch sites and mission control centers.[13]

Based on available data, it seems that the GAD actually controls the various Chinese space launch and mission control facilities. The facilities are generally identified as being designed and constructed by units of the GAD.[14] Moreover, Chinese reporting suggests that GAD has ultimate responsibility over missions conducted at these facilities. According to one Chinese news report, the launch of the 20th Fanhui Shi Weixing (FSW) from Jiuquan Satellite Launch Center encountered difficulties with an instrument. The director of the JSLC debated whether to proceed with the launch, recognizing that any failure to do so might disrupt the subsequent Shenzhou-VI space launch. The JSLC director decided to proceed with the FSW launch, but

[10] Emphasis added. PRC State Council, *China's Space Activities in 2006*, "Aims and Principles of Development," (Beijing, PRC: State Council Information Office, 2006).

[11] Valcir Orlando, Helio Koiti Kuga, Jun Tominaga, "CBERS-2 LEOP Orbit Analysis," Proceedings of the 18th International Symposium on Space Flight Dynamics, ESA SP-548. (Munich, Germany: October 2004), p. 1. http://www2.dem.inpe.br/hkk/2004/Orlando&Kuga&Tominaga-P1062.pdf

[12] Phrase Dictionary Committee, *Large Phrase Dictionary, Military Volume* (Shanghai, China: Shanghai Dictionary Publishing House, 2003), p. 98.

[13] "Academy of Command Equipment and Technology," in *An Overview of Chinese Military Academic Institutions*, ed. by Jin Peng and Dong Ming (Beijing, PRC: Academy of Military Science Publishing House, 2003), pp. 163-164.

[14] "A Development History of China's Aerospace Launch Facilities," *Jiefangjun Bao* (November 2, 2005). www.jingning.gov.cn/zhxx/zhxx/t20051102_114819.htm

only after receiving permission from the GAD (*dedaole zongzhuangbei bu de pizhun*).[15]

While this integration of civilian and military organizations and systems may be understandable, especially in light of constrained Chinese human, financial, and technological resources, it nonetheless complicates any effort at Sino-American cooperation.

The opacity and uncertainty regarding the organization of China's space efforts, beyond the role of the PLA, adds yet another layer of complication. The United States and the PRC have almost no parallels in how each has organized its overall space organizations and political infrastructure. This makes establishing counterparts for even discussing space cooperation much more difficult.

For the United States, there are four major sectors of space activity: [16]

Civil. The activities in this sector are conducted by the US Government (USG), in order to "explore the universe and advance human knowledge." This sector is mostly under the direction of the National Aeronautics and Space Administration (NASA). It includes exploration of other planets and space bodies, scientific missions relating to Earth observation, and human spaceflight.

Commercial. These activities are performed by the private sector, as a means of making money. Commercial space activities used to mainly involve the launch and operation of communications satellites, but there has now developed a commercial remote sensing sector as well. The space services sector, including satellite positioning and navigation, is one of the fastest growing areas of space activity, in terms of revenue.

Intelligence. The collection of information through the use of a variety of surveillance and reconnaissance satellites is part of the intelligence space sector. Previously referred to as "national technical means," this sector is under the joint purview of both the US military and the US intelligence community.

Military space. This sector supports the military directly, including communications, meteorology, missile early warning, and a variety of other roles. It also includes the use of force to, in, and from space. It is largely administered by the US Department of Defense, operating through Strategic Command (STRATCOM) and the US Air Force Space Command (AFSPC).

While there are inter-relationships among the four sectors, each is also relatively autonomous from the others. By contrast, the fundamental organization of the PRC space program is shrouded in mystery, with few reliable sources of information on whether it has distinctive sectors and communities comparable to those in the American system.

Based upon the limited available evidence, it would appear that in the PRC the space sector as a whole, and not just the space launch facilities and mission control centers, is deeply embedded within the military industrial complex, with very close ties between the military and civilian sides. Indeed, it is not clear whether there is a meaningful distinction

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[15] "Jiuquan Satellite Launch Center Director Zhang Yuling Chases Dreams of Flight," China National Space Agency (October 26, 2005). www.cnsa.gov.cn/n615708/n942529/n942861/70240.html.

[16] This section draws from Peter L. Hays, James M. Smith, et. al., "Spacepower for a New Millennium: Examining Current US Capabilities and Policies," in *Spacepower for a New Millennium: Space and US National Security*, ed. by Peter L. Hays, James M. Smith, et. al. (NY: McGraw-Hill Companies, 2000), pp. 2-3. All quotes are drawn from this section.

between the civilian and military in the Chinese space arena.

Thus, until March 2008, for example, China's space program was part of the Commission on Science, Technology, and Industry for National Defense (COSTIND). Indeed, the China National Space Agency (CNSA), ostensibly responsible for all civilian space activities, was a subordinate entity within COSTIND (or State-COSTIND, as Western China scholars commonly refer to it).

State-COSTIND was itself an outgrowth of the National Defense Science and Technology Commission (NDSTC), which was established in 1958 in order to oversee China's strategic weapons development and was also given authority over the space program. The NDSTC reported directly to the Central Military Commission, the highest military authority, and therefore "could lay nearly automatic claim to extensive proprietary rights throughout the Chinese bureaucracy…. [and gave it] the ability to mobilize resources and to command compliance virtually at will."[17]

Over time, the NDSTC underwent bureaucratic evolution, merging with several other bureaucracies focused on science and technology in 1982, to become the Commission on Science, Technology, and Industry for National Defense (COSTIND). It retained responsibility for the space program, along with other key high-technology areas of interest to the military. In 1999, COSTIND in turn underwent further bureaucratic reorganization, calving off a new General Department (the General Armaments Department or GAD) to oversee military weapons development, while retaining a quasi-civilianized COSTIND (often referred to in Western writings as State-COSTIND, to distinguish it from its predecessor) to serve as an administrative oversight of defense industries.

The situation is further confused by uncertainties of how recent reorganizations have affected the Chinese space program. In March 2008, several ministries were consolidated into super-ministries. COSTIND, previously a ministerial-level government entity, was subsumed under the newly established Ministry of Industry and Information Technology (MIIT). At the same time, it was ostensibly downgraded to become the State Administration for Science, Technology, and Industry for National Defense (SASTIND). This would have made it the equivalent of CNSA in terms of bureaucratic power.

It remains unclear, nearly a year later, however, whether CNSA is a component of SASTIND (i.e., was itself also downgraded), or separated from SASTIND to become a stand-alone agency, and if so, at what level of authority. For example, the release of several hundred hours of data from the Chang'e-1 lunar mission (a CNSA mission area) was announced by SASTIND.[18] Meanwhile, Sun Laiyan, the director of CNSA, has been described as a Deputy Director of SASTIND, while Chen Qiufa, the director of SASTIND, is described as a deputy minister of MIIT.[19] This would suggest that CNSA remains subordinate to SASTIND, within the larger context of MIIT.

[17] Evan Feigenbaum, *China's Techno-Warriors* (Stanford, CA: Stanford University Press, 2003), p. 54.

[18] "China to Release 700 Hours of Chang'e-1 Data," Xinhua (August 4, 2008).

[19] "SASTIND to Study and Implement National IP Strategy Outline," Intellectual Property Protection in China (July 22, 2008), http://english.ipr.gov.cn/ipr/en/info/Article.jsp?a_no=225422&col_no=925&dir=200807, and "China Reveals Its First Full Map of Moon Surface," Xinhua (November 12, 2008), http://news.xinhuanet.com/ english/ 2008-11/12/content_10347379.htm.

Even Chinese officials appear uncertain at this time about exactly how the various pieces of the Chinese space bureaucracy will fit together, noting that the reorganization remains "a work in progress." Nonetheless, the uncertainty associated with the basic organization of the Chinese space bureaucracy, including who is subordinate to whom, underscores the potential difficulties confronting more extended negotiations between the two sides, as well as more extensive cooperation.

Different Approaches to Negotiations

Should the US and the PRC actively seek to cooperate, any ventures will first require extensive negotiations. As noted earlier, there has been only minimal interaction between American and Chinese space authorities. This means that there is not an extensive foundation of personal relationships or even negotiating experience on space issues between the two countries upon which to build. With neither institutional nor personal relations, the process is likely to be extremely lengthy.

In particular, the absence of a legacy of interactions goes to the heart of the Chinese approach to negotiations. President Richard Nixon's visit to China in 1972 and the subsequent establishment of diplomatic relations in 1979, for example, was the culmination of nearly twenty years of meetings in Geneva and Warsaw.[20] "From the Chinese perspective, these [Ambassadorial] Talks and the events leading to the Talks established the boundaries within which the ultimate solutions were found. Like building a stone house, a solid foundation for the relationship had to be laid, if the relationship was to endure."[21]

The absence of such a foundation means that any effort to foster cooperation in space arena, which touches on sensitive issues of national capabilities as well as being potentially highly technical, will also have to reconcile very different approaches to the ***process*** of negotiation.

"Top-Down" versus "Bottom-Up"

In this regard, American and Chinese negotiators tend to take very different approaches. Chinese negotiators in general seek first to establish sets of principles that will then govern all subsequent interactions.[22] For example, in many international negotiations, the Chinese emphasize the importance of both sides starting from the "five principles of peaceful co-existence":

- Mutual respect for territorial integrity and sovereignty
- Mutual non-aggression
- Mutual non-interference in internal affairs
- Equality and mutual benefit
- Peaceful coexistence[23]

This is in direct contrast to the American approach, in which negotiations begin by establishing specifics, "avoiding debates about generalities which can easily become entangled in political or philosophical

[20] For further details on the Ambassadorial Talks, see Kenneth T. Young, *Negotiating with the Chinese Communists* (NY: McGraw-Hill, 1968).

[21] Alfred D. Wilhelm, *The Chinese at the Negotiating Table* (Washington, DC: NDU Press, 1994), p. 201.

[22] For more discussion about the role of principles in Chinese negotiating style, see Alfred D. Wilhelm, *The Chinese at the Negotiating Table* (Washington, DC: NDU Press, 1994), pp. 51-52.

[23] Samuel S. Kim, "China and the Third World," in *China and the World*, 3rd Edition, ed. by Samuel S. Kim (Boulder, CO: Westview Press, 1994), p. 131.

differences."[24] In essence, Chinese negotiators tend to adopt a "top-down" approach, with senior leaders focusing on broad principles, whereas American negotiators more frequently adopt a "bottom-up" approach, with working level officials focusing on concrete measures.

The Chinese focus on principles, as one Japanese diplomat has noted, is rooted in a number of factors.

- It establishes the essence of the Chinese position. This is in keeping with what the Chinese are seeking to determine about their counterpart, i.e., their counterpart's essential "bottom lines."

- The negotiating process for the principles also provides an opportunity for the Chinese to take their measure of their counterparts. Are they a cohesive group? Or are they internally fragmented, presenting opportunities for division and exploitation?

- The creation of principles are also a means of establishing ***internal*** support among various Chinese stakeholders. The establishment of the Chinese position in any given negotiation is likely to require extensive internal negotiation ***within*** the Chinese bureaucracy (and may explain why getting the Chinese to shift away from their own principles can often be so difficult). Along these lines, the principles serve as a short-hand, easily understood at a glance (*yi mu liao ran*).[25]

- Once principles are established, they become the starting point for subsequent negotiations. For this reason, the Chinese will strive to establish said principles on their own terms. If a negotiating partner will accept the principle that "the weak need not reveal to the strong," or that "knowledge should not be limited," that position will then be exploited in subsequent rounds.

The first two factors listed by Ambassador Matano indicate, again, that American and Chinese negotiators hold very different perceptions of the significance of negotiations. In general, the Chinese, unlike their American counterparts, do ***not*** see political negotiations as "a highly technical process of haggling over details in which the two sides move to a point of convergence from their original positions through incremental compromises."[26] Instead, they are viewed an attempt to reconcile (or impose) "principles and objectives of the two sides and the testing of their interlocutor's commitment to a relationship with the PRC."[27] Rather than "getting to 'Yes,'" for the Chinese "the purpose…is to size the opposition to draw out the US position with minimum exposure of China's."[28]

Under such circumstances, an opening position is unlikely to have "give," since the aim is not so much to gain reciprocal

[24] Lucian Pye**,** *Chinese Commercial Negotiating Style*, R-2837-AF (Santa Monica, CA: RAND, 1982), p. 40.

[25] Ambassador Kagechika Matano, "Chinese Negotiating Styles: Japan's Experience," Center Occasional Paper, Asia Pacific Center for Security Studies (Honolulu, HI: Asia Pacific Center for Security Studies, December 1998). http://www.apcss.org/Publications/Ocasional%20Papers/OPChinese.htm.

[26] Richard H. Solomon, "Friendship and Obligation in Chinese Negotiating Style," in *National Negotiating Styles*, ed. by Hans Binnendijk (Washington, DC: Foreign Service Institute, 1987), p. 6.

[27] *Ibid*.

[28] Alfred D. Wilhelm, *The Chinese at the Negotiating Table* (Washington, DC: NDU Press, 1994), p. 46.

concessions, but to address a counterpart's bottom line requirements without compromising one's own. This, again, is in contrast with most American negotiating styles. "Flexibility, by indicating the softness of the US position, may impede and not facilitate agreement."[29] The resulting disconnect may well hamper negotiations.

Another consideration is that the Chinese usually appear at the negotiating table with their own position already formulated. If they are seeking to determine their counterpart's bottom lines, the Chinese negotiators are well aware of their own. "Before negotiations at any level begin, the central leadership will have assessed the 'objective reality' and determined its objectives vis-à-vis the principal 'contradictions as well as the strategy for achieving those objectives."[30] Such assessments are likely to have been arrived at only after significant internal bargaining within the Chinese system, in order to create the necessary consensus among competing bureaucracies, stakeholders, and leadership groupings. They are therefore unlikely to be lightly modified, much less altered or abandoned.

In order to shift the Chinese, then, it is essential to be able to traverse the labyrinthine bureaucracy of China. As one observer notes, "The first stage of wisdom in negotiating with the Chinese is to grasp that one is confronted with the world's oldest bureaucracy."[31]
Apparent gains at the negotiating table are insubstantial unless they can garner support from the actual Chinese leadership. As one Japanese diplomat has observed, "In order for a point to be accepted by the Chinese side, it is important that our presentation is formulated in such a way that it would reach the top strata of the Chinese decision-making machinery."[32] Conversely, "pragmatism is displayed amply when there is positive political will in the top leadership of China to conclude an accord…."[33]

The key leaders and decision-makers, however, are not located in the state bureaucracy, but within the Chinese Communist Party, specifically, the Chinese Politburo. This is because policy ***decisions*** are the purview of the Party's leadership, whereas policy ***implementation*** is the responsibility of the state's bureaucracy. It is arguably for this reason that the Chinese are extremely opaque about the details of their space policy decision-making process. The process of determining policy occurs, not in the government, but in the Party. Allowing outsiders to gain an understanding of said processes would also provide them with the ability to detect and exploit potential vulnerabilities.

Different Views of Each Party's Responsibilities

A more fundamental issue rests in the perception of roles and responsibilities. In particular, in seeking to establish "common principles," the Chinese are often seeking to establish that both sides agree upon "mutual interests" being at stake. In the Chinese perception, however, once such mutual interests are established, it is the responsibility of the better off, more powerful, or more well-to-do to sustain said interests. "For the Chinese, the acknowledgement that both sides

[29] Raymond Cohen, *Negotiating Across Cultures* (Washington, DC: US Institute of Peace, 1991), p. 93.

[30] Wilhelm, p. 40.

[31] Cohen, p. 101.

[32] Ambassador Kagechika Matano, "Chinese Negotiating Styles: Japan's Experience," Center Occasional Paper, Asia Pacific Center for Security Studies (Honolulu, HI: Asia Pacific Center for Security Studies, December 1998). http://www.apcss.org/Publications/Ocasional%20Papers/OPChinese.htm.

[33] Ambassador Matano

have common interests is only a first step in a continuous process of trying to get the other party to do more for the common interest."[34]

Thus, from the Chinese perspective, it is not incumbent upon the weaker party to disclose information, or indeed, to even reciprocate concessions. This message was sounded by one Chinese delegate who attended the 2007 Eisenhower Center China conference, who noted that the weak are not obliged to reveal their secrets to the strong. A variation of this asymmetric view of obligations was sounded by the three Chinese delegates who attended the 2008 China conference. One specifically stated that the purpose of space arms control was to constrain the strong, by which she meant the United States.

Such an attitude is deeply problematic under most circumstances. Coupled with some discussions about whether the very concept of transparency isn't analogous to espionage, and it soon raises questions about whether cooperation with China would involve symmetric or asymmetric concessions and reciprocity. Where the issues are dual-use technologies, however, many of which are considered essential for national security, it dims the prospects for cooperation.

Broader International Implications

Beyond the bilateral difficulties of cooperating with the PRC, it is also important to consider potential ramifications of Sino-US cooperation in space on the Asian political landscape. In particular, cooperation between Washington and Beijing on space issues may well arouse concerns in Tokyo and Delhi. Both of these nations have their own space programs, and while they are arguably not engaged in a "space race" with China (or each other), they are certainly keeping a close eye on developments regarding China.

Of particular importance is Japan. The United States relationship with Japan is arguably its most important in East Asia.

> US interest in Japan should be self-evident. Japan hosts 47,000 US troops and is the linchpin for forward US presence in that hemisphere. Japan is the second largest contributor to all major international organizations that buttress US foreign policy…. Japan is the bulwark for US deterrence and engagement of China and North Korea—the reason why those countries cannot assume that the United States will eventually withdraw from the region.[35]

For Japan, whose "peace constitution" forbids it from using war as an instrument of state policy, the United States is an essential guarantor of its security. Any move by the US that might undermine this view raises not only the prospect of weakening US-Japanese ties, but also potentially affecting Japan's security policies.

In this regard, then, it is essential not to engage in activities that would undercut perceptions of American reliability. Such moves, it should be noted, are not limited to those in the security realm. For example, the Nixon administration undertook several initiatives in the late 1960s and early 1970s that rocked Tokyo-Washington relations, and are still remembered as the "Nixon shocks." While some of these were in the realm of security (including Nixon's opening to China and the promulgation of the Nixon Doctrine), the others were in the trade area. These

[34] Lucian Pye, p. 77.

[35] Michael Green, *Japan's Reluctant Realism* (NY: Palgrave, 2003), p. 9.

included a ten percent surcharge on all imports entering the US and suspended the convertibility of the dollar (i.e., removed the US from the gold standard).[36]

Part of the "shock" was the fundamental nature of these shifts. Even more damaging, however, was the failure of the Nixon Administration to consult their Japanese counterparts, catching them wholly off-guard. It took several years for the effects of these shocks to wear off. If the United States is intent upon expanding space relations with the PRC, then it would behoove it to consult Japan, in order to minimize the prospect of a "space shock."

Failing to do so may well incur a Japanese reaction. The decision on the part of Japan to build an explicitly intelligence-focused satellite was in response to the North Korean missile test of 1999, suggesting that Tokyo is fully capable of undertaking space-oriented responses when it is concerned.[37] That, in turn, would potentially arouse the ire of China. The tragic history of Sino-Japanese relations continues to cast a baleful influence upon current interactions between the two states. If there is not a "space race" currently underway between Beijing and Tokyo, it would be most unfortunate if American actions were to precipitate one.

Potentially further complicating this situation is India. With a burgeoning space program, India constitutes yet another participant in a potential Asian space race. Fueled by a growing economy, India has steadily improved its space capabilities, launching the Chandrayaan-1 lunar probe in 2008, soon after the Japanese Kaguya and Chinese Chang'e-1 probes. Again, this is not to suggest that there is a space race underway, but it would be hard to deny that the major Asian powers are each watching the others carefully (or, more accurately, that China is being watched carefully by its neighbors).

That space is a major potential arena for competition among these states is highlighted by the Joint Declaration on Security Cooperation Between Japan and India, initialed by the Japanese and Indian Prime Ministers on October 22, 2008 in Tokyo. The final "mechanism of cooperation" listed in the agreement was for cooperation between the two nations' space programs. "Cooperation will be conducted between the Japan Aerospace Exploration Agency (JAXA) and the Indian Space Research Organisation (ISRO) in the field of disaster management."[38]

For the United States, cooperating with China on space issues, when it is not yet doing so with India, could well send mixed messages to Delhi. In particular, there is a perception in many quarters that the United States is intent upon balancing China through India.[39] US space cooperation with China might allay such concerns and signal that the US is not seeking

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[36] Laura Stone, "Whither Trade and Security? A Historical Perspective," in *The US-Japan Alliance: Past, Present, and Future*, ed. by Michael Green and Patrick Cronin (NY: Council on Foreign Relations Press, 1999), p. 255, and Robert Gilpin, "The Global Context," in *The United States & Japan in the Postwar World*, ed. by Akira Irye and Warren Cohen (Lexington, KY: University Press of Kentucky, 1989), pp. 12-13.

[37] Brian Harvey, *The Japanese and Indian Space Programmes* (NY: Springer Books, 2000), p. 119.

[38] Joint Declaration on Security Cooperation Between Japan and India, Japan Ministry of Foreign Affairs. http://www.mofa.go.jp/region/asia-paci/india/pmv0810/joint_d.html.

[39] Paul Richter, "In Deal with India, Bush Has Eye on China," *Los Angles Times* (March 4, 2006). http://articles.latimes.com/2006/mar/04/world/fg-usindia4, and Leonard S. Spector, "US Nuclear Cooperation with India," Testimony before House Committee on Foreign Relations (October 26, 2005), p. VII., http://cns.miis.edu/research/ congress/ testim/spe102605.pdf.

to counter China through India. It might, however, be seen as "double-dealing" by the Indian government, which has its own concerns about China stemming to at least the 1962 Sino-Indian War.

Prospects for Cooperation

In light of these difficulties, what are the prospects for Sino-American cooperation in space?

As noted previously, there is already some degree of cooperation, at least at the level of data-sharing. Both multilateral and bilateral data sharing might therefore be expanded, with minimal staffing or negotiations required. The Chinese, for example, have donated ground stations that can access its *Fengyun* weather satellites to nearly a dozen nations, as part of its FENGYUNCast network. [40] It might choose to provide the United States with comparable ground stations (or information on how to access the data from the satellite).

At the same time, however, such sharing of data constitutes only a minimal level of interaction between the two states and their respective space programs. If it is relatively easy, it is also relatively low-level.

The political situation in the United States, unfortunately, suggests that there may be significant obstacles to implementing a more extensive bilateral cooperative approach. In particular, there was little optimism among attendees to the various workshops that ITAR would be changed anytime soon—although there was broad agreement that the ITAR system needed significant overhauling and revamping. Similarly, longstanding restrictions on technology transfer to the PRC (for reasons of not only national security but also intellectual property rights and questions of competitiveness), as well as concerns about human rights and other aspects of the Chinese situation suggest that there would be significant political opposition to any effort to radically upgrade Sino-US bilateral cooperation in space. It remains to be seen how the incoming Obama administration might deal with these concerns.

While the US has not engaged the PRC in negotiations over cooperating in space, it has engaged in a variety of other cooperative efforts, both commercial and political. From these past instances, it is clear that, should there be an effort to expand cooperation in space, there are certain essential preconditions that need to be met, if one is to be successful when working with the PRC.

First and foremost, it is essential to not make space cooperation an end unto itself. Rather, it is essential to consider it in the larger context of Sino-American relations. What is the purpose of this cooperation, not only in terms of scientific or technical data, but in terms of broader national ends? Is it primarily intended to presage further, substantive cooperation in other fields? Is it intended to build mutual confidence in space? Is it to allay security concerns?

Then, the American side needs to do a great deal of homework. Past experience with the Chinese in negotiations makes clear that the following rules need to be followed:

- Know the substantive issues thoroughly
- Master the past negotiating record
- Know your own bottom line
- Present your position in a broad framework
- Understand the PRC's political context

[40] "CMA's Satellite Based Data Services," Undated presentation to the World Meteorological Organization, www.wmo.int/pages/prog/www/ISS/Meetings/ET-CTS_Toulouse2008/documents/pCMASat.ppt

- Be patient, avoiding deadlines or being rushed
- Minimize media pressures[41]

One of the key findings of the Eisenhower Center workshops has been that both sides would like to see more "clarity of intent." For the Chinese, gaining that clarity from the United States requires that the American side actually know its own positions, and that it be pursued consistently and with support from above.

At this point, it is not clear that the American side has done this. Nor is it clear that the groundwork necessary for negotiations, as noted above, has begun. To balance this, however, it is unlikely that Sino-American space cooperation will be a "front-burner" topic for the new administration. Consequently, even the initiation of discussions for cooperation is likely to be delayed. This means that the American side has been granted a reprieve to learn the record, understand the issues, and arrive at an American bottom line, to which it can then adhere.

What the Eisenhower Center workshop experience suggests, however, is that the Chinese are unlikely to be helpful in gaining an understanding of the PRC's political context. Judging from their comments, there is an apparent indifference towards, if not rejection of, transparency. This is complicated by the lack of American analysts on Chinese space policy. It remains to be seen whether the Chinese will value providing clarity of intent to the American side.

Options for the Future

Given the lack of a bilateral track record in negotiating cooperation in space, much less actually engaging in joint efforts, this would suggest that a series of lower profile options might well be more productive as a starting point for Sino-American space cooperation. Such steps would provide both sides with an opportunity to understand their counterpart's negotiating behavior, and in particular would help the American side to understand the "bottom lines" that the Chinese are likely to be pursuing. At the same time, achieving some lower profile cooperative ventures would also reassure the US, building confidence in, and support for, the process.

In particular, it is worth considering the consequences of potential failure—that is, if a given initiative were to fail, either due to internal political pressures from either side or external political developments (e.g., an EP-3 type incident), how would this affect the overall course of Sino-US cooperation in space and in other areas?

The perceived failure of high-profile projects would likely generate a long-term adverse effect on US-Chinese cooperation in space and elsewhere. Conversely, while successes in small projects may not create as much benefit, they would provide additional data for subsequent cooperative efforts. In this regard, it is useful to consider that the Apollo-Soyuz mission occurred after the negotiation of the SALT I Accords, and in the midst of SALT II, as well as a variety of negotiations (e.g., Helsinki).

The pressures of today's media environment also would militate against high-visibility projects. On the one hand, news that the US was negotiating with China to cooperate on space issues would generate correspondingly heightened expectations from the American mass media—which the Chinese media would happily abet. The push to initial some kind of agreement would run counter to the need for patience when negotiating with Beijing.

[41] Solomon, pp. 14-16.

Ironically, these same pressures might also ***undermine*** Sino-American cooperation. Beijing's release of a "transcript" of conversations between the Beijing mission control center and the Shenzhou VII even before the mission had begun suggests that the PRC retains a skeptical view of free reporting. Conversely, Western coverage of the 2008 Beijing Olympics aroused some indignation despite its generally positive tenor, as the press noted the lip-synching by Lin Miaoke and the age controversy of the Chinese women's gymnastics team.[42]

This mutual suspicion (if not antagonism) would likely be exacerbated in the event of a high-profile mission such as a Sino-American counterpart to Apollo-Soyuz. While such a mission would likely provide moments of high drama, as well as significant public relations value, the reality is that the media pressures would be far greater in today's media environment than thirty years ago.

All this suggests that there should be an effort to first establish precedents for cooperation at lower levels, before striving for such approaches as a joint mission, or even joint mission planning. It should be possible, for example, to foster common standards and procedures between the two sides, as the logical next step in deepening cooperation between the two space powers. If coupled with an overhaul of the ITAR system, this would allow for the possibility of commercial as well as civilian space cooperation. Even without addressing ITAR, however, working together towards common standards and techniques would lay the groundwork for eventually building a common spacecraft, as well as mounting a joint mission together.

[42] "Chinese Defense Olympic Ceremony Lip-Synch," AP (August 13, 2008). http://www.msnbc.msn.com/id/26182056/, "IOC Seeks to Settle Furor Over Age of Chinese Gymnasts," AP (August 22, 2008). http://www.foxnews.com/story/0,2933,408541,00.html.

SPACE AND SINO-AMERICAN SECURITY RELATIONS

PETER L. HAYS

China's emphasis on space exploration and its development and use of space capabilities are prominent and tangible expressions of its emergence as a great power and make space an increasingly important dimension of Sino-American relations. In October 2003 China independently launched and recovered its first taikonaut, becoming just the third member of an elite spacefaring club with Russia and the United States. Then in January 2007 China first successfully tested a kinetic energy anti-satellite (ASAT) weapon and again joined Russia and the United States as one of only three states known to have demonstrated this capability. China's growing power and space emphasis may become manifest in mostly peaceful and cooperative ways or may lead to increasing competition and perhaps even conflict with the United States.

Addressing four issue areas can help provide context and focus for these concerns: contrasting Chinese and American views of space and comparing the place of space during the Cold War with its role in the current global security environment; reviewing the evolution of security space capabilities and superpower space arms control; evaluating the role of space capabilities in Sino-American security interrelationships, particularly with respect to a potential conflict over Taiwan; and assessing the prospects for a range of possible cooperative ventures and transparency- and confidence-building measures (TCBMs). Defusing space apprehensions will be difficult and there are currently several worrisome trends, but space holds unique potential to help define the Sino-American security relationship and shape the very future of humanity. If Beijing and Washington can work towards resolving or at least lessening space tensions they will not only better manage their overall relationship but also open more opportunities to use space for the benefit of all humanity through pursuit of genuinely cooperative spacepower objectives such as joint science and exploration missions, generating wealth in space, harvesting energy from space, and, ultimately, improving the odds for humanity's survival by better protecting Earth and creating capabilities to become a multi-planetary species.

Cold War Baggage and Differing Perspectives

Although each is far from monolithic, China and the United States often view the costs and benefits of exploring and using space in different ways; their perspectives reflect the times and environments in which their space capabilities developed and the challenges they were designed to address. Sometimes it can also be difficult to synthesize the statements and actions of China and the United States into a single perspective about space since each has a number of powerful domestic space actors and these organizations at times speak and act in conflicting ways. In addition, their perspectives about space have evolved due to shifts in the relative power of China and the United States and other changes in the global environment. Despite these challenges, it is now more important than ever to continue synthesizing these space perspectives and building a better foundation of shared perceptions and understanding for future dialogue and actions about space security and other issues.

China and the United States started their space activities in very different ways. The United

States first articulated its highest priorities for space in a then-classified policy document, National Security Council (NSC)-5520, signed by President Dwight Eisenhower in May 1955. NSC-5520 indicated that the primary U.S. rationale for going to space was to attempt to open up the closed Soviet state via secret reconnaissance satellites and laid out a process for the United States to help establish a new legal regime for space that would legitimize their overflight of the Soviet Union.[1] Although secret, this policy was an important factor in shaping the opening of the space age and, in retrospect, helps explain the structuring of United States space activities both then and now. For example, it sheds light on issues such as why the United States: did not race the Soviets into space, used its International Geophysical Year (IGY) scientific satellite program as a "stalking horse" to test the acceptability of reconnaissance satellite overflight, is not interested in drawing a clear demarcation line between air and space, and in public diplomacy strongly emphasizes separate civil and military space sectors and the use of space for "peaceful purposes."[2] The United States first successfully recovered satellite imagery of the Soviet Union in August 1960 and created the National Reconnaissance Office (NRO) a year later. Collecting intelligence data has been a primary U.S. space mission ever since.

Intelligence collection from space soon also developed an essential, enabling, and symbiotic relationship with superpower arms control. This role began with the Vela Hotel nuclear detonation detection satellite system that allowed the 1963 Limited Test Ban Treaty to extend the prohibited area for nuclear testing into space, was first codified as "National Technical Means" (NTM) of verification in the 1972 Anti-Ballistic Missile (ABM) Treaty, and remains the most important verification mechanism for several arms control regimes. The NTM language in Article XII of the ABM Treaty was repeated in many subsequent treaties and remains a part of the international legal regime for space despite U.S. withdrawal from the ABM Treaty in 2002. This language helps indicate that NTM are a peaceful use of space, highlights direct interrelationships between NTM capabilities and the units of limitation in arms control agreements, establishes some degree of protection for space-based intelligence collection in international law, but clearly stops well short of being a blanket ban on ASAT weapons or even an explicit approval of all spying from space.

China, by contrast, was not involved in structuring the legal regime at the opening of the space age, has never made collecting intelligence data from space its highest priority space mission, is wary of the role of NTM in TCBMs, and has only limited experience with strategic arms control. Like many other major spacefaring states around

[1]The best and most comprehensive analysis of the complex maneuvering by the superpowers at the opening of the space age remains Walter A. McDougall's Pulitzer Prize-winning . . . *the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985). NSC-5520 is reprinted in John M. Logsdon, ed. *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, Vol. I, *Organizing for Exploration* (Washington, D.C.: NASA History Office, 1995), 308-313. McDougall in *Heavens and Earth* and R. Cargill Hall's introductory essay, "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown* masterfully develop the context and purposes of NSC-5520.

[2]Hall uses the term *stalking horse* to describe the purpose of the IGY satellite in relation to the WS-117L (America's first reconnaissance satellite program). *Peaceful purposes* for space activity are often referenced and cited but never authoritatively defined. For a revisionist analysis of the IGY program see Rip Bulkeley, *The Sputniks Crisis and Early United States Space Policy: A Critique of the Historiography of Space* (Bloomington: Indiana University Press, 1991).

the world, China does not make clear distinctions between its civil and military space activities, pursuing instead many advanced capabilities with military applications, sometimes even with foreign partners such as on the China-Brazil Earth Resources Satellite (CBERS) program. In 1956 Chairman Mao Zedong set China on a path towards strategic modernization by urging development of "two bombs, one satellite." After developing atomic and thermonuclear bombs, China launched its first satellite, the *Dong Fang Hong* I, in April 1970; this system combined a radio transmitter with tests of satellite technology and science experiments to take readings of the ionosphere and atmosphere. Today China operates a number of dual-use remote sensing satellites but they do not constitute a separate sector of Chinese space activity and they have no organization apparent to western analysts that is equivalent to the NRO.

China's position on NTM during negotiations on the Comprehensive Test Ban Treaty is perhaps the best example of how differently Chinese and Americans view this capability. Although it eventually signed the treaty, China has not yet ratified it and also submitted a signing declaration objecting to the use of NTM as an adequate basis for inspections and opposing "the abuse of verification rights by any country, including the use of espionage or human intelligence to infringe on the sovereignty of China."[3] Even more importantly, China and the United States have no shared experience with strategic arms control, a process that arguably provided the most important channel for maintaining United States-Soviet communications and developing shared understanding of key strategic concepts throughout the Cold War. Using space or some other key dimension of their relationship to build a broader foundation for subsequent strategic dialogue needs to become a high priority for Beijing and Washington since it is very unlikely shared understanding can be developed in real-time during a crisis.

United States and Chinese civil space activities align more closely but are more than forty years out of phase. Following the Soviet triumphs with the first satellite and the first manned orbital flight, the United States reprioritized its objectives in space and publicly emphasized human spaceflight and the civil space sector much more than intelligence or military space missions. The United States shaped the Moon Race as a high technology and ideological contest for prestige, betting that space successes would translate into increased allegiance from the developed and developing worlds. The superpowers also made some effort to pursue cooperative civil space activities but the Apollo-Soyuz Test Project of 1975 proved to be the high water mark for these efforts during the Cold War.

The end of the Cold War removed one important motivation for prestige-based civil space activities and strengthened incentives to pursue cooperative ventures such as the International Space Station (ISS). The United States also had important counterproliferation objectives in employing Russian space scientists in the civil sector as major partners on the ISS effort and lessening their potential to contribute to the weapons market. In addition, development and use of the aerospace workers and industrial base that supports civil and all other space activities are significantly out of phase in the United States and China. The United States has lost 750,000 scientific and technical workers since the end of the Cold War, 60 percent of aerospace industry workers are over age 45,

[3]"China's Attitude Toward National Technical Means (NTM) of Verification," available from Nuclear Threat Initiative (NTI) website at http://www.nti.org/db/china/ntmpos.htm; downloaded on 16 January 2009.

and 25 percent are eligible to retire; by contrast, a large percentage of the Chinese aerospace industry workforce is under age 45 and the Chinese graduate some 351,500 engineers each year, versus about 137,400 engineers graduated from four year engineering programs in the United States.[4]

China's civil space effort began in earnest in the post-Cold War era; it pursues human spaceflight and exploration for prestige and to set China apart as a great power. From the beginning, however, all Chinese space activity, including its civil space activity, has been either directly or indirectly controlled by the People's Liberation Army (PLA). Although some Chinese civil space efforts began in the 1950s and the China National Space Agency (CNSA) was established in 1993, ostensibly to direct China's civil space program, under the current bureaucratic structure and for "most of its existence CNSA was embedded within the Commission for Science, Technology, and Industry for National Defense (COSTIND), a higher ministerial entity that oversaw many of China's defense industries."[5] Moreover, CNSA appears to have little decision-making authority; its main function seems to be to interface with foreign space agencies, a role similar to that played by the Ministry of Defense and other organizations within the Chinese government that present this type of façade as the way the outside world is to interact with the Middle Kingdom. The U.S. Department of Defense believes that "the majority of the technology used in China's manned space program is derived from Russian equipment, and China receives significant help from Russia with specific satellite payloads and applications."[6] China launched its first lunar orbiter, the *Chang'e*-1, in October 2007; "successful completion of this mission demonstrated China's ability to conduct complicated space maneuvers – a capability which has broad implications for military counterspace operations."[7]

Now that it has achieved its major initial prestige goals, China may become more interested in partnering on cooperative efforts

[4]Kevin Pollpeter, *Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the U.S. Response*, (Carlisle: Strategic Studies Institute, U.S. Army War College, March 2008), 38-9; and Aerospace Industries Association, *The Role of Space in Addressing America's National Priorities*, (Washington: Aerospace Industries Association, January 2009), 11. Complicating comparisons, there is considerable controversy about the accuracy of reported numbers of engineering graduates as well as questions about the consistency of criteria and accreditation for engineering degrees, see Gerald W. Bracey, "Heard the One about the 600,000 Chinese Engineers?" *Washington Post*, 21 May 2006, p. B3.

[5]Dean Cheng, "Beginning the Journey of a Thousand Miles? Prospects and Pitfalls of US-China Space Cooperation," *The Space Review*, 23 March 2009. Cheng explains that COSTIND "was downgraded in a March 2008 Chinese governmental reorganization, which saw many parts of the space bureaucracy subsumed under, after several iterations, what is now called the Ministry of Industry and Information Technology (MIIT). Yet, there has yet been little indication of whether CNSA remains subordinate to this lower entity (the State Administration for Science, Technology, and Industry for National Defense or SASTIND), is its bureaucratic equivalent, or is now independent of the military-industrial bureaucracy. More troubling is the lack of explanation on how CNSA relates to the PLA, and specifically the General Armaments Department (GAD)—one of the four General Departments that manages the PLA. The GAD is apparently responsible for managing all of China's space infrastructure, i.e., its launch facilities and mission control centers. It will also, according to press reports, be responsible for the new Chinese space lab (the Tiangong). Yet, despite its importance, the GAD is rarely mentioned in official Chinese documents on their space program." Downloaded from http://www.thespacereview.com/article/1335/1 on 18 June 2009.

[6]*Annual Report to Congress: Military Power of the People's Republic of China 2008* (Washington: Office of the Secretary of Defense, Department of Defense, April 2008), p. 3.

[7]*Ibid*.

such as the ISS or other joint projects to pursue the ambitious exploration goals it has espoused that include a permanently inhabited space station and a lunar landing by 2020. It is not clear, however, whether China will continue to pursue civil space objectives primarily unilaterally, will work increasingly with the very diverse members of the Asia-Pacific Space Cooperation Organization (APSCO) it has established,[8] or partner with other major space actors. If China is interested in pursuing cooperative civil space efforts with the United States, it will need to make that more clear than it did to Michael Griffin in September 2006 when he made the first visit by a NASA Administrator to China yet was granted only limited access to his counterpart space decision makers and other space personnel and facilities. The rhetoric during the October 2009 visit of the second-highest ranking PLA member, General Xu Caihou, vice chairman of the Chinese Central Military Commission, to a number of important U.S. locations including the headquarters of Strategic Command, as well as the dialogue between Presidents Hu Jintao and Barak Obama during Obama's November 2009 visit to Beijing offer an opportunity to begin building cooperative space efforts and developing better space and security relationships.

United States and Chinese commercial space objectives probably align most closely but they are also out of sync and face considerable friction due to economic competition, protectionist policies, and export controls. The United States was first to develop space services such as communications, remote sensing, launch, and positioning, navigation, and timing capabilities but did so within the public sector. This approach began to change in the 1980s, first with the November 1984 Presidential Determination to allow some private sector communication services to compete with Intelsat, and continued with subsequent policies designed to foster development of a commercial space sector. By the late 1990s commercial space activity worldwide had outpaced government activity and although government space investments remain very important, they are likely to become increasingly overshadowed by commercial activity. Other clear commercial and economic distinctions with the Cold War era have even more significant implications: whereas the Soviet Union was only a military superpower, China is a major U.S. trading partner and an economic superpower that recently passed Germany to became the world's third largest economy, is poised to pass Japan soon, and is on a path to become larger than the U.S. economy, perhaps within only ten years. Because of its economic muscle, China can afford to devote commensurately more resources to its military capabilities and will play a more significant role in shaping the global economic system. For example, China holds an estimated $1.4 trillion in foreign assets (mainly U.S. treasury notes), an amount that gives it great leverage in the structure of the system.[9]

Beginning in the 1990s, China made major efforts to break into commercial space markets, especially with launch vehicles, but this progress significantly slowed after U.S. aerospace firms Hughes and Loral worked with insurance companies to analyze Chinese launch failures in January 1995 and February 1996. A congressional review completed in 1998 (Cox Report) determined these analyses violated the International Traffic in Arms Regulations (ITAR) by communicating technical information to the Chinese. The

[8]APSCO is headquartered in Beijing and began formal operations in December 2008. China, Bangladesh, Iran, Mongolia, Pakistan, Peru and Thailand are member states and Indonesia and Turkey also signed the APSCO convention

[9]James Fallows, "The $1.4 Trillion Question," *The Atlantic*, January/February 2008.

1999 National Defense Authorization Act transferred export controls for all satellites and related items from the Commerce Department to the Munitions List administered by the State Department.[10] The stringent Munitions List controls contributed to a severe downturn in both U.S. satellite exports and in China's share of the worldwide launch services market.[11] To avoid these restrictions, foreign satellite manufacturers, beginning in 2002 with Alcatel Space (now Thales) and followed by European Aeronautic Defense and Space (EADS), Surrey Satellite Company, and others replaced all U.S.-built components on their satellites to make them "ITAR-free" and Russia now dominates the commercial space launch market.[12] The ITAR irritant in Sino-American commercial space relations can be salved if U.S. export control policy can find a better way to balance the conflicting objectives of developing mechanisms to keep dual-use technologies thought to be dangerous out of the wrong hands while promoting exports of benign commercial space technology. Congress and the Obama Administration should make it a priority to reevaluate current U.S. export controls and adjust policies and regulations accordingly. Excellent starting points are the recently released recommendations for rebalancing overall U.S. export control priorities in the congressionally mandated National Academies of Science (NAS) study.[13] In addition, the United States should implement key recommendations from the Center for Strategic and International Studies (CSIS) study on the space industrial base such as removing from the Munitions List commercial communications satellite systems, dedicated subsystems, and components specifically designed for commercial use.[14]

[10]The January 1995 failure was a Long March 2E rocket carrying Hughes-built Apstar 2 spacecraft and the February 1996 failure was a Long March 3B rocket carrying Space Systems/Loral-built Intelsat 708 spacecraft. Representative Christopher Cox (R.-California) led a six-month long House Select Committee investigation that produced the "U.S. National Security and Military/Commercial Concerns with the People's Republic of China" Report released on 25 May 1999. The report is available from http://www.house.gov/coxreport. In January of 2002, Loral agreed to pay the U.S. government $20 million to settle the charges of the illegal technology transfer and in March of 2003, Boeing agreed to pay $32 million for the role of Hughes (which Boeing acquired in 2000). Requirements for transferring controls back to state are in Sections 1513 and 1516 of the Fiscal Year 1999 National Defense Authorization Act. Related items are defined as "satellite fuel, ground support equipment, test equipment, payload adapter or interface hardware, replacement parts, and non-embedded solid propellant orbit transfer engines."

[11]Satellite builders claim that their exports dropped 59 percent in 2000 and that since March 1999 their share of the global market declined sharply (from 75 percent to 45 percent). Evelyn Iritani and Peter Pae, "U.S. Satellite Industry Reeling Under New Export Controls," *Los Angeles Times*, 11 December 2000, p. 1. According to *Space News*, 2000 marked the first time that U.S. firms were awarded fewer contracts for GEO communications satellites than their European competitors (the Europeans were ahead 15 to 13). Peter B. de Selding and Sam Silverstein, "Europe Bests U.S. in Satellite Contracts in 2000," *Space News*, 15 January 2001, pp. 1 and 20.

[12]Peter B. de Selding, "European Satellite Component Maker Says it is Dropping U.S. Components Because of ITAR," *Space News Business Report*, 13 June 2005; and Douglas Barrie and Michael A. Taverna, "Specious Relationship," *Aviation Week & Space Technology*, 17 July 2006, pp. 93-96.

[13]National Research Council, *Beyond "Fortress America:" National Security Controls on Science and Technology in a Globalized World* (Washington: National Academies Press, 2009). With the new administration and Congress as well as former Congresswoman Ellen Tauscher now confirmed in the key position of Under Secretary of State for Arms Control and International Security, conditions for changing the space export control law are the most favorable they have been for the last decade.

[14]"Briefing of the Working Group on the Health of the U.S. Space Industrial Base and the Impact of Export Controls," (Washington: Center for Strategic and International Studies, February 2008).

Cold War Evolution of Security Space Capabilities and Space Arms Control

Understanding the evolution of space capabilities and negotiations during the Cold War provides an essential foundation for assessing current Sino-American space security issues and evaluating the prospects for space TCBMs. Three major lessons stand out from superpower space security developments during the Cold War: First, the superpowers used space to bolster their strategic warning, communications, and nuclear force structure in significant ways and also conducted extensive testing and limited deployments of ASATs, but both sides chose to end their ASAT deployments without reaching a formal space arms control agreement. Second, the superpowers devoted considerable effort towards negotiations on ASAT arms control and on the Defense and Space Talks but were unable to come close to signing any treaties, agreeing to space "rules-of-the-road," or even defining what constitute offensive or defensive space systems. Finally, all the ASAT testing, deployments, and deactivations show that some level of arms control and stability can be achieved without a formal treaty. For open, pluralist democracies like the United States, arms are *always* controlled as a part of normal debates over guns versus butter and open dialogue about the strategic utility of specific weapons systems. These mechanisms for controlling arms hold the potential to become increasingly important for China if it chooses to embrace democratic processes, publicly debate guns versus butter issues, and engage in transparent dialogue over the strategic utility of space weapons.

The United States began very limited testing of ASAT capabilities in the late 1950s and both superpowers tested and deployed a small number of ASAT systems from the 1960s through the 1980s. From 1963 to 1975, the United States tested and deployed two types of nuclear armed, direct ascent ASAT systems: Program 505, modified Army Nike Zeus missiles stationed at Kwajalein Atoll in the Pacific Missile Range; and Program 437, Air Force Thor missiles on Johnson Island in the Pacific.[15] Between October 1968 and June 1982 the Soviets conducted at least 20 tests of their co orbital ASAT system that employed a warhead with explosively-propelled metal pellets and launched atop a Tsyklon-2 booster from Tyuratam (now Baikonur Cosmodrome in Kazakhstan). By the mid-1970s these ASAT deployments as well as employment of other increasingly comprehensive and mature space capabilities began to reveal basic truths about the attributes of military space systems and the strategic balance in space—many of which remain valid today. A 1976 study for the NSC concluded that a U.S. ASAT would not enhance the survivability of U.S. satellites by deterring use of the Soviet ASAT because the U.S. was more dependent on space than the Soviets.[16] The report also concluded, however, that a U.S. ASAT could be used to counter the threat to U.S. forces posed by Soviet space-based targeting systems such as Radar Ocean Reconnaissance Satellites (RORSATs) and Electronic Intelligence Ocean Reconnaissance Satellites (EORSATs) and that the development of a U.S. system could serve as a "bargaining chip" in possible U.S.-U.S.S.R. ASAT arms control negotiations. In one of the final acts of his presidency, on 18 January 1977 President Gerald Ford signed National Security Decision Memorandum (NSDM)-345, directing the

[15]Paul B. Stares, *The Militarization of Space: U.S. Policy 1945-84* (Ithaca: Cornell University Press, 1985), p. 121.

[16]*Ibid*., 170. The vulnerability of U.S. Defense Support Program ballistic missile launch detection satellites in Geostationary Earth Orbit (GEO) to being "blinded" by Soviet ground-based lasers was apparently first demonstrated in September and October 1975, adding to U.S. concerns about the survivability and utility of its military space assets. See Stares, *Militarization of Space*, 169; and *U.S. Military Uses of Space, 1945-199: Guide and Index* (Washington: National Security Archive, 1991), "Chronology," p. 41.

Department of Defense to develop an operational ASAT system.[17] This initiated the air-launched miniature homing vehicle (MHV) ASAT program and set the stage for two-track ASAT negotiations during the Carter Administration.

U.S. and Soviet negotiators met for three rounds of ASAT talks: 8-16 June 1978 in Helsinki, 23 January-16 February 1979 in Bern, and 23 April-17 June 1979 in Vienna. The two sides apparently were far apart on most issues during the first two sessions and by the third session had drawn closer together but only by limiting the depth and scope of the original objectives. Some of the controversies that have publicly emerged include debates over: an ASAT ban versus limitations or rules of the road; the degree of protection afforded to third-party satellites; long versus short testing moratoria; and how to deal with systems having latent ASAT capabilities—for example, the Soviets insisted that the U.S. Space Shuttle then under development be included as an ASAT system.[18] By the third session, both sides reportedly tabled draft agreements that only covered provisions on "no use" of ASAT weapons but even at this longest negotiating session they were unable to reach closure on this most basic issue.[19] Carter Administration focus on attempting to get the second Strategic Arms Limitation Treaty (SALT II) ratified, the breakdown of U.S.-U.S.S.R. relations following the Soviet invasion of Afghanistan, and the arrival of the Reagan Administration with its initial lack of enthusiasm for arms control spelled the end of the ASAT negotiations.

The 1978-79 ASAT negotiations were the most militarily focused space-related arms control effort of the Cold War era and offers important specific lessons. Failure to reach any agreement at these negotiations underscores significant conceptual and operational difficulties involved in developing meaningful ASAT arms control agreements including strategic and doctrinal conflicts regarding the military utility of space; unavoidable overlaps and dual-use issues with respect to civil, commercial, and military space capabilities; and a lack of clarity regarding foundational definitions as well as the proper scope and object of ASAT arms control. Unresolved ASAT arms control issues at the time included: whether the primary objective should be to ban the development and testing of dedicated ASAT systems or to create TCBMs such as no use pledges, rules of the road, and keep out zones; conceptual and verification problems related to the growing number of systems with significant residual ASAT capability and the considerable military potential of even a few covert ASAT systems; and questions concerning whether the scope of the negotiations should cover some superpower satellites, all military satellites, or

[17]Stares, *Militarization of Space*, p. 171. President Ford apparently was "very upset and concerned about the relaxed approach of the Defense Department" towards developing a new ASAT system and felt "the only thing to do was to issue a formal directive." According to Donald Hafner, an analyst with the NSC ASAT Working Group during 1977-78,: "Secretary of State Kissinger argued that the U.S. should redress any asymmetry in ASAT capabilities between the two sides before any arms control restraints were considered. The directive [NSDM-345] by the Ford Administration to go ahead with the MHV system did call for a study of arms control options, but it did not include any concrete proposal for inviting the Soviets to ASAT talks. Kissinger may have felt it was premature to make such a proposal; or indeed, he may not have favored negotiations at all." See Donald L. Hafner, "Averting a Brobdingnagian Skeet Shoot: Arms Control Measures for Anti-Satellite Weapons," *International Security* 5 (Winter 1980/81), pp. 50-51.

[18] Stares, *Militarization of Space*, p. 197; and John Wertheimer, "The Antisatellite Negotiations," in *Superpower Arms Control: Setting the Record Straight*, eds. Albert Carnesale, and Richard N. Haass, (Cambridge, Mass.: Ballinger Publishers, 1987), pp. 145-46. The ASAT talks, like all serious international negotiations, were conducted in secret in order to encourage candor and flexibility; the negotiation record remains classified.

[19]Stares, *Militarization of Space*, pp. 198-99.

all (including third-party) satellites. Breakdown of these negotiations also highlights difficulties with two-track approaches to arms control. Two-track approaches are seemingly attractive for dealing with divergent positions within an administration but they may actually impede progress towards eventual resolution of policy differences by creating committed constituencies behind each track that oppose the compromises that may be required to create coherent policy. Paul Stares argues that the U.S. two-track approach to ASAT arms control legitimized and perpetuated the MHV ASAT system—a system he believes had value only as a bargaining chip. Finally, failure to reach agreement also highlights what Ashton Carter refers to as the "basic paradox of ASAT arms control:" the inverse relationship between ASATs and incentives to place very threatening military systems in space.[20] This paradox emphasizes that space weapons cannot be divorced from terrestrial security considerations, the natural offense-defense dialectic, and the trade-offs inherent in all strategic thinking. Accordingly, any benefits ASAT arms control may provide in limiting space debris or protecting stabilizing space systems such as those that provide hotlines, early warning, or NTM must be balanced against the role of ASATs in discouraging potentially destabilizing space missions such as space-to-Earth force application. This basic paradox, together with the major conceptual difficulties outlined above call into question the overall desirability of ASAT arms control.

During the 1980s the United States and Soviet Union tested kinetic energy ASAT systems, negotiated, and eventually stopped most testing and deployments. Congress imposed various restrictions on ASAT development and testing in response to the unilateral Soviet ASAT test moratorium announced in August 1983 and questions about the commitment of the Reagan Administration to pursuing ASAT arms control. The timing of the Soviet moratorium was no accident, coming shortly after President Reagan's "Star Wars" speech, a pivotal event which reopened continuing debates over the utility of strategic defenses that overshadow discussions about ASATs and space weapons. In order to justify continuing development and testing, the administration was required to submit to Congress a report, "U.S. Policy on ASAT Arms Control" in March 1984.[21] The report detailed more than four pages of "Problems Facing ASAT Arms Control" and reached the following conclusions with respect to deterrence and ASAT arms control:

> Deterrence provided by a U.S. ASAT capability would inhibit Soviet attacks against U.S. satellites, but deterrence is not sufficient to protect U.S. satellites. Because of the potential for covert development of ASAT capabilities and because of the existence of non-specialized weapons which also have ASAT capability, no arms control measures have been identified which can fully protect U.S. satellites. Hence, we must continue to pursue satellite survivability measures to cope with both known and technologically possible, yet undetected, threats.[22]

[20]Ashton B. Carter, "Satellites and Anti-Satellites: The Limits of the Possible," *International Security* 10 (Spring 1986), p. 68.

[21]Executive Office of the President, "Report to Congress: U.S. Policy on ASAT Arms Control," 31 March 1984; microfiche document 00075 in *Military Uses of Space*. This is the unclassified version of the report; a more detailed classified version was also delivered to Congress at the same time.

[22]*Ibid*., p. 9. The ASAT arms control problem areas listed included: verification, breakout, disclosure of information, definitions, vulnerability of satellite support systems, and the Soviet non-weapon military space threat. Assistant Director of the Arms Control and Disarmament Agency, Dr. Henry F. Cooper, and Deputy Under Secretary of Defense for Strategic and Theater Nuclear

Following this report, the administration was successful in preventing further limitations on ASAT testing and also managed to water down previous restrictions.[23] This allowed the most complete test of the MHV ASAT on 13 September 1985 when it successfully intercepted and destroyed Air Force satellite P78-1 at an altitude of approximately 330 miles.[24] Although just the start of a planned test series, this proved to be the MHV's only test against a satellite in space. A December 1985 congressional amendment banned testing against objects in space unless the President certified the Soviets violated their moratorium by conducting a dedicated ASAT test, effectively giving the Soviets a veto over further U.S. testing.[25] The United States and Soviet Union also conducted years of apparently fruitless negotiations about strategic defenses and space weapons in the Defense and Space Talks begun in 1985. It should be instructive that this was the only category of superpower arms control negotiations started in the 1980s that did not produce a treaty; the Intermediate Range Nuclear Forces Treaty was signed in December 1987 and the Strategic Arms Reduction Treaty was signed in July 1991. Finally, strategic defenses had become the central issue in strategic relations between the superpowers and a catalyst for the end of the Cold War as shown, among other things, by General Secretary Mikhail ***Gorbachev***'s rejection of U.S. proposals at the Reykjavik Summit of October 1986 for continued testing of missile defenses while proceeding over ten years to eliminate all ballistic missiles and thereafter abolish all offensive nuclear weapons, and the end of the Cold War just five years later.

Space in the Sino-American Security Relationship and in a Taiwan Conflict Scenario

Strategic analysts debate whether modern technology can change the basic nature of warfare and how much it has modified fundamental precepts such as mass and the fog of war, but most agree that modern technologies including space capabilities have radically altered the tactics and conduct of war. The evolution of warfare through World Wars I and II showed that coupling the increasingly lethal products of the industrial revolution with improved military organizations and doctrine created a fearsome attrition-based war machine. Modern attrition warfare also necessitated development of what Stephen Biddle calls the modern system: a complex combined arms approach to fire, maneuver, and concealment that enables survival and military effectiveness but requires an adaptive and well trained military to produce the skills required for success in the modern battlespace.[26] The modern system exacerbates disparities in military

Forces, T.K. Jones, did most of the drafting of the report. The Services were not principle participants in any of the discussions leading to this report but they did, along with the Central Intelligence Agency, draft the appendices in the classified version of the report.

[23]Stares, *Militarization of Space*, p. 233.

[24]The Air Force Space Test Program satellite P78-1 was an experimental system launched in February 1979 that was designed to study the sun's corona. P78-1 was still operational in a LEO between 319 to 335 nautical miles in altitude when it was destroyed by the MHV. The last piece of tracked debris from this test did not decay out of orbit until 2002.

[25]On 12 December 1985, immediately prior to this new and much more serious restriction, the Air Force had placed two instrumented target vehicle (ITV) satellites into LEO of approximately 200 by 480 nautical mile orbits. See "Launch Listing" in *Military Uses of Space*, 118-19. These ITVs cost $20 million, had a limited lifetime, and were specifically designed to minimize debris while providing data on MHV intercepts, see Michael R. Gordon, "Air Force to Test a Weapon in Space," *New York Times*, 20 February 1986, p. A18.

[26]Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton: Princeton University Press, 2004).

effectiveness because militaries that lack the resources to adopt a complex combined arms approach or fail to adapt are punished severely in conventional warfare. These factors have also created incentives for development of "hybrid warfare," an approach that attempts to exploit sanctuaries associated with traditional legal constructs for warfare and other vulnerabilities by employing all forms of war and tactics (conventional, irregular, and terrorist), perhaps even simultaneously.[27]

The United States has been at the forefront of employing the modern system and developing a space-enabled global reconnaissance, long-range precision strike complex. Operation Desert Storm in 1991 marked the emergence of space-enabled warfare when a wide range of space systems including those designed for Cold War strategic missions such as the Defense Support Program (DSP) missile launch detection satellites and other constellations that were not yet completed such as the Global Positioning System (GPS) produced transformational effects from the lowest tactical level, for instance guiding individual vehicles across trackless deserts, up through the highest strategic level, including helping to keep Israel out of the conflict. In Operation Desert Storm less than eight percent of air-delivered munitions were precision-guided (none by GPS) and satellites provided only one megabit per second (Mbps) communications connectivity to battalion-sized units deployed in theater; by the time of Operations Enduring Freedom and Iraqi Freedom in 2001 and 2003, almost 70 percent of air-delivered munitions were precision-guided (mostly by GPS) and satellites provided communications at speeds over 50 Mbps to deployed battalions.[28] This acceleration of space enabled capabilities today allows U.S. commanders to draw from worldwide intelligence, surveillance, and reconnaissance (ISR) and analysis, communicate faster, strike more accurately, and assess operational effectiveness in real time. Space capabilities have become so seamlessly integrated into the overall U.S. military structure that commanders can remain focused on strategic objectives instead of making tactical decisions on how to prosecute specific targets. For example, during Operations Enduring Freedom and Iraqi Freedom the majority of aircraft took off on their combat sorties without assigned targets; they were dynamically tasked in flight onto targets that emerged during their sortie or attacked remaining targets assessed as most important after their arrival on station. The United States continues to develop lighter and more easily deployable forces that are better able to leverage space and network-enabled operations and strike more precisely from greater distances to achieve full spectrum dominance over adversaries that may range from emerging military peers to insurgents

[27] Frank G. Hoffman, "Hybrid Threats: Reconceptualizing the Evolving Character of Modern Conflict," Strategic Forum, no. 240 (April 2009), Institute for National Strategic Studies, National Defense University; and Frank G. Hoffman, "Hybrid Warfare and Challenges," *Joint Force Quarterly* 52 (1st Quarter 2009): 34-39. For a more theoretical perspective on the evolving nature of modern conflict, see Thomas A. Drohan, "Clausewitz for Complex Warfare," *The Wright Stuff*, vol. 4, no. 5 (5 March 2009).

[28] Data on Precision-guided munitions and communications are derived from Central Air Forces, "Operation Iraqi Freedom: By the Numbers," Prince Sultan Air Base, Saudi Arabia, 30 April 2003; Benjamin S. Lambeth, *The Transformation of American Airpower* (Ithaca: Cornell University Press, 2000); and Eliot A. Cohen, director, *Gulf War Air Power Survey, Summary Report* (Washington: Government Printing Office, 1993). For viewpoints that deemphasize the role of technological factors in modern warfare see: Stephen Biddle, "Victory Misunderstood: What the Gulf War tells us about the Future of Conflict," *International Security* 21 no. 2 (Fall1996), pp. 139-79; and Darrell Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare," *International Security* 26 no. 2 (Fall 2001), pp. 5-44.

and terrorists. Space-enabled warfare can deliver highly precise effects, minimize collateral damage, and shorten the duration of conflict, but should be part of a balanced portfolio of capabilities that encourages pursuit of political objectives using all appropriate tools of statecraft and reduces temptations to overuse or inappropriately use the military instrument of power.

Of course, it has not escaped notice worldwide that the United States has already employed and continues to develop network-enabled warfare or that space capabilities often provide the best and sometimes the only way to make these kinds of operations possible. The Chinese, in particular, have been among the most careful students of the modern system and U.S. space-enabled military operations over the last generation. They have concluded that information operations and space capabilities are required to fight and win what it refers to as "local wars under conditions of informatization" and are following their own unique path toward improved military potential while making significant efforts both to emulate and counter U.S. space capabilities.[29]

In the past, PLA authors acknowledged that its information systems were incapable of enabling it to act more quickly than the U.S. military and their writings focused more on denying space to potential adversaries. However, as the PLA begins to contemplate using space, it recognizes that it must not only deny the use of information to its opponents but also use space to facilitate its own operations.[30]

Leveraging its latecomer's advantage during its 10th (2001-05) and 11th (2006-10) Five Year Plans,[31] China has moved more quickly in developing a wider range of space capabilities than any previous spacefaring state and today has deployed comprehensive space systems that are less capable but parallel those of the United States in all mission areas except for space-based missile launch detection. China's array of space reconnaissance systems offer increasingly precise visible, infrared, multi-spectral, and synthetic aperture radar imaging and include the *Ziyuan*-2 series, the *Yaogan*-1 through -8, the *Haiyang*-1B, the CBERS-2 and -2B satellites, and the *Huanjing* disaster and environmental monitoring satellite constellation.[32] "In the next decade, Beijing most likely will field radar, ocean surveillance, and high-resolution photoreconnaissance satellites. In the interim, China probably will rely on commercial satellite imagery to supplement existing coverage."[33] For navigation and timing, the Chinese have launched five *Beidou* satellites that provide signals with 20 meter accuracy over China and surrounding areas. China also plans to deploy a more advanced, accurate, and global PNT system known as *Beidou*-2 or Compass comprised of five Geostationary-Earth Orbit (GEO) satellites and 30 Medium-Earth Orbit (MEO) satellites; the Compass-M1 experimental satellite was launched in April 2007. In addition, China has "a very advanced indigenous microsatellite

[29] *Annual Report to Congress: Military Power of the People's Republic of China 2009* (Washington: Office of the Secretary of Defense, Department of Defense, March 2009), p. I.

[30] Pollpeter, *China's Progress in Space Technology*, p. 26.

[31] Parts of China's space goals for its 10th and 11th Five Year Plans were announced publicly; see *ibid*., pp. 3-5 and pp. 19-22.

[32] *Military Power of the People's Republic of China 2008*, 27; *Military Power of the People's Republic of China 2009*, 26. Resolution on *Ziyuan* satellites, for example, has improved from 20 to three meters; see Pollpeter, *China's Progress in Space Technology*, p. 26.

[33] *Military Power of the People's Republic of China 2008*, p. 27.

program"[34] with microsatellites currently deployed for technology development, imagery, remote sensing, and communications missions. Finally, China uses a wide range of foreign and domestic communications satellites, is increasing its military employment of these communications capabilities, and is moving to replace all foreign communications satellites with indigenous satellites by 2010. With launch in April 2008 of its first tracking and data relay satellite (*Tianlian* I) the Chinese have demonstrated the potential to develop a nascent real-time, global reconnaissance strike complex.

China is moving more secretly but probably even more quickly and comprehensively in developing "a multi-dimensional program to limit or prevent the use of space-based assets by its potential adversaries during times of crisis or conflict."[35] The PLA has deployed a variety of kinetic and non-kinetic weapons and terrestrial jammers and is also exploring other counterspace capabilities including in-space jammers, high-energy lasers, high-powered microwave weapons, particle beam weapons, and electromagnetic pulse weapons. In addition, China is "researching and deploying capabilities intended to disrupt satellite operations or functionality without inflicting physical damage."[36] The successful Chinese ASAT test of January 2007 was perhaps most notorious for its dangerous irresponsibility in creating a persistent debris cloud that now accounts for more than 25 percent of all catalogued objects in Low-Earth Orbit (LEO),[37] but the debris the test created should not obfuscate the system's very significant strategic implications given the high-value U.S. assets it can hold at risk in LEO, difficulties in finding and tracking the road-mobile transporter-erector-launcher (TEL) for the *Dong Feng* (DF)-21 (or SC-19) intermediate-range missile that launches the ASAT, and the extremely limited protection measures the United States currently has against this capability. Moreover, the direct ascent ASAT is just one of the many types of counterspace capabilities the Chinese are developing or have already fielded; it may not even be their most threatening or pervasive capability. It is more important to consider the synergistic and tailored benefits China is likely to obtain by employing many counterspace capabilities that operate in different ways against different orbital regimes and mission areas including hundreds if not thousands of high-power mobile terrestrial jammers, high-energy lasers with precision tracking capabilities at multiple sites, and potentially sophisticated in-space jamming and negation capabilities.

Tensions between the United States and China and between Taiwan and China have been easing in a number of ways and this article is not suggesting that conflict over Taiwan is imminent. However, many seemingly irreconcilable issues remain, including the "sacred responsibility" of the PLA in stopping

[34]Steven A. Smith, "Chinese Space Superiority? China's Military Space Capabilities and the Impact of their use in a Taiwan Conflict," (Maxwell AFB, Ala: Air War College, 17 February 2006), p. 15.

[35]*Military Power of the People's Republic of China 2009*, p. 27.

[36]*Military Power of the People's Republic of China 2008*, p. 21.

[37]"Fengyun 1-C Debris: Two Years Later," *Orbital Debris Quarterly News*, Johnson Spaceflight Center: NASA Orbital Debris Program Office, vol. 13, no. 1 (January 2009): 2. As a result of the 11 January 2007 Chinese ASAT test, the U.S. Space Surveillance Network has catalogued 2378 pieces of debris with diameters greater than five centimeters, is tracking 400 additional debris objects that are not yet catalogued, and estimates the test created more that 150,000 pieces of debris larger than one square centimeter. Unfortunately, less than two percent of this debris has reentered the atmosphere so far and it is estimated that many pieces will remain in orbit for decades and some for more than a century.

independence and the "anti-succession" law passed by China's National People's Congress in March 2005; U.S. commitments under the 1979 U.S. Taiwan Relations Act to resist any force or other coercion that threatens Taiwan; and Taiwanese independence aspirations. Taiwan is still clearly the most likely flashpoint for any conflict between the United States and China. Because the PLA is continuously improving the quality and effectiveness of its overall military capabilities and "China's space activities and capabilities, including ASAT programs, have significant implications for anti-access/area denial in Taiwan Strait contingencies and beyond"[38] military analysts must continually assess the correlation of forces in this scenario and statesmen must remain aware of its implications. Michael O'Hanlon's 2004 assessment is both reassuring and sobering, especially given the continuing and accelerating progress of PLA modernization and the considerable stresses placed on U.S. forces by ongoing operations in Iraq and Afghanistan:

> It is doubtful that trends in space capabilities or other aspects of defense modernization will radically alter the military balance in the next decade or so. The size and caliber of the U.S. military is sufficient that, even if China were able to close the technological gap and have the potential to cause substantial losses to the United States in a war over Taiwan, the American armed forces would surely prevail. The United States could lose a carrier or two and still maintain overwhelming military superiority in the region.[39]

In a presentation at the Naval War College in April 2009 Secretary of Defense Robert Gates found adversary development of anti-access/area denial capabilities more troubling and noteda particular concern with aircraft carriers and other large, multi-billion dollar blue-water surface combatants – where the loss of even one ship would be a national catastrophe. We know other nations are working on ways to thwart the reach and striking power of the U.S. battle fleet – whether by producing stealthy submarines in quantity or developing anti-ship missiles with increasing range and accuracy. We ignore these developments at our peril.[40]

A large number of factors and complex interrelationships are involved, but all Taiwan scenarios are fundamentally shaped by a small number of geopolitical factors including the very close proximity of the theater of operations to China and its extreme distance from the United States, very limited basing options for U.S. forces in this region, and the increasing vulnerability of all fixed and even some mobile targets to attack from a growing number of long-range precision strike forces. These factors combine to make the effectiveness of U.S. aircraft carrier battle groups a most important variable in any Taiwan scenario. A key objective for China is to find and strike carrier battle groups as far away from Taiwan as possible; keeping them out of the main fight or at least primarily focused on self-defense. For the United States and Taiwan key objectives include finding and striking a large percentage of landing craft and transport aircraft before they can lodge and sustain an overwhelming number of ground forces on Taiwan.

[38] *Military Power of the People's Republic of China 2009*, p. 25.

[39] Michael E. O'Hanlon, *Neither Star Wars Nor Sanctuary: Constraining the Military Uses of Space* (Washington: Brookings Institution, 2004), p. 97.

[40] Presentation by Secretary of Defense Robert M. Gates at Naval War College, Newport RI, 17 April 2009, available from http://www.defenselink.mil/speeches/speech.aspx?speechid=1346

Space and counterspace capabilities play an increasingly important role for both sides in this scenario. For China, space forces, and space ISR in particular, are needed to find, fix, track, target, engage, and assess strikes on carrier battle groups in near real time. Space links considered necessary for day-night, inclement weather, and near real time operation of this kill chain include high-resolution imagery, tracking and data relay, synthetic aperture radar, wake tracking, and electronic intelligence—all capabilities the Chinese appear to have increasingly emphasized. It is not yet clear that China has networked together all the capabilities required for long-range precision strikes against carrier battle groups let alone what the effectiveness of Chinese forces so employed might be, even before they are attrited by the concentric layers of defenses around carrier battle groups.[41]

Nonetheless, it is apparent that Chinese capabilities for long-range precision strikes against ships have improved significantly; U.S. forces are threatened as they approach what the Chinese call the second island chain that includes Guam, and operate at growing peril the closer they come to Taiwan and the first island chain. The increasingly potent anti-access strike forces the Chinese have deployed or are developing include large numbers of highly accurate cruise missiles, such as domestically produced ground-launched DH-10 land attack cruise missiles, SS-N-22/Sunburn and SS-N-27B/Sizzler supersonic anti-ship cruise missiles mounted on *Sovremennyy*-class guided missile destroyers and Kilo-class diesel electric submarines acquired from Russia, as well as an anti-ship ballistic missile based on a variant of the DF-21 that has a range in excess of 1,500 km and highly accurate maneuvering reentry vehicles with conventional warheads and "terminal-sensitive penetrating sub-munitions" to "destroy the enemy's carrier-borne planes, the control tower and other easily damaged and vital positions."[42] It is also a near certainty that China would mount large-scale counterspace operations, perhaps even as a precursor to other attacks, in any Taiwan scenario. Chinese counterspace operations would likely concentrate on cyber and electronic warfare attacks against U.S. communications and positioning, navigation and timing (PNT) capabilities using terrestrial, airborne, seaborne, and perhaps in-space jammers or ASAT systems. In addition, the Chinese could use their direct ascent ASAT and high-energy lasers to attack U.S. ISR assets in LEO and it is unlikely that either preemptive or reactive maneuvering of these assets would be able to protect them or ensure they could collect on assigned targets.[43]

U.S. and Taiwanese space capabilities and counterspace operations are also critically important, would be highly stressed in defending Taiwan, and would be tested in novel ways since the United States has not yet

[41]The Chinese demonstrated an ability to find carrier battle groups and penetrate their defenses in 2006 when a Chinese submarine surfaced within the perimeter of the Kitty Hawk (CV-63) carrier battle group. See Michele Flournoy and Shawn Brimley, "The Contested Commons," *Proceedings Magazine* Vol. 135 (July 2009).

[42]*Military Power of the People's Republic of China 2009*, p. 21; and Michael Richardson, Beijing Takes Aim at U.S. Aircraft Carriers, *Japan Times*, 22 January 2009. The quotations cited in the DOD report are from an authoritative 2004 article for the second artillery corps and the report also notes that this "capability would have particular significance, as it would provide China with preemptive and coercive options in a regional crisis."

[43]Brian Weeden, "How China 'Wins' a Potential Space War," *China Security*, vol. 4, no. 1 (Winter 2008), pp. 134-47. Weeden explains why it is unlikely a U.S. LEO ISR satellite can be reactively maneuvered away from the direct ascent ASAT after launch and how preemptive maneuvering away from known laser or ASAT launch sites would be likely to preclude these satellites from performing key collection and shorten their mission life.

fought against a space-enabled, near-peer military power. All U.S. space-enabled force enhancement capabilities—ISR, missile warning and attack assessment, communications, PNT, and environmental monitoring—would be challenged in attempting just to establish and maintain a kill chain for the thousands of fixed and mobile targets in the Taiwan theater even without enemy countermeasures; in a degraded electronic warfare environment and under direct attack, their efficacy is likely to be significantly reduced. Under these conditions, projecting strike assets into the theater and maintaining an effective kill chain, especially against the many small and fleeting, mobile targets presented by Chinese landing craft and aircraft, would be a daunting challenge. The United States would also engage in counterspace operations, primarily to disrupt PNT and command and control of landing forces as well as in attempts to deny Chinese ability to track and target carrier battle groups. With respect to the latter counterspace objective in particular, it is noteworthy that O'Hanlon believes the United States could be quite hard pressed to disrupt Chinese ability to target carriers in a Taiwan scenario without ASAT capabilities such as those it demonstrated in February 2008 when an Aegis Cruiser used a Standard Missile-3 to destroy the inoperative USA-193 satellite just prior to reentry.[44]

Prospective TCBMs

Seemingly new focus and direction in space policy initially was provided by a statement on the Obama Administration White House website that appeared on 20 January 2009: "Ensure Freedom of Space**:** The Obama-Biden Administration will restore American leadership on space issues, seeking a worldwide ban on weapons that interfere with military and commercial satellites."[45] The language about seeking a worldwide ban on space weapons was taken from position papers issued during the Obama-Biden campaign but was much less detailed and nuanced; it drew considerable attention and some criticism.[46] By May 2009 the space part of the Defense Issues section on the White House website had been changed to read: "**Space:** The full spectrum of U.S. military capabilities depends on our space systems. To maintain our technological edge and protect assets in this domain, we will continue to invest in next-generation capabilities such as operationally responsive space and global positioning systems. We will cooperate with our allies and the private sector to identify and protect against intentional and unintentional threats to U.S. and allied space capabilities." Ongoing space policy reviews including a congressionally-directed Space Posture Review and Presidential Study Directives on National Space Policy are likely to encourage policies that are more supportive of pursuing TCBMs as well as greater reliance on commercial and international partners.[47]

[44]O'Hanlon, *Neither Star Wars Nor Sanctuary*, 101; Flournoy and Brimley, "The Contested Commons." On the engagement of USA-193 see, in particular, James Oberg, "OPERATION BURNT FROST: Five Myths About the Satellite Smashup," NBC News Analysis, 27 February 2008 and James E. Oberg, "Down in Flames: Media "Space Experts" Flub the Shoot-Down Story," *The New Atlantis*, No. 24 (Spring 2009): 120-29. The last piece of catalogued debris from the destruction of USA-193 reentered on 9 October 2008.

[45]The statement appeared on the Defense Agenda section of the White House website, www.whitehouse.gov.

[46]See in particular, the *Space News* editorial for 2 February 2009, "Banning Space Weapons—and Reality."

[47]Section 913 of the Fiscal Year 2009 National Defense Authorization Act (P.L. 110-417) directs the Secretary of Defense and Director of National Intelligence to

Consideration is also being given to the best ways to reconcile any new approach with fundamental goals in the 2006 U.S. National Space Policy to "oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space" while also encouraging "international cooperation with foreign nations and/or consortia on space activities that are of mutual benefit."[48] Indeed, the United States can expect that it will continue to make the best progress in developing effective, sustainable, and cooperative approaches to space security by building on the ongoing thoughtful dialogue between all major space actors in several venues that emphasizes a number of primarily incremental, pragmatic, technical, and bottom-up steps. Prime examples of this approach include the February 2008 adoption by the United Nations General Assembly of the Inter-Agency Debris Committee (IADC) voluntary guidelines for mitigating space debris and the December 2008 release from the Council of the European Union of a draft Code of Conduct for outer space activities.[49] A key challenge for Beijing and Washington is to find ways to move away from inflexible positions and become more involved with and leverage these processes in both bilateral and multilateral ways.

History suggests there is a very important role for militaries both in setting the stage for the emergence of international legal regimes and in enforcing the norms of those regimes once they emerge. Development of any rules of the road or codes of conduct for space should draw closely from the development and operation of such measures in other domains such as sea or air. The international community should consider the most appropriate times and ways to separate military activities from civil and commercial activities in the building of these measures because advocating a single standard for how all space activities ought to be regulated may be inappropriately ambitious and unhelpful. The Department of Defense requires safe and responsible operations by warships and military aircraft but they do not always follow all the same rules as commercial traffic and often operate within specially protected zones that separate them from other traffic. Full and open vetting of these ideas along with others will help develop space rules that draw from years of experience in operating in these other domains and make the most sense for the unique operational characteristics of space.

Another consideration is the historic role of the Royal and U.S. Navies in fighting piracy, promoting free trade, and enforcing global norms against slave trading. Is there an analogous role in space for the U.S. military and other military forces today and in the future? What would be the space component of the Proliferation Security Initiative and how might the United States and others encourage like-minded actors to cooperate on such an initiative? Attempts to create regimes or enforcement norms that do not specifically include and build upon military capabilities

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submit a Space Posture Review to Congress by 1 December 2009. In addition, the Obama Administration has ongoing Presidential Study Directives that are examining the need for changes to current National Space Policy; see Amy Klamper, "White House Orders Sweeping U.S. Space Policy Review," *Space News*, 15 July 2009.

[48]"U.S. National Space Policy," (Washington, D.C.: The White House, Office of Science and Technology Policy, 14 October 2006), p. 2.

[49]United Nations General Assembly Resolution 62/217, "International cooperation in the peaceful uses of outer space," (New York: UNGA, 1 February 2008) and Council of the European Union, "Council conclusions and draft Code of Conduct for Outer Space Activity, (Brussels: Council of the European Union, 3 December 2008).

are likely to be divorced from pragmatic realities and ultimately frustrating efforts.[50]

There is much consensus on the general direction in which the international space community is moving regarding many space security issues, but, as in so many other critical issue-areas, the devil really is in the details concerning how best to proceed. As the most important first step, the United States and others should work harder to develop more fully and achieve more universal adherence to the Outer Space Treaty (OST) regime. It simply does not make sense to charge far ahead when this foundational piece still has significant gaps in terms of compliance with existing rules and norms. Particular areas that are underdeveloped within the OST regime include the Article VI signatory responsibilities for authorization and continuing supervision over activities of non-governmental entities in space and the Article IX obligations for signatories to undertake or request appropriate international consultations before proceeding with any activity or experiment that would cause potentially harmful interference.

One key way the United States can continue supporting these OST obligations is by making more progress on sharing space situational awareness (SSA) data worldwide by building on the Commercial and Foreign Entities (CFE) program. Following the February 2009 collision between Iridium and Cosmos satellites and increasing motivation to improve the program and provide SSA data to users in more timely and consistent ways, the Fiscal Year 2010 National Defense Authorization Act expanded the CFE pilot program and gave the Secretary of Defense instructions on providing SSA information and services to non U.S. Government entities. One excellent specific goal would be creation of a U.S. Government operated data center for ephemeris, planned maneuvers, and propagation data for all active satellites. Users would voluntarily contribute data to this center, perhaps through a GPS transponder on each satellite, and the data would be constantly updated, freely available, and readily accessible so that it could be used by satellite operators to plan for and avoid conjunctions.[51] Difficult issues that inhibit progress on sharing SSA data include liability and proprietary concerns; data formatting standards and compatibility between propagators and other cataloguing tools, and security concerns over exclusion of certain

[50]On the role of militaries in enforcing legal norms and analogies between the law of the sea and space law, see R. Joseph DeSutter, "Space Control, Diplomacy, and Strategic Integration," *Space and Defense* vol. 1, no. 1 (Fall 2006), pp. 29-51.

[51]SSA issues are framed by specialized concepts and jargon. Conjunctions are close approaches, or potential collisions, between objects in orbit. Propagators are complex modeling tools used to predict the future location of orbital objects. Satellite operators currently use a number of different propagators and have different standards for evaluating and potentially maneuvering away from conjunctions. Maneuvering requires fuel and shortens the operational life of satellites. Orbital paths are described by a set of variables known as ephemeris data; two-line element sets (TLEs) are the most commonly used ephemeris data. Much of this data is contained in the form of a satellite catalog. The United States maintains a public catalog at www.space-track.org. Other entities maintain their own catalogs. Orbital paths constantly change, or are perturbed, by a number a factors including Earth's inconsistent gravity gradient, solar activity, and the gravitational pull of other orbital objects. Perturbations cause propagation of orbital paths to become increasingly inaccurate over time; beyond approximately four days into the future predictions about the location of orbital objects can be significantly inaccurate. For more about SSA concepts see Brain Weeden, "The Numbers Game," *The Space Review*, 13 July 2009; downloaded from http://www.thespacereview.com/article/1417/1. For more details about this approach and other space security ideas fostered by meetings between the Department of Defense Executive Agent for Space and the Chief Executive Officers of commercial satellite communications providers see David McGlade, "Commentary: Preserving the Orbital Environment," *Space News*, 19 February 2007, p. 27.

satellites from any public data. Developing and institutionalizing better ways to address these existing obligations under the OST regime could be one of the most direct and important steps in dealing with many of the most significant current international space security concerns.

Beyond the OST, efforts to craft comprehensive top-down space arms control or regulation with the Chinese bilaterally, or among all spacefaring actors, still face all of the significant problems that plagued attempts to develop such mechanisms in the past. The most serious of these problems include: disagreements over the proper scope and object of negotiations; basic definitional issues about what is a space system and how they might be categorized as offensive or defensive and stabilizing or destabilizing; and daunting questions concerning how any agreement might be adequately verified. These problems relate to a number of very thorny specific issues such as whether the negotiations should be bilateral or multilateral, what satellites and other terrestrial systems should be covered, and whether the object should be control of space weapons or TCBMs for space; questions concerning which types of TCBMs such as rules of the road or keep out zones, for example, might be most useful and how these might be reconciled with existing space law such as the OST; and verification problems such as how to address the latent or residual ASAT capabilities possessed by many dual-use or military systems or deal with the significant military potential of even a small number of covert ASAT systems. New space system technologies, continuing growth of the commercial space sector, and new verification technologies interact with these existing problems in complex ways. Some of the changes would seem to favor arms control and regulation, such as better radars and optical systems for improved SSA and verification capabilities, technologies for better space system diagnostics, and the stabilizing potential of microsatellite-based redundant and distributed space architectures. Many other trends, however, would seem to make space arms control and regulation even more difficult. For example, micro- or nanosatellites might be used as virtually undetectable active ASATs or passive space mines; proliferation of space technology has radically increased the number of significant space actors to include a number of non-state actors that have developed or are developing sophisticated dual use technologies such as autonomous rendezvous and docking capabilities; and growth in the commercial space sector raises issues such as how quasi-military systems could be protected or negated and the unclear security implications of global markets for dual-use space capabilities and products.

The history of top-down approaches to space arms control repeatedly has shown they are not likely to be the most fruitful ways to advance space security, a point strongly emphasized by Ambassador Donald Mahley in February 2008: "Since the 1970s, five consecutive U.S. administrations have concluded it is impossible to achieve an effectively verifiable and militarily meaningful space arms control agreement."[52] Nonetheless, in ways that seem both shrewd and hypocritical, the Chinese are developing significant counterspace capabilities while simultaneously advancing various proposals in support of prevention of an arms race in outer space (PAROS) initiatives and pursuing the Chinese-Russian draft treaty on Prevention of Placement of Weapons in Outer Space (PPWT) introduced at the Conference on Disarmament in February 2008. For the PPWT in particular, while it goes to

[52]Ambassador Donald A. Mahley, "Remarks on the State of Space Security," The State of Space Security Workshop, Space Policy Institute, George Washington University, Washington, 1 February 2008.

considerable lengths in attempting to define space, space objects, weapons in space, placement in space, and the use or threat of force, there are still very difficult and unclear issues with respect to how specific capabilities would be defined. An even more significant problem relates to all the terrestrial capabilities that are able to eliminate, damage, or disrupt normal function of objects in outer space such as the Chinese direct ascent ASAT. One must question the utility of an agreement that does not address the security implications of current space systems to support network enabled terrestrial warfare, does not deal with dual-use space capabilities, seems to be focused on a class of weapons that does not exist or at least is not deployed in space, is silent about all the terrestrial capabilities that are able to produce weapons effects in space, and would not ban development and testing of space weapons, only their use.[53] Given these glaring weaknesses in the PPWT it seems plausible that it is designed as much to continue political pressure on the United States and derail U.S. missile defense efforts as it is to promote sustainable space security.

Other specific Sino-American cooperative space ventures or TCBMs that have been proposed and are worthy of further consideration include: inviting a taikonaut to fly on one of the remaining Space Shuttle missions and making repeated, specific, and public invitations for the Chinese to join the ISS program and other major cooperative international space efforts. The United States and China could also work towards developing non-offensive defenses of the type advocated by Philip Baines.[54] Kevin Pollpeter explains how China and the United States could cooperate in promoting the safety of human spaceflight and "coordinate space science missions to derive scientific benefits and to share costs. Coordinating space science missions with separately developed, but complementary space assets, removes the chance of sensitive technology transfer and allows the two countries to combine their resources to achieve the same effects as jointly developed missions."[55] Michael Pillsbury outlined six other areas where U.S. experts could profitably exchange views with Chinese specialists in a dialogue about space weapons issues: "reducing Chinese misperceptions of U.S. Space Policy, increasing Chinese transparency on space weapons, probing Chinese interest in verifiable agreements, multilateral versus bilateral approaches, economic consequences of use of space

[53]Reaching Critical Will, "Preventing the Placement of Weapons in Outer Space: A Backgrounder on the draft treaty by Russia and China. For an outstanding analysis of trigger events for space weaponization and why space-basing is not necessarily the most important consideration, see Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment* (Washington, D.C.: Center for Strategic and Budgetary Assessments, February 2001), pp. 97-106. Watts argues that: "There are at least two paths by which orbital space might become a battleground for human conflict. One consists of dramatic, hard-to-miss trigger events such as the use of nuclear weapons to attack orbital assets. The other class involves more gradual changes such as a series of small, seemingly innocuous steps over a period of years that would, only in hindsight, be recognized as having crossed the boundary from force enhancement to force application. For reasons stemming from the railroad analogy . . . the slippery slope of halting, incremental steps toward force application may be the most likely path of the two." Watts discusses high-altitude nuclear detonations, failure of nuclear deterrence, and threats to use nuclear ballistic missiles during a crisis as the most likely of the dramatic trigger events.

[54] Philip J. Baines, "The Prospects for 'Non-Offensive' Defenses in Space," in James Clay Moltz, ed., *New Challenges in Missile Proliferation, Missile Defense, and Space Security* (Monterey: Center for Nonproliferation Studies Occasional Paper no. 12, Monterey Institute of International Studies, July 2003), pp. 31-48

[55] Pollpeter, *China's Progress in Space Technology*, pp. 48-50.

weapons, and reconsideration of U.S. high-tech exports to China."[56]

Bruce MacDonald's report on *China, Space Weapons, and U.S. Security* for the Council on Foreign Relations offers a number of noteworthy additional specific recommendations for both the United States and China including: For the United States: assessing the impact of different U.S. and Chinese offensive space postures and policies through intensified analysis and "crisis games," in addition to wargames; evaluating the desirability of a "no first use" pledge for offensive counterspace weapons that have irreversible effects; pursuing selected offensive capabilities meeting important criteria—including effectiveness, reversible effects, and survivability—in a deterrence context to be able to negate adversary space capabilities on a temporary and reversible basis, refraining from further direct ascent ASAT tests and demonstrations as long as China does, unless there is a substantial risk to human health and safety from uncontrolled space object reentry; and entering negotiations on a [kinetic energy] KE-ASAT testing ban. MacDonald's recommendations for China include: providing more transparency into its military space programs; refraining from further direct ascent ASAT tests as long as the United States does; establishing a senior national security coordinating body, equivalent to a Chinese National Security Council; strengthening its leadership's foreign policy understanding by increasing the international affairs training of senior officer candidates and establishing an international security affairs office within the PLA; providing a clear and credible policy and doctrinal context for its 2007 ASAT test and counterspace programs more generally and addressing foreign concerns over China's ASAT test; and offering to engage in dialogue with the United States on mutual space concerns and become actively involved in discussions on establishing international space codes of conduct and confidence-building measures.[57]

Finally, Beijing and Washington should pursue specific initiatives to follow-up on the cooperative dialogue during the visits of General Xu Caihou and President Obama as well as initiating discussions about recent statements by General Xu Qiliang, Commander of the PLA Air Force (PLAAF), that a space arms race is inevitable and the PLAAF must develop offensive space operations.[58] President Hu quickly repudiated these statements but the two sides need to find a way to initiate and sustain focused discussions about the difficult space security issues raised by the General's statements since they represent an unprecedented level of public transparency on the part of the PLA, undoubtedly reflect the position of the PLA and other important stakeholders within the Chinese government, and represent an inherent part of the context for space security about which the United States and China must develop better shared understanding. Counterintuitively, Beijing and Washington can lay a stronger foundation for sustainable space security through transparent dialogue over these most difficult issues rather than by trying to avoid them since more diplomatic approaches may assuage but cannot eliminate the growing strategic and military potential of space capabilities.

[56]Michael P. Pillsbury, "An Assessment of China's Anti-Satellite and Space Warfare Programs, Policies, and Doctrines," Report prepared for the U.S.-China Economic and Security Review Commission, 19 January 2007, 48.

[57]Bruce W. MacDonald, *China, Space Weapons, and U.S. Security* (New York: Council on Foreign Relations, September 2008), pp. 34-38.

[58]Kathrin Hille, "China General Sees Military Space Race," *Financial Times*, 3 November 2009.

Most importantly, even if these approaches do improve space transparency and cooperation with China, the United States still bears unilateral responsibilities to improve sustainable space security by better protecting its space capabilities. It is simply irresponsible and untenable for the nation to continue building space systems that are increasingly important and vulnerable. The United States should improve the protection of all space capabilities that support national security through a multifaceted political and technical approach that includes denial, deception, assurance, dissuasion, deterrence, changed employment strategies, hosted payloads, international coalition architectures, technical solutions, and passive and active measures. One of the best technical approaches to accomplishing these objectives would be for the United States to change the space paradigm by emphasizing flexible distributed architectures and sparse arrays consisting of many networked microsatellites in multiple orbits that are able to perform a range of missions as well or better than missions performed by constellations with small numbers of single function satellites and, even more importantly, radically reduce the vulnerabilities inherent in space systems with just a few nodes. Proliferation of the wide range of current and projected threats to all orbital regimes, combined with the intrinsic fragility of space systems and the predictability of their operations indicate that distributed architectures must at least supplement, if not eventually replace, current architectures if space systems are to remain operationally relevant in an increasingly contested domain.

As the most important first steps in implementing specific protection measures, the United States should ensure critical infrastructure protection and continuity of operations by eliminating critical single points of failure on the ground and hardening LEO satellites against total radiation dose failures following high altitude nuclear detonations. A second essential step is to implement and institutionalize the protection standards for all future NSS systems called for in the national security space (NSS) Protection Strategy Framework signed by DOD Executive Agent for Space Peter Teets in March 2005. In addition, all future national security space acquisitions should be required to perform a cross-domain analysis of terrestrial alternatives and the space portion should consider tradeoffs between traditional architectures and microsatellite distributed architectures as well as explicitly evaluating many factors beyond just costs such as persistence, survivability, and space industrial base considerations. Increased effort towards this goal is urgently need now and it is particularly important that the Air Force Space and Missile Systems Center (SMC) and the NRO adopt this approach but moving these organizations toward this approach will be a difficult challenge since they are the centers of current NSS acquisition efforts that have evolved, with good reasons, towards larger and more capable but very small numbers of satellites in most current architectures.[59] Other important steps towards better capability protection that have been initiated or should be undertaken include: developing responsive space capabilities through the Operationally Responsive Space Office that was established at Kirtland AFB in May 2007 and other approaches; funding protection efforts commensurate with their importance;

[59]Outstanding and comprehensive technical evaluations of the prospects for moving toward distributed architectures are provided in: Gregory A. Orndorff, Bruce F. Zink, and John D. Cosby, "Clustered Architecture for Responsive Space," AIAA-RS5 2007-1002, (Los Angeles: American Institute for Aeronautics and Astronautics, 5th Responsive Space Conference, 23-26 April 2007), and Mr. Naresh Shah and Dr. Owen C. Brown, "Fractionated Satellites: Changing the Future of Risk and Opportunity for Space Systems," *High Frontier* vol. 5, no. 1 (November 2008), pp. 29-36.

development of a comprehensive space protection strategy and creation of the joint Air Force Space Command-NRO Space Protection Program in July 2008; use of wargames, "crisis games," and simulations to explore and refine space deterrence concepts and develop shared understanding about specific "red lines" for deterring potential attacks against satellites that support U.S. national security; and multifaceted approaches to raise awareness about space dependency and vulnerabilities as well as adopting a "whole of government, whole of nation, and whole of coalition" approach to address these interdependent issues.[60]

[60]U.S. Representative Terry Everett, "Work Worth Doing," *High Frontier* vol. 5, no. 1 (November 2008), pp. 2-6.

UNITED STATES–CHINA ENGAGEMENT ON SPACE: A ROLE FOR CANADA

WADE HUNTLEY

Introduction[1]

As advancing technologies expand the scope of human activities in space, the international security implications of these activities have become increasingly contested. For the United States, military space capabilities now serve integral roles in a spectrum of terrestrial needs, and sustaining U.S. security interests in space has become a key concern for many military planners. Meanwhile, the space technologies of many other countries are developing rapidly. Although an outright challenge of the U.S. position is not yet imminent, some countries already possess asymmetric capabilities posing genuine threats to U.S. space operations.

The relationship of the United States and China with respect to security uses of space has emerged as a focal point of these concerns. The advancement of Chinese space capabilities was showcased positively by its achievement of human orbital flight in October 2003 and more negatively by its missile destruction of a defunct weather satellite in January 2007, demonstrating anti-satellite (ASAT) capabilities. The February 2008 U.S. missile destruction of a failed U.S. satellite provided a counterpoint to the emerging U.S.-China military rivalry in space. The U.S.-China space rivalry is woven through the fabric of these countries' broader political relationship, involving nuclear deterrence and missile defense, and overshadowed by the volatile and enduring problem of Taiwan. Yet that broader relationship also has positive attributes. Beyond Taiwan, the U.S. and China have few pointed geopolitical conflicts and successfully collaborate on some security problems, as for example in the Six-Party Talks process aiming to de-nuclearize North Korea. China's economic liberalization saps the ideological ferocity that defined U.S.-Soviet relations for decades; U.S.-China trade volume is now hundreds of billions of dollars annually, and engagement of China on international finance, climate change, global health, product safety and other issues promotes professionalism in their interaction. Due to its far-reaching impact, the U.S.-China bilateral relationship is increasingly becoming the axis around which the rest of the world revolves.

As a case in point, Canada has specific interests in many of the issues for which the U.S.-China relationship is the central feature, and so observes developments in that relationship closely. Canada's integral ties to the U.S. are well known. Canada also maintains unique and familiar ties to China, sustained in part by domestic demographics – 1.3 million Canadians, some four percent of the population, are of Chinese origin.[2] While economic and trade issues are perhaps at the forefront, security questions are close at hand

[1] Portions of this work draw on "Canada-China Space Engagement: Opportunities and Prospects, "Canadian International Council Canada-China Project, December 2009.

[2] Following the post-1980 wave of immigration, Chinese are now the largest visible minority group in Canada, with heterogeneity of origin including mainland China, Taiwan and Hong Kong. See David Zweig, "A Limited Engagement: Mainland Returnees from Canada," Research Report, Asia Pacific Foundation of Canada, December 19, 2008 (http://www.asiapacific.ca/research-report/limited-engagement-mainland-returnees-canada); and Shibao Guo and Don J. DeVoretz, "The Changing Face of Chinese Immigrants in Canada," Institute for the Study of Labor Discussion Paper No. 3018, August 2007 (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1012808#).

and space security specifically is a key concern.

The Canadian government has a longstanding and highly refined interest in the future of space security (described more fully below). Canada has historically been among the world's most active states seeking to prevent deployment of weapons in space, operating through multilateral forums and other diplomatic avenues to address questions of definitions, transparency, entry-into-force and verification. At the same time, Canada also has a space program of its own– uniquely accomplished for a country of its size– and has had a cooperative relationship with the U.S. on military space uses, such as early warning satellite information, since the earliest years of the Cold War. The high level of public attention to both sides of Canada's space interests was vividly displayed by the contentious and controversial decision of the Canadian government in February 2005 not to join US continental missile defense development efforts, under the auspices of the North American Aerospace Defense Command (NORAD), largely on the basis of concerns over connections to space weapons planning.[3]

These viewpoints reflect two underlying tensions that animate Canadian international policy-making. The first tension, distinct to countries of modern development levels and moderate size, is between conceptions of national interest and conceptions of what might be termed "international interest." This follows from the high permeation of and sensitivity to global circumstances characteristic of developed middle powers. Thus, there is little parallel in Canada to the isolationist streak in U.S. international policy; Canadian debates tend to be framed in terms of how, rather than whether, to be "in the world."[4]

The second tension, more unique to Canada, is between seeking national objectives, and specifically security objectives, either through the intimate relationship with the U.S. or through broader multilateral structures. This tension often converges with the first but is functionally distinct in the sense that either set of interests might potentially be pursued through either type of relationship.[5]

These outlooks animate Canadian observation of the percolating U.S.-China rivalry in space, in terms of both direct impact on Canadian national security interests and broader impact on international security interests. Many Canadians in and out of government are interested in opportunities to contribute positively to ameliorating these concerns through both multilateral mechanisms and through the unique relationship with the United States – and, if possible, through direct Canada-China engagement as well. Facilitating U.S.-China engagement on space aiming to resolve tensions and establish an environment for secure and peaceful use of space contributes directly to addressing core Canadian concerns.[6]

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[3] For contrasting assessments see James Fergusson, "Shall We Dance? The Missile Defence Decision, NORAD Renewal, and the Future of Canada-US Defence Relations," *Canadian Military Journal,* Summer 2005 (http://www.journal.forces.gc.ca/vo6/no2/inter-01-eng.asp); and Steven Staples, *Missile Defence: Round One* (Lorimer, Oct 3, 2006; ISBN: 1550289292).

[4] For a notable exposition see Jennifer Welsh, *At Home in the World: Canada's Global Vision for the 21st Century* (HarperCollins: 2004). This work was widely circulated and discussed in Ottawa, framing then-current debates over the future of Canada's international role.

[5] These observations are elaborated in the following section.

[6] For a recent articulation of Canada's space interests, see Candace Mergle, Representative of Canada to the First Committee of the 64th Session of the U.N. General Assembly, "Statement on the Prevention of an Arms Race in Outer Space," Permanent Mission of Canada to the United Nations New York, October 19,

This article considers the question of Canadian engagement of the U.S.-China relationship on space issues. The next section briefly reviews key elements in the development of Canada's space capabilities, interests, and relationships, concluding with a skeletal explanation of the sometimes contradictory nature of Canadian values and objectives with respect to the future uses of space. The following section applies this discussion specifically to the question of which Canadian roles would be most efficacious, and which not, with respect to U.S.-China space engagement.

Canada in Space

As a "moderate" global power, Canada enjoys a highly developed industrial/information economy and standards of living, but its relatively small population limits the absolute global impact of its qualitatively high material capabilities. Canada's space accomplishments stand out; but given its smaller absolute size and the large scale required for space activities, these accomplishments have depended upon a continuing secure and peaceful space environment.

The cornerstone of Canada's space activities has been effective partnerships, by far most importantly with the U.S.[7] In the earliest period of space exploration, the prospect of Canada-U.S. cooperation was much more attractive for Canada, which accordingly sought to identify activities that would be useful for Canada, while eliciting active U.S. interest. Cooperative Arctic defense and scientific activities provided an optimal combination of benefits. Satellites offered to provide vitally needed reliable communications among the small and isolated populations in the harshest reaches of the country as well as a wealth of atmospheric and weather data. Effective communications also served the critical shared U.S.-Canada Cold War concern to support systems providing early warning of Soviet attack.

The first fruit of this cooperation was the *Alouette-1* satellite. When launched into low Earth orbit (LEO) in September 1962, this satellite made Canada the third state to enter outer space. Measuring electron density in the ionosphere, the satellite's mission aimed to improve communications for both military and civilian purposes.[8] This clear dual-use function exemplified the equivalent importance of social/economic and security purposes for Canadian space activities. The equivalent concern for the civil and military space sectors became a defining motif of Canadian space outlooks.

This early collaboration also expressed what grew into two prominent tactical features of Canadian space efforts. One was to concentrate on opportunities to cooperate with the U.S. that fit an independent national space agenda. The second was to focus not on becoming a minimally independent space power, but on developing specific roles and excelling in "niche" capabilities that would entail significant, if selective, technology and information flows to and from larger partners. Canada sought to use this strategy to take part in advanced space achievements, stay at the leading edge of space technologies and leverage these capabilities for long-term national economic competitiveness.[9]

2009 (http://www.canadainternational.gc.ca/prmny-mponu/canada_un-canada_onu/statements-declarations/peace-paix/20091019_ArmsRaceSpace-CourseArmementEspace.aspx).

[7] For one review see Roger Handberg, "Outer Space as a Shared Frontier: Canada and the United States, Cooperation Between Unequal Partners," *American Behavioral Scientist* 47:10 (June 2004).

[8] "Alouette I and II," Canadian Space Agency (http://www.asc-csa.gc.ca/eng/satellites/alouette.asp)

[9] Canadian Space Agency, *State of the Canadian space sector 2000* (Saint-Hubert: Author, External Relations Directorate, 2002).

The "niche" strategy enabled Canada to offer tangible value in cooperation with the U.S. in civil activities, as demonstrated by the next major opportunity: Canada's role as the developer of remote manipulator arm, the "Canadarm," for the U.S. Space Shuttle program. The Canadarm provided a visibility previously lacking for Canada's space program and facilitated Canadian astronauts reaching space for the first time. U.S.-Canadian space cooperation deepened further with the International Space Station (ISS) program: Canada's eventual development of the two manipulator units was the first time the U.S. approved a Canadian role in a "critical pathway"− activities or actions that absolutely must be accomplished for the program to succeed.

At the same time, Canada increasingly pursued national capabilities in commercial areas. The 1972 launch of the first Anik satellite created a national Comsat system, Telesat Canada, independent of the then U.S.-dominated Intelsat. Continuing efforts in this vein led to *Radarsat-1*, a remote sensing satellite, launched from the Space Shuttle in 1995, capable of producing military-quality, all-weather radar images across the globe. As Canada's commercial interests and achievements grew, however, they also generated friction, as the U.S. resisted providing launch services for commercial competitors to U.S. satellites.

Meanwhile, in the late 1990s, notorious worries over increasing Chinese efforts to surreptitiously obtain U.S. high technology capabilities was a factor leading to a tightening of U.S. export control mechanisms, including return of U.S. export control authority on dual-use space technologies from the Commerce Department to the State Department. In 1999, the U.S. withdrew its exemption for Canada, and other US allies, to the restrictions of the U.S. International Traffic in Arms Regulations (ITAR), significantly limiting Canadian technology exchanges with the U.S. Canada was able to partially restore these exchanges through implementation of parallel export controls under its Controlled Goods Program (CGP), however, those controls impinged on technology cooperation with non-U.S. partners.[10]

These types of factors decisively constrained Canada's development of the successor *Radarsat-2*. The new ITAR restrictions, which encompassed concerns over Canada's intentions to make high quality Radarsat imagery commercially available, forced *Radarsat-2*'s Canadian contractor, MacDonald, Dettwiler and Associates (MDA), to sever its contract with Orbital Sciences' space systems group to provide the primary satellite platform. By this time, however, Canada had other partnership opportunities; *Radarsat-2* was instead developed with European collaboration (Italy's Alenia Spazio provided the platform) and launched by Russia in Kazakhstan.[11] Canada subsequently adopted legislation specifically seeking to assuage US concerns over access to *Radarsat-2*'s advanced remote sensing capabilities.[12]

[10] Eric Choi and Sorin Nicelescu, "The Impact of US Export Controls on the Canadian Space Industry," *Space Policy* 22 (2006), pp. 29-34.

[11] Canadian Space Agency, *Radarsat, Annual Review 1998/99* (Saint-Hubert: Author, 1999); cf. Dave Caddey, "Radarsat-2: A cautionary tale," *Aerospace America,* January 2001 (http://www.aiaa.org/Aerospace/Article.cfm?issuetocid=45&ArchiveIssueID=9); J. Bates, "Canadian Military Mulls Tandem Radarsat Mission," *Space News*, May 13, 2002.

[12] "Bill C-25: An Act Governing the Operation of Remote Sensing Space Systems," prepared by Lalita Acharya, Science and Technology Division, Library of Parliament, Government of Canada, December 20, 2004 (http://www.parl.gc.ca/common/Bills_ls.asp?Parl=38&Ses=1&ls=C25).

The conflict over *Radarsat* illustrates how, as Canada's space activities developed, tensions emerged between predominant U.S. security concerns and Canada's emphasis on commercial opportunities and reliance on a peaceful space environment. As U.S. military space activities were kept obscured and cooperation with Canada was increasingly channeled through NASA, military space activities for Canada either declined in relative importance or were pursued more independently. For example, Canada will soon have its first dedicated military satellite.[13] Meanwhile, its expanding civil activities fueled interest in securing peaceful use of space through international cooperation. Canada became a leader of efforts to construct a space legal regime, joining in drafting the first international space treaties at the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), and has also pressed at the UN Conference on Disarmament for work to proceed on a Prevention of an Arms Race in Outer Space (PAROS) treaty, sometimes collaborating with China and Russia.[14] Many in Canada perceived that, in light of its otherwise close relationship, demonstrating a measure of independence from the U.S. military space ambitions enabled Canada to more easily take advantage of opportunities for cooperation with other states. At the same time, Canada continued to face the same dilemma of many other countries in enhancing its security through both independent uses of space and multilateral arms control.

Radarsat became an issue again in 2008 with the announcement that MDA, by then Canada's largest space technology firm, had agreed to sell its space division, including rights to the data from the just-launched *Radarsat-2*, to U.S.-based Alliant Techsystems. The proposed sale generated immediate controversy on several fronts. Many viewed the turnover of Canada's showcase independent space achievement as tantamount to selling off the family heirlooms– all the more galling given the degree of taxpayer investment in development of the satellite. Others connected the sale to Canadian resistance to U.S. military space planning, noting the role of Alliant as a U.S. defense contractor and the high quality of *Radarsat-2's* imaging data. Some long-time observers of Canadian space activities lamented less the immediate loss of control over *Radarsat-2* than the longer-term impact that the loss of the space division as a whole represented for Canada's future space technology development capacities. Coalescing politically, these concerns impelled the government in May 2008 to invoke the Investment Canada Act to block the sale on national interest grounds – the first such veto after some 1600 reviews of over 10,000 foreign takeovers.[15] The episode once

[13] Chris Wattie, "Canada will launch own spy satellite: Project Sapphire," *National Post,* November 14, 2006, p.A6; "MDA Awarded Definition Phase Contract For Canadian Space Surveillance System," Press Release (http://www.mda.ca/corporate/news/pr/pr2005011101.html). See also Paul Maskell & Lorne Oram, "Sapphire: Canada's Answer to Space-Based Surveillance of Orbital Objects," Canadian Forces Surveillance of Space Project, n.d. [2008] (http://appspacesol.com/pdf/sapphire.pdf).

[14] "Space Security," Canadian Department of Foreign Affairs and International Trade, July 15, 2008 (http://www.international.gc.ca/arms-armes/non_nuclear-non_nucleaire/space_security-securite_spatiale.aspx?lang=en&menu_id=120&menu=R).

[15] Andrew Mayeda and David Akin, "Ottawa blocks sale of space agency to U.S. firm," Canwest News Service, April 10, 2008 (http://www2.canada.com/montrealgazette/ news/story.html?id=6426dd8d-ab10-426b-9f60-358c1fea7b9b&k=35463); "Govt. confirms decision to block sale of MDA space division," CBC News, May 9, 2008 (http://www.cbc.ca/money/story/2008/05/09/alliant-sale.html). See also Jessica West, "Radarsat-2: Launched and lost?," The Ploughshares Monitor 29:1, Spring 2008 (http://www.ploughshares.ca/libraries/monitor/monm08d.pdf); and Michael Byers, "For Sale: Arctic Sovereignty?" *The Walrus* June 2008 (http://www.walrusmagazine.com/articles/2008.06-

again highlighted the tension between intimate cooperation with the U.S. and maintaining independent capabilities and policies that has defined Canadian space activities for decades.

Presently, Canadian space activities have reached a crossroads. Many past projects are now concluding with commitments to future projects indeterminate, particularly in light of limited budgets for new initiatives. Additionally, the tensions among Canada's disparate space activities reflect divisions among internal bureaucratic orientations, exacerbating the challenges of coherent national planning. Much current debate now centers on whether Canada needs a single national space policy, what that policy would be, and how it would function as to organize the disparate agencies and private actors currently pursuing their own space-related agendas.[16]

To many US analysts, the tension inherent in the Canadian position appears puzzling, if not contradictory. But there is a consistency underlying Canada's seemingly "zig-zag" course on space activities, stemming from its interests and capabilities as a "moderate" power. Given the high costs of entry, military space, like nuclear deterrence, is a realm of principally the great powers, underscoring the salience of military uses of space and reinforcing these states' competitive and self-reliant nature in it.[17] Other states, disempowered in military space, tend to regard it as a realm of lawlessness where potential conflict could easily spill over to impact their own interests. Instead, moderate powers prioritize civil space, a realm where potential collaborations and niche roles offer opportunities of access and advancement of interests. Conversely, great powers are more prone to subsume civil space activities to military space concerns – security issues take priority, with civilian capabilities becoming national "assets."[18]

This disposition toward civil space activities does not mean moderate powers are unconcerned about space security issues. In fact, the opposite often holds: as common consumers of space-based communications and imaging products, moderate powers tend to perceive a keen interest in activities there, and sensitivity to their own vulnerabilities regarding those activities. But moderate powers tend to lack the capabilities to influence events in space, particularly in conflictual situations. This gap between interests and capabilities magnifies the predisposition of moderate powers to develop other means of securing their security interests.

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technology-for-sale-arctic-sovereignty-radarsat-mda-michael-byers/).

[16] Author's observations drawn from participation in several forums on these topics.

[17] For a thorough overview, see Barry D. Watts, "The Military Use of Space: A Diagnostic Assessment," Center for Strategic and Budgetary Assessments, February 2001 (http://www.csbaonline.org/4Publications/PubLibrary/R.20010201.The_Military_Use_o/R.20010201.The_Military_Use_o.pdf). With respect to this generalization, Israel's independent space capabilities represent in some respects the exception that proves the rule, while in other respects – the relatively small scale of its military program and its longstanding reliance on U.S. support – not an exception at all.

[18] While in the U.S. there is political and programmatic demarcation between civil and military space activities, there is also spillover between the sectors and the generally perceived security interest flowing from any perceived threats to vital commercial capabilities. U.S. military reliance on commercial communication bandwidth in certain circumstances is a poignant example; for assessments see Patrick Rayermann, "Exploiting Commercial SATCOM: A Better Way," *Parameters*, Winter 2003-04, pp. 54-66 (http://www.carlisle.army.mil/usawc/Parameters/03winter/rayerman.htm); Benjamin D.Forest, "An Analysis of Military Use of Commercial Satellite Communications," Master's Thesis, Naval Postgraduate School, September 2008 (http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA488621).

The search for security through novel means characterizes moderate power behavior more generally. Great powers tend to focus on securing their interests with indigenous resources. Moderate powers, however, must be concerned not only for the great powers' disposition – friend or foe – but also their attention: a principal objective is to prevent the greater powers from impinging on interests merely out of ignorance or apathy. Hence, moderate powers focus on developing relationships. Such relationships may take the form of a bilateral collaboration with a greater power or multilateral participation in a global regime. Both alliances and treaties can help assure moderate powers that their interests will be acknowledged and recognized over time.

Herein is found the common core of the Canada's otherwise divergent behavior on space activities. Canada's collaborations with the U.S. on space-related efforts and its active pursuit of an international agreement to prevent weaponization of space both reflect the pursuit of security interests through relationship formation. Both efforts seek to advance the view that a peaceful space environment is a prerequisite to securing the full range of Canada's space-related activities.[19]

Canada, China and Space

Today, China is in many respects emerging as a "great power" in the space domain. The U.S.-China interaction on space activities expresses many typical features of a great power rivalry, though one more akin to the managed European rivalries of the nineteenth century than the ideologically oriented superpower rivalry that defined the twentieth century. Canada, conversely, brings a quite different moderate power perspective to space development generally, and to the emerging U.S.-China relationship in space particularly. Canada's intimate familiarity with the United States and, to a lesser extent, China, enriches this perspective. In some respects, Canada can see both these countries in ways they cannot see themselves or each other. As the United States and China seek to manage their relationship, they may find considerable value in the unique and informed perspectives that Canada's government, commercial enterprises and expert communities can offer. Canada, for its part, can find new opportunities to maintain its own interests through such roles.
Possible future Canadian initiatives with respect to the United States, China, and space divide into two categories. The first comprises the bilateral Canada-China relationship on space, and how development of that relationship would bear on U.S.-China engagement. The second category focuses on whether and how Canada could help facilitate the U.S.-China relationship directly.

Across both these categories, Canada can draw on and enhance its previous relationships with these two countries. As noted above, Canada's cooperation with the U.S. in space has a long history. Canada today also has productive collaborative relationships with ESA and other partners, such as Japan.[20] Canadian ties on space with China are less developed, but their prior engagement on promoting multilateral regime solutions to military and civil space challenges provides a foundation for growing Canada's role.

[19] For an elaboration of these observations see Wade L. Huntley, "Smaller State Perspectives on the Future of Space Governance," *Astropolitics* 5:3 (Fall 2007), pp.237-71, at pp.252-7.

[20] Lydia Dotto, *Canada and the European Space Agency: Three Decades of Cooperation*. (Norodwijk, Netherlands: European Space Agency Publications Division, 2002); Daniel Sorid, "Japan to Sign Space Accord with Canada," Space.com News, September 10, 1999 (http://www.space.com/news/japan_canada.html).

One big obstacle to advancing Canada-China space cooperation concerns restrictions on transfers of technology and information with security-related applications. This obstacle traces back directly to ITAR-related constraints given by the importance of the Canada-U.S. relationship and continuing Canadian concerns over Chinese industrial intelligence interests. For Canadian private firms and civil agencies interested in developing new initiatives with China, these restrictions loom large. Many commercial enterprises perceive that the restrictions are excessively cumbersome, with numerous prohibited exports listed unnecessarily. Limited resources restrain organizations from hacking through the restrictions to determine their precise limitations. The reputation of ubiquitous difficulties garnered by contemporary export controls dampens interest in investing in relationships where fulfillment is uncertain or pursuing potentially problematic partnerships, sometimes beyond what the actual restrictions would require. China in particular is in a "category of its own" with respect to restrictions, exacerbating these difficulties.

New initiatives in China-Canada engagement can focus on overcoming such obstacles. For example, there are entire categories of potential cooperation, not involving technology exchanges, which might be fruitfully pursued. One possibility is to focus on joint utilization of information already being generated from existing space-based systems rather than on the joint development of new systems. This could include creating a common collection system and database for information on environmental monitoring and ocean research and convening joint scientific panels to generate new ideas for collaboration. Initiatives could also focus on identifying collaborations leveraging comparative advantages, such as combining Canada's experience in deep space exploration and China's launching capabilities to develop a partnership in a relatively non-controversial area.

Of course, any Canada-China cooperative effort in space would need to serve the aims of each country's own programs. But building cooperative linkages on space, either bilaterally or in a multilateral institutional context, would also serve to bolster the broader bilateral relationship, which is itself an inducement complementing specific project benefits. Expanding space cooperation between these two countries could also produce benefits for Chinese engagement on space with the United States and other countries.

One area offering potentially broadly applicable benefits is the issue of transparency. Many observers experience frustration over China's reticence to release information concerning its military and security capabilities and behavior, notably in the area of space activities. This opacity is particularly perplexing when the information in question is relatively innocuous and/or already in the public domain through non-Chinese sources, and even cited by Chinese analysts themselves. In such cases, some suggest, China's unwillingness to validate and/or clarify information serves no strategic purpose and fuels an atmosphere of suspicion. Defenders of China have offered a number of answers to these contentions: China does not want to confirm information that might still be uncertain or that would be embarrassing domestically; China sometimes sees the call to "transparency" as a guise for intrusiveness or espionage; and, in any event, China is slowly getting better.

The focus on information, however, obscures a potentially more fruitful dimension for promoting transparency – people. Learning more accurately how Chinese space activities

are bureaucratically organized and identifying key decision-makers, both formal and informal, can enhance transparency as much or more than sharing detailed technical data or sensitive policy directions. Focusing transparency-oriented initiatives on "who" rather than "what" would also facilitate the development of personal relationships in specific sectors. A deeper Canada-China relationship on space activities would doubtlessly expand linkages in civil and commercial sectors, but would likely also facilitate exchanges on security matters, increasing knowledge of Chinese actors and perspectives in that area as well.

Attention to this interpersonal dimension of building a better understanding of China's space interests and behavior reflects the penchant for relationship development that typifies moderate powers' approaches to international relations. In other words, the proclivity for relationship-building of moderate powers, such as Canada, can be an important asset to successfully engaging China on space issues in ways that not only realize the specific interests of the two countries directly, but also yield benefits valuable more generally, such as enhancing Chinese transparency and indirectly facilitating U.S.-China engagement.

Beyond pursuing the prospects of developing its own relationship with China on space matters, the role that Canada might play in directly facilitating the U.S.-China relationship on space is ambiguous. If the U.S.-China relationship is increasingly the central axis of space security relationships, the purposes that would be served by a direct Canadian link to that relationship are unclear. Nor does Canada typically seek a "seat at the table" in circumstances where such a role would not be efficacious.

Instead, Canada might contribute more productively to support positive directions in the U.S.-China relationship in a facilitative role. Such a role would take into account both the distinct advantages and unalterable limitations given by its unique relationship to the United States, characterized by a history of both intimate civil and military cooperation and adamant defiance on certain key security policy questions. This history leaves Canada at once familiar and independent. The independence provides a certain level of credibility with China, with which Canada shares the goal of a legally binding treaty restraining the military uses of space, and has at times collaborated in promoting such a treaty (as noted above). In short, Canada has demonstrated that it is independent, but not neutral, and able to speak and act on its own behalf on all matters of space activities.

In such a facilitative role, Canada could productively operate in two modes: as a convening force and an innovation source. To operate as a convening force means to provide the venue and forum within which the principal agents may better advance their engagement. It does not mean to be a "mediator," which would be a direct rather than facilitative role. It may mean providing a nurturing environment for low-key meetings or other expert exchanges at either official or track-2 diplomatic levels, particularly where key participants find it problematic to travel into either the United States or China.[21] But operating as a convening force can be less

[21] One example is the 2008 workshop, convened under this author's direction by the Simons Centre at the University of British Columbia, exploring specifically what initiatives Canada could undertake to facilitate positive growth in the U.S.-China relationship on space. This workshop, gathering government, industry and academic representatives, was linked to the annual "China, Space, and Strategy" workshops convened by the Eisenhower Center for Space and Defense Studies, U.S. Air Force Academy. See "Engaging China on Space: Implications for Canada," Report of the Conference, Liu Institute, University of British Columbia, Vancouver, September 5, 2008 (http://www.ligi.ubc.ca/page244.htm).

direct as well. For example, in pursuing project cooperation with China, Canada might prioritize initiatives that would also enable a U.S. role (perhaps more remotely, perhaps not immediately) or at least have Canada-U.S. counterpart initiatives. Such a focus would be especially useful in areas in which direct U.S.-China engagement is most problematic, such as in inter-military contacts or analysis of longer-term prospects for military uses of space.

Canada can be an innovation source with respect to facilitating the U.S.-China relationship in a number of ways. Initiatives could begin by synthesizing the perspectives garnered through a host of small-scale close encounters with both countries into a dynamic third-party assessment of the ongoing state of the U.S.-China relationship. Developing a process to draw on civil, commercial, military, and diplomatic contacts, this analysis could generate perspectives less evident to the U.S. and China themselves. This analysis would then draw on Canada's own unique attributes – some specific to a particular sector or issue, others more general to Canada's national position as a moderate power – to develop specific proposals for enhancing U.S.-China space engagement. These proposals could again be specific to a particular sector or issue, or general and long-term. One focus might be on enhancing incipient U.S.-China work on erecting confidence-building measures (CBM). Efforts to develop innovations to help advance the U.S.-China relationship would take place in a host of civil, commercial, and academic settings; they would not necessarily carry an official imprimatur, but could be promoted as a clear objective in Canadian space policy.

Canada's success in serving this facilitative role, in either of these modes, would depend in part on the United States and China positively reinforcing that role. But such a role could be fulfilled through the accumulated activities of a host of agents – such as companies, universities and NGOs – operating in independent capacities. Positive reinforcement would come more in the aggregate of these activities than from a singular Canadian government posture. Many forums and innovations could also have independent impact, while sensitivity to the feedback from the efforts would be further data to the ongoing analysis of the U.S.-China dynamic.

Conclusion

Debate concerning the overarching prospects for the future of the U.S.-China relationship on space activities – and for that matter the U.S.-China relationship as a whole – often tends to resolve into two basic concerns, yielding two very different implications.

The first concern is that the U.S. and China face a sharp security dilemma with respect to their encounters on military uses of space. Flowing from the basic postulates of "realist" international theory, this means that both countries find themselves with postures and interests compelling them to suspect the worst of each other.[22] Even if each side were to pursue only its most vital interests in the most innocuous means possible, nevertheless those activities would still be threatening to the other, and perceived as such. Though neither side wishes conflict, each finds it exceedingly difficult to forsake defensive measures that would increase vulnerability in the absence of an impossibly complete confidence of reciprocation. This is the key feature of the security dilemma: it is a real dilemma, leaving the parties inescapably victims of circumstance.

[22] For a classic conception see Kenneth N. Waltz, *Theory of International Politics* (Reading, MA: Addison-Wesley, 1979); for a recent comprehensive treatment, see Ken Booth and Nicolas J. Wheeler, *The Security Dilemma: Fear, Cooperation and Trust in World Politics* (Houndmills: Palgrave, 2008).

The second concern is that the U.S. and China sometimes dangerously misunderstand each others' intentions and fail to communicate effectively. International relations theory has long recognized the fundamental role of perception in shaping state relationships and global outcomes.[23] Misunderstandings flowing from differences of language and strategic culture pose significant obstacles. Misperceptions of true intentions aggravate reactions to otherwise innocent actions and events. Domestic political dynamics on both sides produce mixed and/or opaque signals. In this context, gaps in understandings and expectations for future conduct invite unnecessary conflict; as if the parties willfully discarded the map before entering the minefield. In this view, there is no fundamental conflict beyond overcoming these communications challenges; in principle the U.S. and China could build a peaceful security partnership that would be self-sustainable into the indefinite future.

In reality, the dynamics of the U.S.-China relationship probably comprise a combination of both concerns, though in varying degrees across issues and time. Moreover, the concerns are mutually reinforcing and the threshold between them is opaque. Hence, degradation of relations and crises involve both real conflicts of interest and intensifying mistrust; stabilization of relations and constructive engagement entail both improved understanding and practical reconciliations. But the distinction between these two types of concern is vital because the types of prescriptions for dealing with each concern are very different.

To the extent the security dilemma predominates, conflict of interest, though not necessarily combat of forces, is inevitable. The best that can be hoped for is to manage the relationship by thinking enough moves ahead to avoid a reciprocal spiral into violence. To the extent instead that miscommunication predominates, the possibilities for genuine resolution of interests are more promising. Diligent efforts to advance mutual understanding will inevitably ameliorate the dangers of military violence.

Focusing only on one or the other concern carries considerable risks. The risk of presuming only a security dilemma is to miss opportunities to develop a more transformative relationship; to the extent that the security dilemma is not current reality, it instead becomes self-fulfilling prophecy. The risk of presuming only misperceptions and miscommunications, however, is to depend too much on political accommodation for security and fail to close vulnerabilities that the other side might someday exploit – indeed, that might tempt the other side to cast off political restraints for that very purpose.

Hence, the future of the U.S.-China relationship depends upon the wisdom of policy-makers and analysts not to follow a predisposition to conclude that either one of these concerns defines alone the core challenge of the relationship. Success will lie in realizing the reality of both concerns and undertaking diligent efforts to untangle their manifestations in the issues of the day. Nor is this simply a matter of distinguishing the military/security and civil/commercial sides of space activity; both areas manifest both genuine conflict and communication deficiencies.

Finding this wisdom will be difficult for policy-makers in the U.S. and China to do on their own. Both countries approach their encounters with one another with the

[23] For classic treatments see Robert Jervis, *Perception and Misperception in International Politics* (Princeton, NJ: Princeton University Press: 1976) and Graham Allison and P. Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York: Longman, 1999).

disposition of great powers, established in the one case, rising in the other. These dispositions incline them to approach their relationship as independent and self-sufficient agents.

Here is where the contribution of moderate powers, such as Canada, can be most contributory. Moderate powers are as well acquainted with managing security dilemmas as with overcoming communication obstacles. More experienced with having the vicissitudes of international power thrust upon them, they are more attuned to the value of well-formed relationships to survival in an anarchic world. The U.S.-China relationship is more than ever a central feature in the Canadian conception of its own dealings with China.[24] If the U.S.-China relationship is the axis for the future of space security, Canada orbits it closely, and is suited to help the world understand and even stabilize how that axis spins. As the human presence in space develops into an integral aspect of global life, stabilizing that space axis may prove to be the center of gravity of a stable future for life on Earth as well.

[24] For a recent discussion, see Yuen Pau Woo and Wang Huiyao, "The Fortune in our Future," Editorial, Asia Pacific Foundation of Canada, June 23, 2009 (http://www.asiapacific.ca/editorials/canada-asia-viewpoints/editorials/fortune-our-future).

STRATEGIC COMMUNICATIONS WITH CHINA ABOUT SPACE

JOAN JOHNSON-FREESE

In 2006, I published an article entitled "Strategic Communication with China: What Message About Space?"[1] The article pointed out that difficulties encountered in trying to convey its message regarding the Global War on Terror to a global audience had convinced the United States, or at least the Defense Science Board, that it needed to use strategic communications more effectively. From there I extrapolated, "If one believes that big problems are best tackled in small bites, 'space' perhaps offers an area where the United States can begin to understand and tackle some of the strategic communication issues it faces."[2] Communication mishaps encountered in the space policy field, especially between the United States and China, made it ripe for improvement. Unfortunately, a review of both words and actions since 2006 reveals little headway has been made toward bettering U.S.-Sino communications on space related matters, and in fact in some ways the problem has worsened through second order unintended consequences.

Communication issues were a thread running through discussions at the October 2008 China, Space and Strategy Workshop sponsored by the Eisenhower Center in Vancouver.[3] From the Chinese professing translation issues with such U.S. concepts as transparency, dual use, offense and defense, to a lack of official channels of communication existing between the U.S and China on the subject of space, communications clearly emerged as an issue meriting further consideration. In some instances, addressing conceptual confusion and linguistic imprecision may be primarily a matter of making the other party aware of the issue, and that is an effort well worth making. Other issues, such as sorting out which Chinese publications are reliable sources versus internal propaganda rags, will just take time. In some cases, such as setting up effective communications channels and mechanisms between China and the United States, it will be a matter of political will on both sides. Perhaps the most difficult areas to effectively address will be sensationalism and political spin for partisan or ideological goals, overcoming bureaucratic barriers, and policy inertia. Nevertheless, it will be in the best interests of the United States to recognize and deal with all of them.

This article focuses on communication issues regarding U.S. assessments of Chinese space activities stemming from two general areas: scholarly error, through either misinterpretation or "over-translation" of Chinese documents or just plain inaccuracy, and the continued sensationalist "spinning" of Chinese actions and events. The dangers of both were stated in the 2006 article: "Why is it important that U.S. reports regarding China's space program, capabilities and intentions be scrupulously researched and documented? First, analysis researched in support of a preordained conclusion is not analysis and is not useful to security planners. In fact, it can lead to dangerous miscalculations. Second, if a report is 98 percent valid and 2 percent based on erroneous interpretations or questionable sources, the credibility of the entire report is open to question. Credibility

[1] *China Security*. Vol. 1, No. 2 (2006), pp. 37-57.
[2] *Ibid*, p. 37.
[3] China, Space & Strategy, Workshop held October 2008, Vancouver, Canada, sponsored by the Eisenhower Center for Space annd Defense Studies.

is critical in communications."[4] I would now add a third reason to those -- potentially influencing analysts and policy-makers in other countries toward paths of action neither in their interests nor U.S. interests. The Obama administration requires sound information to make sound decisions. Further, restoring trust in America's message will be a critical part of reviving America's "brand" throughout the world, as the Obama administration has pledged to do. A recent U.S. government publication and an editorial provide examples of the problems.

U.S. China Commission on Economics and Security (UCSS)

Research on the Chinese space program is difficult to say the least, and the Chinese make no effort to make it any less difficult for Westerners. Quite the contrary; a combination of a lack of openness to their own people in general, a policy process that outsiders, as well as insiders, cannot see or easily access, and a system of bureaucratic stovepipes narrowly restricting what individuals actually deal with makes silence the prudent path for individuals and organizations. In other words – it's an authoritarian government and it's hard to see inside. Add that to the inherent complexities of language translation and the situation for even experienced researchers is a challenging one at best. Nevertheless, the Internet and the multitude of new publication outlets offer Westerners access to far more information than in the past. In fact, part of the challenge now is not just getting information and trying to put it into some kind of usable context, long a problem, but sorting through information for what is useful and what is not. Some of the dangers of that problem and proclivities to ignore it were pointed out in the 2006 article.

Government documents such as the Department of Defense (DOD) Annual Report on the Military Power of the People's Republic of China and the annual report of the U.S. – China Economic Security and Review Commission (USCC) are generally considered authoritative U.S. government sources. Neither, however, has been immune to difficulties regarding telling fact from fiction, or at least discrepancies regarding Chinese space activities. Both the fiscal year 2003 and 2004 Department of Defense (DOD) Annual Reports on the Military Power of the People's Republic of China, for example, contained references to Chinese "parasite" satellites for potential use as ASATs that were later debunked.[5]

The USCC is chartered by Congress to "monitor, investigate, and submit to Congress an annual report on the national security implications of the bilateral trade and economic relationship between the United States and the People's Republic of China, and to provide recommendations, where appropriate, to Congress for legislative and administrative action." It holds hearings and takes testimony from expert witnesses from which they base their report. These reports become cited as authoritative documents and are heavily relied upon by policy-makers to set future courses of action.

[4] *China Security*. Vol. 1, No. 2 (2006), p. 43.

[5] David Wright and Gregory Kulacki, "A Military Intelligence Failure: The Case of the Parasite Satellite," Union of Concerned Scientists, August 16, 2004. http://www.ucsusa.org/assets/documents/nwgs/parasite_satellite_8-17-04.pdf ; Joan Johnson-Freese, "Strategic Communications with China: What Message About Space?" *China Security*, p. 41.

On May 20, 2008 the USCC held a hearing entitled "China's Proliferation Practices and the Development of its Cyber and Space Warfare Capabilities." In reviewing the testimony, Union of Concerned Scientists China Project Manager Gregory Kulacki, who was also instrumental in debunking the earlier parasite satellite claims, discovered three significant factual errors in the written testimony of one of the panelists. Because of the weight given this report by Congress, a memo was submitted to UCSS detailing those factual errors, along with references to sites and documentation where correct information could be found.[6]

The first error referenced the Chinese Commission of Science, Technology and Industry for National Defense (COSTIND) as sitting "at the apex of China's defense-industrial complex." While COSTIND was undeniably an organization of considerable importance for Chinese military modernization in the past, it was officially dissolved in March 2008 by the People's Congress, an event widely publicized in China. While other organizations will undoubtedly take up many COSTIND responsibilities, the point is the change should have been noted and explained in more detail. Further, the apex of China's aerospace policy has always been the interagency "special committee" set up under the State Council, chaired by the Premier, which has been in place since the late 1950's. Understanding the organizational charts of China's aerospace and policy structures has been and remains an important but often elusive goal for Western analysts, which makes it even more imperative that careful attention be made to assertions about them before groups like the USCC.

The second error concerned a statement regarding "the recent demonstration of a mobile launch capability exemplified by the Pioneer rocket." While there have been two attempted launches of the Pioneer rocket, one in both 2002 and 2003, neither has been successful. In fact, it appears the program has been returned to the research and development phase because of the continued difficulties. If the Pioneer rocket tests had been successful that would certainly be worth noting to the USCC, but the fact remains that they were not, which is a matter of equal value for their considerations as well.

It is likely the testimony statement was based on Western press reports such as one widely circulated from Agence France-Presse, "China Develops its First Solid-Fuel Rocket."[7] Press reports called it successful and got away with it because they didn't define success. The report only said "China has successfully test-fired its first four-stage solid-fuel rocket capable of putting small satellites into space on short notice, the Xinhua news agency reported Wednesday." The test did not, however, produce a working missile. An article in the Chinese publication *Engineering Science* by Long Lehao (senior author) contains a critical passage clearly indicating China does not, at least as of 2006, have a Pioneer-like solid-fueled carrier rocket for small, micro sat payloads to low earth orbit or medium earth orbit.[8]

In all fairness, errors based on "what defines success" are common in many areas of space technology development assessment.

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[6] http://www.ucsusa.org/assets/documents/nwgs/memo-to-uscc.pdf

[7] AFP, "China Develops its First Solid-Fuel Rocket," carried in *REDORBIT NEWS* 25 September 2003. http://www.redorbit.com/news/display/?id=8282

[8] *Engineering Science,* Vol 8 Number 11, November 2006, p. 27.

A December 2008 U.S. missile defense test was widely billed by the Pentagon as "successful," supposedly the seventh successful test from a total of twelve. Other analysts, however, have pointed out what constitutes "success" in missile defense tests seems to depend on what is counted.[9] For example, whereas the Pentagon does not count tests where the interceptor fails to launch as tests, others argue it should – apparently feeling such a failure would "count" in an operational situation - though that brings the percentage of "successful" tests down considerably. Also, while test parameters are set prior, not meeting those parameters does not necessarily mean the test will not be counted as successful. In the December 2008 test, "countermeasures"--a key element of the very complex missile defense system--were to be included. These countermeasures are defenses that an opponent would almost certainly employ to confuse the U.S. system. The countermeasures, however, failed to deploy, thereby negating at least part of the intended results of the test, and illustrating how "success" can sometimes be in the eye of the beholder, the sponsoring agency, or the press.

Finally, the third error in the UCS testimony was found in the statement "Beijing still appears to lack a dedicated data relay satellite." Quite the contrary: Beijing had launched its first data relay satellite, the Tianlian 1, in April 2008 and it was placed in it final orbit several weeks before the testimony was given. Both the launch and its being successfully placed in its final orbit were widely reported in China.

The difficulties for analysts in keeping up with Chinese space activities, organizational changes (especially since the basic Chinese organizational and policy structure is only nominally understood by Western analysts) and finding reliable sources and solid translations of Chinese sources should not be underestimated. It is very difficult. But that makes it even more important for government organizations issuing reports widely read by policy makers to be scrupulous in their interpreting and analysis.

However, on page 158 of the USCC 2008 Annual Report[10] it states that "China's Pioneer rocket has demonstrated a mobile launch capability" in turn citing the May 2008 testimony, which the Commission had been notified was in error. It is always possible the Commission had different – and more accurate – sources, but none were cited. On the same page, however, the Commission does say that China had "launched its first data relay and tracking satellite in April 2008" thereby correcting one of the other errors. COSTIND is not mentioned in the report. Again, not only is it not useful to policy makers to be working from erroneous information, but the credibility of the entire report becomes questionable when clearly identified errors are reported as fact.

The USCC report also reaches the conclusion that "Some experts in China are attempting to assert a view that China is entitled to sovereignty over outer space above its territory, contrary to international practice."[11] This conclusion might be considered an "over-interpretation" of Chinese documents – that is, reaching unwarranted conclusions based on dubious

[9] Victoria Samson, "Missile Defense Success, a Muddled Picture," 7 May 2008, http://www.isn.ethz.ch/ isn/Current-Affairs/Security-Watch/Detail/?ots591 =4888CAA0-B3DB-1461-98B9-E20E7B9C13D4&lng=en&id=88328

[10] http://www.uscc.gov/annual_report/2008 /annual_report_full_08.pdf

[11] *Ibid.*

foundations. The conclusion appears to be based on the writings of one People's Liberation Army (PLA) officer, Cai Fengzhen. According to the Commission report "…Cai Fengzhen contends that 'the area above the ground, airspace and outer space are inseparable and integrated. They are the strategic commanding height of modern informationalized warfare.' He admits, however, that '…there is no clear standard in international law as to the altitude to which territorial airspace extends.'"[12] The report goes on to state that "If Cai Fengzhen's interpretation represents the common view of the Chinese government and military officials, it differs dramatically from the U.S. position and interpretation of Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, also called the Outer Space Treaty of 1967." The report does not, however, offer any evidence that Cai Fengzhen's views do in fact represent those of the Chinese government. It also provides no evidence that the Chinese reference to air and space being "inseparable and integrated" has sovereignty implications. Finally, China's view of space sovereignty has not been challenged as inconsistent with those of other space powers based on any prior documents or articles, and this one article hardly seems conclusive of a policy change.

The Commission raising concerns of China potentially impinging on the principles of the Outer Space Treaty regarding sovereignty could also be seen as hypocritical. The United States has made it clear for years that it has no use for any kind of space treaty which restricts its use of space, has not even been interested in revisiting ambiguous portions of the Outer Space Treaty for clarification (lest it result in more restrictions on the United States) and promulgated a National Space Policy in 2006 that the *Times* of London called "…comically proprietary in tone about the U.S.'s right to control access to the rest of the solar system." The *Times* further stated that, according to the 2006 National Space Policy, space was no longer the final frontier, but the fifty-first state of the United States. [13] Cai Fengzhen's statement about the potential integration of ground, air and outer space seems to be the basis for raising the Commission raising the sovereignty issue, but that is curious as well.

According to the Fact Sheet on the internet for the U.S. Air Force Warfare Center at Nellis Air Force Base, Nevada, one of its specific tasks is to "Integrate air, space, and cyberspace capabilities, systems, forces and operations, in and through all domains, to deliver precise effects for the Joint Force Commander across the full range of military operations." Could that be similarly over-interpreted in China to mean that the U.S. Air Force, or the U.S, considers the area above the ground to be inseparable and integrated? Or what about the following? "Meanwhile, the Air Force has recently refocused on the concept of aerospace – a concept that defines air and space as a seamless operational medium and that strongly implies two things: the Air Force should be the lead service in this operational medium, and it should seek to control and apply force from this medium."[14] While it

[12] U.S.-China Economic and Security Review Commission, 2008, 110th Congress, November 2008, p. 147.

[13] Bronwen Maddox, "America Wants it All—Life, the Universe, and Everything." http://www.timesonline.co.uk/article/0,,30809-2410592,00.html.

[14] Lt. Col. Peter Hays, USAF, Dr. Karl Mueller, "Going Boldly – Where? Aerospace Integration, the Space Commission, and the Air Force's Vision for Space, *Aerospace Power Journal*, Spring 2001, p. 35.

could be argued that this statement refers to operational definitions only, according to the endnote in the USCC report, Cai Fengzhen's quote was from book concerning integrated space operations as well.[15] The point is, it is quite a leap from one quote to a conclusion that at least tacitly leads readers to believe that China may be seeking to claim space as part of its sovereign territory. Given the nebulous foundation for the USCC assertions regarding China's position on space sovereignty – a statement regarding integration with other domains for operational purposes -- especially considering the U.S. position on the same issue, could raise questions as to the reason for raising the sovereignty issue at all.

Similarly, the report links its concerns about Chinese views on sovereignty as they relate to space with concerns about China's interpretation of the use of space for "peaceful purposes" as the Outer Space Treaty dictates. The concerns seem to focus on whether China considers "peaceful use" to mean "non-aggressive" or "non-military." The debate on the meaning of "peaceful use" has a long tradition, with a variety of positions stated by numerous scholars in multiple countries, including both the United States and China. The Report goes on to say that "the majority of parties to the treaty interpret that language as meaning 'non-aggressive' and not as a prohibition on military activities in space. According to the U.S. interpretation of this clause, 'peaceful purposes' allows defense and intelligence-related activities conducted in the pursuit of national interests. China's interpretation of the peaceful use of space seems inconsistent with its development of PLA space weapons programs."[16] This passage oversimplifies a topic which has kept scores of lawyers occupied for decades to an unbelievable degree.

First, with 95% or more of space technology dual use – being of use to both the military and civilian communities, and within the military applications, having both offensive and defense uses – how does one define non-aggressive? And how does one define national interests? Traditionally, national interests are anything the defining country says they are. Those countries that defined "peaceful" as non-military in policy or legislation, such as Japan, have subsequently had to amend that policy or legislation, as a strict interpretation would mean that Japanese Defense Forces could not use satellites for communications. In 2008, the Japanese parliament approved legislation officially lifting a 1969 ban on the military use of outer space. Previously, Japanese Defense Forces had to creatively circumvent the prohibition through programs like Japan's Information Gathering Satellites (IGS), exploiting the dual-use nature of the technology.[17] Therefore, it is unlikely China would take such a literal stance. The leap from accepting "peaceful purposes" as a principle to be upheld from the Outer Space Treaty, however defined, to inconsistency between that principle and Chinese development of a space weapons program is puzzling at best. The United States has argued for years that it is impossible to define a space weapons, hence there can be no treaty to prohibit them, because the technology and its intended use – offense or

[15] Cai Fengzhen et al., *Kongtian Yiti Zuozhan Xue* [Integrated Aerospace Operations] (PLA Press, Beijing: 2006) pp. 90-91

[16] U.S.-China Economic and Security Review Commission, 2008, 110th Congress, November 2008, p. 149.

[17] Joan Johnson-Freese and Lance Gatling, "Security Implications of Japan's Information Gathering Satellite System," *Intelligence & National Security,,* Issue 19/3, 2004.

defense -- is too ambiguous. If one assumes that the space weapons program being referenced is the ASAT program demonstrated in 2007, then the United States possesses similar technology, as demonstrated in 2008 with the deliberate destruction of US-193, and it has no professed space weapons program either. All in all, the scholarly premises backing the 2008 USCC Report, at least in some areas regarding space, seem less than rigorous and potentially even misleading.

Shenzhou 7 (SH-7) and the Banxing (BX-1) Mini-satellite

In September 2008 China, only the third country to obtain a human spaceflight capability, added more accolades to its roster of space accomplishments by successfully completing its first extra vehicular activity (EVA), or spacewalk. Taikonaut Zhai Zigang, wearing a Chinese developed spacesuit (as opposed to Russian made spacesuits worn on previous Shenzhou missions) waved the Chinese flag during his twenty minute spacewalk at about 845 (GMT) on September 27, timed at least partially for good lighting to accommodate the carefully placed television cameras broadcasting the event live to an interested Chinese public. Shortly after Zhai reentered the orbital module and the hatch was sealed, the miniaturized satellite BanXing 1, or CampanionSat, was released. The small cube, 16 inches on each side, carried two cameras and boost devices for maneuvering. Officially, the satellite's tasks included testing the mini-satellite technology, observing, monitoring and photographing the Shenzhou spacecraft, and testing the tracking and approaching technology required for future space rendezvous and docking missions. China has already announced plans for a space lab and space station, both of which would require rendezvous and docking technology, perhaps as early as Shenzhou 8.

On October 31, Richard Fisher, Jr. published an editorial in the *Asian Wall Street Journal* entitled "China's Close Call"[18] where Fisher raised the idea that BanXing's mission was actually far more dangerous, and nefarious. An excerpt from the editorial is worth reproducing at some length, as it illustrates the kinds of problems being discussed:

> With minimal publicity -- let alone notice to any other government -- Beijing's space ship passed unusually close to the International Space Station soon after the spacewalk. The event may offer a window into both China's space-based military aspirations and its willingness to be a good orbital citizen. On September 27 at 3:07 p.m. Greenwich Mean Time, the Shenzhou-7 ship passed within 45 kilometers of the International Space Station, according to the U.S. Strategic Command. While the respective orbits ensured they would not collide, there was little margin for error. At that level of low-earth orbit objects travel at about 7.7 kilometers per second, and at that speed an object as small as five millimeters in diameter can inflict serious damage on the $100 billion space station, which at the time had two Russians and one American aboard. No one has offered a full explanation for why Beijing would do this. But China's track record of using all of

[18] Richard Fisher, Jr., "China's Close Call," *Asian Wall Street Journal*, 31 October 2008. http://online.wsj.com/article/SB122539460905385099.html?mod=googlenews_wsj

> its Shenzhou missions since 1999 for dual military-civil missions justifies speculation that it might have been part of a test of a new antisatellite missile technology… [T]he launch of the BX-1 so near to the space station also could be considered a test of 'co-orbital' antisatellite interception technology…The problem here is not that China is testing this kind of system per se. Rather, it's the irresponsible way in which it is doing so, if indeed this recent space mission was such a test. Chinese state television reported on October 2 that "after the satellite was released by the Shenzhou-7 last weekend, it quickly started drifting away from its intended trajectory." NASA has not responded to questions about the BX-1 ventured closer to the space station than the Shenzhou incident. Neither has Washington.

Beyond his comment that the Shenzhou mission and BX launch were done "with little publicity"--a curious claim given extensive Chinese media coverage of the event for six months prior, including far more detail than ever provided before, there are at least four puzzling implications drawn in the full text of editorial, and previewed here: 1) Beijing lost control of its satellite upon release; 2) BX-1 intentionally came dangerously and irresponsibly close to the International Space Station (ISS); 3) BX-1 was deliberately launched near the ISS as an antisatellite test and 4) NASA or Washington-at-large not commenting on these conjectures makes an (apparently) already suspicious event appear even more likely sinister. Ironically, the author also implies – says – that if this was an antisatellite test, that is not the problem, per se. But if it was an ASAT test, it is indeed a problem. Each of the implications deserves further attention.

Mr. Fisher, an analyst for the International Assessment and Strategy Center, appears to conclude that Beijing lost control of the satellite after its release from a single CCTV International English-language broadcast where it was mentioned that controllers brought the BX-1 back under "active control." However, comparing the language of that broadcast with more extensive and detailed Chinese language media accounts, such as the September 25 television interviews with Shen Xuemin, the head of the institute that designed the BX-1 and Zhu Zhencai, the chief designer of the satellite, it becomes clear that China never lost control or communication with the BX-1. Brian Weeden, a technical consultant for the Secure World Foundation and a former Air Force officer with a background in space surveillance and ICBM operations, explains. "The BX-1 microsatellite was released from its resting position on top of the Shenzhou 7 module. This release was done via a spring, which is a very common method of deploying microsatellites due to its reliability and simplicity. At this point the BX-1 was not under active control and drifted away from the SH-7 to a maximum distance of around 100-200 kilometers after a few days…After the taikonauts had returned to Earth, the BX-1 was placed under active control and commanded back towards the orbital module, which had been left in orbit. This period of drift followed by active control was part of the mission plan all along…unguided space release is a standard method of deployment for microsatellites used by many countries"[19] Hence the perils and potential of

[19] Brian Weeden, "China's BX-1 microsatellite: a litmus test for space weaponization," The Space Review, 20 October 2008. http://www.thespacereview.com/article/1235/1

misinterpreting the content of an ambiguous translation on a technical issue by a non-technical analyst become evident.

With regard to BX-1 coming intentionally and recklessly close to the ISS, again, technical experts and those who carefully followed the Chinese language information, seem to disagree with Mr. Fisher's assessment.[20] BX-1 came within around 25 kilometers of the International Space Station, and the SH-7 came within 36 kilometers of the ISS. But when thinking about spacecraft in orbits, there is more to consider than just distances. The Shenzhou spacecraft and BX-1 were in orbits with a 42.5 degree inclination, whereas the ISS orbit is at a 51.6 degree inclination. "This means that not only were they at different altitudes, but their orbits intersected at about a 10-degree angle. There was no danger of collision."[21] Furthermore, the Chinese have used 42 degree inclinations for past Shenzhou flights so unless they have been planning an ASAT test rendezvous with ISS for some time, Shenzhou's orbit cannot really be considered evidence of anything unusual being intended.

The third conjecture, that BX-1 was actually an ASAT test, also appears technically-challenged. The ability to maneuver a spacecraft is certainly an enabling technology toward development of a co-orbital antisatellite technology, where one spacecraft targets another for collision. But the lack of technical sophistication of the BX-1, such as an on-board guidance capability,[22] seems to make BX-1 no more, in fact much less, an ASAT test than maneuvering demonstrations done by U.S. spacecraft such as the XSS-11 or the Demonstration for Autonomous Rendezvous Technology (DART). Given that China has already tested ground-based, kinetic-kill ASAT technology in 2006 – and found itself faced with international condemnation -- if BX-1 were a second test, the roar from Washington and other capitals would have been deafening, and rightfully so.

Which leads to the last conjecture of concern: that NASA and Washington not commenting on technically challengeable conjectures implies that somebody is hiding something. That seems to be the political equivalent of asking someone if it's true they don't beat their wife. Regardless of the answer given, a disreputable implication has been raised likely to create a prism through which future events or characterizations are viewed, or worse yet, from which extrapolations will be made and potentially extended from speculation to urban legend to fact. Should the world draw any nefarious conclusions from the United States not commenting on the drifting of an apparently failed U.S. military satellite, believed to be Defense Support Program (DSP) 23, even when it approached other satellites?[23] There are mechanisms in place to allow warnings to be provided to satellite operators if a collision between spacecraft appears likely, and if none were issued either when Shenzhou and ISS were close, or when the errant U.S. satellite was in the vicinity of a

[20] See: David Wright and Gregory Kulacki, "Chinese Shenzhou 7 'Companion Satellite'" 21 October 2008. http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical.../chinese-shenzhou-7-satellite.html

[21] Brian Weeden, "China's BX-1 microsatellite: a litmus test for space weaponization," The Space Review, 20 October 2008. http://www.thespacereveiw.com/article/1235/1

[22] See: David Wright and Gregory Kulacki, "Chinese Shenzhou 7 'Companion Satellite'" 21 October 2008. http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical.../chinese-shenzhou-7-satellite.html

[23] Leonard David, "Russians Track Troubled U.S. Spy Satellite," SPACE.com, December 2, 2008. http://www.space.com/news/081202-miitary-satellite-drift.html

European Eumetsat weather satellite – then in both cases it must be assumed that nobody was worried.

Additionally, whether there was an exchange of technical information between Washington and Beijing regarding the Shenzhou and ISS is unknown. There might have been. As pointed out, NASA does provide information to other countries regarding spacecrafts in orbit, and debris in orbit near spacecrafts. China, however, has been known to be dubious about U.S. motives regarding past offers for data sharing and hence reluctant to ask or accept it. For example, just before the launch of Shenzhou 5, the first Chinese manned launch, NASA apparently offered data to Shenzhou officials. At least some Chinese officials believed the late offer was made with the intent of delaying the launch data. Further, the Chinese have their own limited tracking capabilities which they continue to improve on – much to U.S. consternation, as those tracking facilities provide utility on a broader basis, potentially to the military as well, so they are not reliant on data from the United States.

It is unfortunate that the degree of mistrust that exists between China and the United States on space issues. Certainly China needs to act as a responsible power in space, and the United States needs to do all it can to encourage such behavior, including stringently pointing out foolish and reckless acts, such as the creation of massive amounts of debris with the 2007 ASAT test. The U.S. also needs to note the development of new space technologies with potential military applications – such as the camera used on BX-1 to take imagery of the Shenzhou craft. But analysts need to act with due diligence as well. The 1999 Cox Committee Report did lingering damage to U.S.-China relations through its stringing together of "revelations" regarding China and the U.S. aerospace industry: satellite manufacturers want their satellites to be launched successfully; rockets and missiles share technologies; and China was engaged in espionage.[24] From those conclusions, apparently shocking to the Members of Congress and the Commission staff, including Richard Fisher, a panoply of new rules and regulations were set into place to prevent the transfer of sensitive technology to other countries, rules which continue to hinder the U.S. aerospace industry to no demonstrable benefit because customers simply buy it elsewhere, and U.S.-China relations were severed damaged. The Cox Report experience should be one we should all learn from: drawing dubious conclusions on weak evidence can lead to counterproductive results. Unfortunately, that lesson seems to remain elusive.

On November 2, 2008, Indian analyst Sanjay Kumar, a Research Assistant at the Centre for Strategic Studies and Simulation in New Delhi, published an editorial in the *India Post* entitled "China a threat to space assets of other nations,"[25] which picks up on, and extends, Fisher's conjectures. "The release of the micro-satellite from Shenzhou-7 and the unintended trajectory it gained immediately after its release but it was finally brought under control – have since left many unanswered questions with rising fears whether China could have done this with the intention of testing capabilities required to develop a co-orbital anti-satellite weapon."[26] Here is where doubtful conjecture can become very harmful. Kumar

[24] Joan Johnson-Freese, *Space as a Strategic Asset*, Columbia University Press, 2007, p. 156.
[25] Sanjay Kumar, "China a threat to space assets of other nations," *India Post*, 2 November 2008. http://www.indiapost/article/perspective/4334
[26] Sanjay Kumar, "China a threat to space assets of other nations," *India Post*, 2 November 2008. http://www.indiapost/article/perspective/4334

goes on to say that, "As China and India are engaged in strategic competition with each other, it is essential that India closely monitors China's every move in space." He also notes that Indian military has already created an Integrated Space Cell, which takes it one step closer to active rather than passive military space systems, possibly as a reaction to the Chinese 2007 ASAT test. While certainly prudence is in order on the part of the Indian government, does anybody think encouraging India to move toward active rather than passive military space systems is a good idea? As the Mumbai tragedy just demonstrated, that part of the world is volatile enough, without potentially adding space weapons into the mix.

Conclusion

In November 2009, just prior to President Obama's trip to China, Chinese air commander Xu Qiliang made public statements about the weaponization of space. Since then, his comments have been subject to reinterpretation along both objective and subjective lines. What did he actually say? What did he actually mean? For those hoping that space cooperation with China would be a topic for high-level discussion, Xu's statements certainly complicated any intended agenda. Deciphering intent is hardest when language is the only evidence to go on.

Analysis of technically ambiguous dual-use technology, based on information obtained from ambiguous sources and reliant upon complicated, subjective translation is also difficult. Mistakes happen to everyone and analysis is always subjective. Both, however, make it imperative that analysts and institutions strive to assure that the public and decision-makers are provided with the most accurate and most objective information and analysis possible. Some political analysts view technology development as inherently nefarious. Others allow for perhaps too-benign interpretations. Clearly, however, engineers and scientists are best able to make the technical assessments from which political analyses should be based, to minimize both overreaction and underestimation of a potential threat. Sound technical assessments and concise translations, taken within their intended context and with the source considered, provide the foundation for credible and hence useful political analyses. Especially at a time when the Obama Administration is striving to rebrand America, having the world comfortable again with America's assessments of others as fair and balanced will go a long way toward restoring trust. As the India example points out as well, there can be dangerous unintended consequences to exaggerations and speculation that are not in the interests of the United States. It is our common interest, and our common responsibility, to minimize such opportunities for misunderstanding.

A CHINESE PERSPECTIVE ON CHINA-UNITED STATES COOPERATION IN SPACE

DINGLI SHEN

This article describes the arrival of new space actors from Asia, with particular focus on China. It analyzes the lack of cooperation in civilian space programs between China and the United States (U.S.), and the possible negative consequence of this. The paper suggests that the principles of non-diversion and reciprocity in accession as the foundation for China-U.S. collaboration in the civilian sector of space collaboration. This paper addresses the ongoing defense program with space application by the two countries, suggesting an overall program for China and the U.S. to have dialogue,[1] as well as collaboration in space areas, promoting mutual trust and confidence.[2]

China as an Asian Actor

Space programs are traditionally the realm of the two superpowers, the United States and the former Soviet Union, and Russia as its sole legal successor. These powers have dominated space exploration so far. Both of them have developed significant space programs and assets, and have endeavored great manned space exploration. The U.S. and Russian space programs have developed certain space stations, distinctive launch vehicles, and global position and navigation systems, to name a few. Comparatively speaking, the American program is more advanced, for its success of the lunar landings, which Russians have not attained, and for its deep space exploration programs and advanced space telescope probing technologies. They are also two powers that have carried out military activities in space.

In comparison, Europe is the other established space power, with the European Space Agency (ESA) having developed a number of space launchers, probes, vehicles, and the Galileo position and navigation system (pending further progress). Though space research has been long dominated by the aforementioned three players, more countries have lately joined civilian space exploration.[3] Asian states have been recently intensely engaging in space competition.[4]

In particular, Japan, China, and India are the three key Asian states. Japan started its lunar journey by sending spacecraft *Hiten* in 1991, though without great success. However, after experiencing a series of setbacks in testing its rockets, *Japan successfully launched* its *Kaguya lunar* explorer on 14 September 2007, ahead of China and India in sending their own moon orbiters.

China started its civilian space program in 1956 and accelerated its pace since entering

[1] The then NASA Administrator Michael Griffin visited China in September 2006 and the two sides agreed to launch their first meeting for China-U.S. space cooperation. It was postponed to July 2008 in Beijing for China's ASAT test, mainly to exchange information of respective space programs and to discuss future cooperation. The second meeting was scheduled to take place in Washington, DC, but China suspended all defense talks in November 2008 to protest U.S. weapons sale to Taiwan.

[2] Theresa Hitchens and David Chen have analyzed the same issue. See "Forging a Sino-U.S. 'grand bargain' in space," *Space Policy* 24: 3 (2008), pp. 128-131.

[3] Marc Kaufman, "U.S. Finds It's Getting Crowded Out There; Dominance in Space Slips as Other Nations Step Up Efforts," *Washington Post* (8 July 2008).

[4] Shen Dingli, "One Small Step for China…," ChinaStakes.com (30 November 2008), www.chinastakes.com/story.aspx?id=74 (accessed 2 February 2009); and Trefor Moss, "The Asian space race", *Jane's Defense Weekly* (24 October 2008), http://www.janes.com/news/defence/systems/jdw/jdw081024_1_n.shtml (accessed 2 February 2009).

the 1990s. Since 1999, China has successfully launched seven *Shenzhou* spacecrafts, with manned space missions and China's taikonauts conducting extravehicular activities (EVA). On 24 February 2007, China launched its first lunar orbiter, *Chang'e-1* (phase one of *Chang'e* project). It is understood that China has planned to send its first space station– *Tiangong-1* (Sky Palace)– in 2010, and fulfill its own manned landing on the Moon, possibly by 2024, during the fourth stage of *Chang'e* project.

India has robust rocket industry and missile programs. Though India's space program started late, it is accelerating its pace. On 22 October 2008, India successfully shot its first lunar orbiter *Chandrayaan-1* into space. India has planned to execute its first manned Moon landing by 2020, four years ahead of reported Chinese plan.

Obviously there emerges a space race among the three Asian states. Among them, China seemed to have started the earliest, while Japan and India are following closely. So far, they have demonstrated different features in terms of their space programs and achievements. Roughly within a year, all of them launched their respective first lunar orbiter successfully, with each possessing quite advanced launch capability for space vehicles.

Comparing the three Asian space powers, China is the only country that has commanded human spaceflight through *Shenzhou* spacecrafts, demonstrating both EVAs and remarkable retrieval technology of spacecraft. China has the best record of successful launch of spacecrafts and possesses a young generation of engineers engaged in research and development (R&D) and commanding space program implementation. Japan is relatively advanced in its overall science and technology strength. Though Japan's launch record is unimpressive as of yet, it has comparatively good technology of satellite and probing devices. As far as India is concerned, it has a strong national consensus in pushing lunar probes forward. India's space program is the most cost-effective compared to China and Japan.

The rapid advancement of civilian space programs of the aforementioned Asian states is enabled by some international cooperation. Japan's space program has received assistance from the U.S., while Russia helped China and India to some extent. More recently, the U.S. is interested in working with the Indians to promote their civil space program.[5] The Chinese have sought cooperation with America on civilian space exploration, but the National Aeronautics and Space Administration (NASA) has not responded positively so far.[6]

The U.S. unwillingness or indecision to cooperate with China in civil space enhances, rather than reduces, China's apprehensions of American distancing, if not isolating, China's civilian space program. It has also been observed by China that the Bush Administration pushed hard to cooperate with India on civilian nuclear cooperation, by

[5]Dwayne A. Day, "The new path to space: India and China enter the game", *Space Review* (13 October 2008), http://www.thespacereview.com/article/1231/1 (accessed 2 February 2009).

[6]It is understood that NASA has tried, but failed to obtain, Bush Administration approval of an overture to China for a cooperative U.S.-China space mission, according to NASA Administrator Michael Griffin. The White House believed that a higher level of cooperation is too great a reward to China for its human rights and arms export behavior. See Craig Covault, "Bush Administration Nixed NASA's U.S.-China Cooperation Idea," *Aviation Week and Space Technology* (21 December 2008), http://www.nasa.gov/about/highlights/griffin_bio.html (accessed 2 February 2009). Also, see Marc Kaufman, "NASA's Star Is Fading, Its Chief Says; In Leaked E-Mail, He Rails About Budgetary Tensions and Feared Rise of China," *Washington Post* (14 September 2008).

withdrawing a longstanding code of non-cooperation with any non- Nuclear Non-Proliferation Treaty (NPT) state– a principle to establish Nuclear Supplies Group (NSG) in the aftermath of India's nuclear test in 1974. U.S. collaboration with India on nuclear and space programs is in sharp contrast to the "cool" U.S. stance with China.

The U.S. orientation to India is understood in China as a means to leverage U.S.-India cooperation to counterbalance China's rise as a space and military power. While U.S.-India space cooperation may render a certain edge to India in the trilateral space competition in Asia, China is not idle. In the race of unmanned lunar orbiters, China lost to Japan to be first. It is hard to imagine that China is willing to be behind India's human spaceflight ambitions. Further, it is foreseeable that the Asian space race could only be more intense in the next decade, and China would adjust its schedule to keep its overall lead in civil space, especially in relation to India.[7]

Consequence of Non-Cooperation

The U.S. is unwilling to collaborate with China on civilian space exploration, most likely to protect its dual-use space technology and for fear of China's space development for military ends.[8] China's success of an anti-satellite (ASAT) test on 11 January 2007 exacerbates the U.S. Department of Defense (DOD) concern of a Chinese space weapons program.[9]

China and the U.S. have had a complex relationship. Even in the least sensitive areas, such as economics and trade, the large amount of two-way trade volume has been developed to suit the needs of the two countries. China's economic opening has increased its dependence upon the world that promotes mutual stake-holding between China and the rest of the world. The U.S. has been cooperating at the strategic level, promoting mutual understanding to lessen the likelihood of confrontation across the Pacific, and at business level, promoting economic common goods for the benefit of the two sides plus the Asia-Pacific community.

American businesses have been investing in China for the last three decades, given Chinese governmental protection of foreign investment and inexpensive labor force and various investment incentives. This cuts the investment costs and brings more competitive strength to U.S. companies. While American investors benefit, U.S. laborers do lose jobs due to manufacturing outsourcing.

Therefore, cooperation and competition go in parallel. This applies to not only economy, but also to the security area, defense sector, and dual-use field where civilian and military application of the same technology could be intertwined given the nature of the technology– for instance, space technology is such an example.

To protect the U.S. civilian space technology from being diverted through cooperation, America could pay a cost of distancing China

[7]See Peter Brown, *Asia Times Online* (12 November 2008) "China needs sharper eyes in space," http://www.atimes.com/atimes/China/JJ16Ad02.html (accessed 2 February 2009), and "China fears India-Japan space alliance," (12 November 2008), http://www.atimes.com/atimes/South_Asia/JK12Df02.html (accessed 2 February 2009).

[8]So far, America has maintained a significant lead in space science and technology. It has sent twelve astronauts to the Moon.

[9]Shen Dingli, "China's Defensive Military Strategy: the Space Question," *Survival* 50: 1 (2008), pp. 170-176; and David Sands, "China, India Hasten arms race in space: U.S. dominance challenged," *Washington Times* (25 July 2008).

and forcing China to develop some similar technology relatively independently, while sustaining mutual suspicion in respective intentions in space exploration. The U.S. runs the risk that there will be less of a possibility to negotiate an internationally acceptable norm of conduct to control the spread of military space technology in the world.

Even without American cooperation, China has sent seven *Shenzhou* spacecrafts already to the space, and it is aspiring to send Chinese taikonauts to the Moon. Although China has to experience a technically difficult path, it is still something independently doable for China. The outcome of lack of space cooperation could only lead to a slower pace of program progress, but not fundamentally an inability to move forward for a country like China that trains millions of new scientists and engineers a year.

For instance, during the Cold War, the U.S. never assisted China in China's civilian and military nuclear programs, but China independently attained both technologies. The Soviet Union used to assist China in acquiring nuclear weapons technology, but China has mastered it mainly through its own efforts. At one point, China did request technology of Permissive Action Links (PALs) from America in the 1990s, but the U.S. did not permit. Eventually, China could have received it from Russia.[10]

China is a resourceful country. With a base population at 1.3 billion in the mainland, the country generates over 6 million university graduates a year at present. Given proper policy guidance and resource allocation, the country could have unlimited talents to tap, which promises success in these high-technology programs with or without international cooperation.

At the same time, even if America is unwilling to cooperate with China, this does not close China's opportunities to access to other channels for international cooperation.[11] In 1950s, the Soviet Union used to supply China with technologies of nuclear weapons and advanced conventional weapons, and train Chinese military scientists. Presently, Russia is supplying China with advanced weaponry, plus space aviation technology, and trains Chinese technical personnel as well.[12] This builds Sino-Russian strategic trust and helps release strategic resources that China would otherwise reserve to counter threats from the former Soviet Union.

While the non-cooperation of America on civilian space technology could potentially slow the pace of Chinese space exploration, American strategic interests in securing Chinese understanding and willingness to assist in global security and regional stability could also be met less readily. As long as the U.S. hedges against China on civilian high-technology cooperation, America is prompting China that the US is not China's close friend, and does not deserve China's assistance wholeheartedly.

Terrorism has constituted the paramount threat to America in the past decade, but this is apparently not the case for China. China is certainly threatened by terrorism, but this threat is far less comparing with the

[10]"China's Nuclear Imports and Assistance From Abroad," http://www.nti.org/db/china/nimport.htm (accessed 2 February 2009).

[11]China has maintained international cooperation programs in civil space programs. A recent conference in Vancouver, Canada discussed China's space strategy and the need and possibility of Canada's space cooperation with China. See, "Engaging China on Space: Implication for Canada" in this issue of *Space and Defense*.

[12]It is understood that Russia has supplied nine spacesuits to China, and provided full technical support to China's first space walk.

magnitude of the threat to America. In a similar vein, the level of perceived threat to China and America, due to nuclear development of North Korea and Iran, is quite different. North Korea and Iran are friendly to China and they do not intend to threaten China with their nuclear capacity. It is China that can harm its relationship with them through the argument and practice of nonproliferation. So, Chinese strategists could decide to which level China could render security to America in terms of nonproliferation, depending upon how the U.S. treats China's interests in promoting its civilian high technologies, including civilian space technology.

Under the Bush Administration, the U.S. government identified major threats to America in the following sequence: international terrorism; proliferation of weapons of mass destruction (WMDs) and delivery means; regional instability; and the emergence of new powers such as India, Russia, and China.[13] The Bush Administration did not view the rise of China as the arch threat to America, and in fact China and the U.S. share interests in defeating the first three categories of threat− terrorism, proliferation, and instability. However, in terms of magnitude of such threats to China and the U.S., their levels of intensity are quite different. It would be quite unnatural that the U.S. shall expect China's security cooperation, while China would not be satisfied with American cooperation in other areas, including the willingness that America has demonstrated in bringing civilian nuclear power to India.

Collaboration with Confidence

The U.S. might not be totally unwilling to collaborate with China on civilian space cooperation, provided that dual-use space technology would not be diverted through cooperation, and that reciprocity of cooperation will be ensured so as to promote transparency of respective program.[14] This is directly related to the assumption that U.S.-China cooperation will not be harmful to America. While honesty is at stake when the collaborators may assure each other, it is even more crucial to have a system in place that would lead the least to be diverted in a harmful manner.

Therefore, to attain bilateral cooperation of civilian space program, the principles of non-diversion and reciprocity ought to be imposed. Accordingly, designing a regime of such cooperation will be highly desirable. Short of this, such cooperation will lead to nowhere and could only be viewed as a liability to each other. The Cox Report of 1999 issued by the U.S. Congress served such an example in the sense that: sensitive cooperation between the two countries in dual-use technology areas ought to be properly evaluated and approved; and there existed cases where Chinese side was alleged to have diverted dual-use technology imported from America for defense purpose other than what was initially applied for.[15]

The issue of concern herein in this paper is not to deliberate about the events described by the Cox Report, but rather discuss how to design a system in which the alleged diversion of dual-

[13]White House, *The National Security Strategy of the United States of America*, September 2002; and White House, *The National Security Strategy of the United States of America*, March 2006.

[14]Jürgen Scheffran, "Dual-Use in a New Security Environment: The Case of Missiles and Space," *INESAP Information Bulletin* 26 (June 2006), pp. 48-53.

[15]*U.S. National Security and Military/Commercial Concerns with the People's Republic of China*, Select Committee, United States House of Representative, Washington, D.C., 1999.

use technology could not take place physically. As far as dual-use items are transferred, it is not difficult to deter a diversion. This can be accomplished by post-transfer visiting, by posting personnel regularly or irregularly on site, and/or by long-distance monitoring through camera, or a combination of all these schemes.

For civilian space cooperation, what could then be the potential area of cooperation? Potential areas could include, among others, joint endeavors in design, training, flight and programs, and more general technology cooperation− information consulting and technology transfer.

Joint Design

For the next 10 to 15 years, China's civilian space program will focus on both lunar exploration and space station development and systems, and China would welcome American cooperation in assisting China's design of these systems. In terms of manned Moon landings, that would entail advanced technology in soft landing and taking-off from the Moon. For space station, it will involve chamber design, life sustenance, space connecting, Earth-space shuttling. The U.S. has accumulated significant experiences in all these areas.

It is likely that the U.S. needs to protect its launch, energy, sensing, space communication technologies, and software for space programs. In this case, China has accumulated some experiences already in these critical technologies, and shall work on them more or less independently. For areas as energy thrust, remote sensing, and telecommunication, where duality of technologies is apparent, both sides shall make it clear that neither side might have chance to access to the details of each other's technologies or know-how. For technologies less sensitive, the U.S. may shed some light to the Chinese on the principle of reciprocity of understanding the corresponding Chinese design.

Joint Training

China has already built its training academy and facilities, so this may not be a highly sensitive area for cooperation. However, to have astronauts to participate in the training program of each other could help build mutual understanding of training systems and culture, hence increasing trust building and familiarity with each other's system. This shall be helpful in future development and maintenance of joint programs, such as a possible joint space station. Such cooperation might be conducted in mock space capsules as well, leading each other to understand some design philosophy, without harming much defense secrecy of military assets.

Joint Flight

When reaching proper level of political trust between China and the U.S., the two countries may aspire to set up joint crew on-board each other's spacecraft, or invite the other to a multilateral flight setting. This would assure even wider understanding of space operation culture of each other, and build great team work of astronauts of the two countries. More importantly, such missions carry significant political message of more genuine Sino-U.S. political and scientific cooperation. Certainly critical technologies will be less able to be protected during the operation, but exact design is still likely not to be revealed.

Joint Programs

Joint programs could involve a combined space station, or joint venture of such from the beginning. Even joint space exploration could be contemplated, given the availability of respective financial and technical resources.

Space scientists could develop many ideas of innovative experiments in the space, and execute various missions of different purposes. Given the rapid progress of space programs of Japan and India, these Asian countries could envisage Asian cooperation in joint space exploratory missions, and America could develop wider space cooperation with all these Asian players engaged.

Technology Cooperation

An even longer list of potential cooperation could be developed. The U.S. needs not necessarily be afraid of seeing technology flowing to China. Given China's growth of domestic technology in the next decade, America can benefit from such cooperation with China that promises to emerge as a new major power generating indigenous advanced technology. After all, the build-up of political trust and scientific exchange will help build a new type of cooperative partnership between China and the U.S.

Defense Component: The Deterrence Context

While China-U.S. cooperation on civilian space programs is desirable to generate peaceful common goods collaboratively, and to help nurture political trust, it is also an imperative that the two countries avoid a defensive, or offensive, race that will extend to outer space. China's ASAT test in January 2007 demonstrated the extent of distrust that exists presently between the two states.[16]

This entails careful scrutinizing in terms of its strategic context. While China has been under pressure for its ASAT test, it has its own logic in conducting this experiment. From a Chinese perspective, it is an important step to preserve its critical strategic deterrence at a time of American quest for space monopoly.

In China's view, it is the U.S. drive of space weaponization that is troubling. On the surface of the Earth, the balance of international relations is presently preserved by a certain delicate balance of strategic deterrence amongst major powers. Such balance has been established among the U.S., Russia, and China. Even though China has a rather small nuclear deterrent comparing with that of the U.S., China's deterrence is effective– with China's dispersive basing mode– and without a version of America's national missile defense or space-based missile defense. This, in turn, reassures China its ultimate security in the context of U.S.-China relations.

In history, China used not to be advocates of pursuing nuclear weapons. Chinese leadership had termed nuclear bombs as "paper tigers," despite the devastating power the American atomic bombs had demonstrated against Hiroshima and Nagasaki. However, when the U.S. openly challenged China's security in 1950s, China made its mind to go nuclear in January 1955. These events had prompted China to bid for nuclear weapons– the U.S. threatened to bomb China with American nuclear bombs during the Korean War, during artillery shell exchange between Amoy and Kinmon/Matsu islands, and during China's assistance to Vietcong's Battle of Dien Bien Phu.[17] In less than 10 years, China secured its initial atomic weapons; in October 1964, China tested its first bomb in Gobi Desert successfully.

Though America may not be interested in accepting Chinese nuclear weapons status, the fact that China has established a small strategic deterrent has helped stabilize China-

[16]William J. Broad and David E. Sanger, "China Tests Anti-Satellite Weapon, Unnerving U.S.," *New York Times* (18 January 2007).

[17]McGeorge Bundy, *Danger & Survival: Choices About the Bomb in the First Fifty Years* (New York, New York: Random House, 1988).

U.S. relations. This has restrained American freedom of action vis-à-vis China. The U.S. has to ponder now the military and political consequences of waging a war with China, given the possibility that China developed an effective countervalue retaliatory capacity.

This is particularly relevant in the context of the Taiwan issue. China considers Taiwan a historical part of it and views that it has the sovereign right to handle it with whatever means. Presently, the U.S. is committed to the defense of Taiwan. Hence, there exists a vast difference in Chinese and American positions on Taiwan. After China obtained nuclear weapons in 1964, the U.S. has not publicly threatened China with nuclear bombs anymore to China's satisfaction.

China has purposefully chosen a minimum deterrence strategy, to attain the effect of deterrence, while least affecting the status quo. Initially, China opted for this path due to economic strain and moral concern. Over time, China has still adhered to it despite its improvement of economy.[18] It might be true that China is modernizing its strategic forces by introducing certain new launch platforms, and even experiencing its own version of science-based stewardship program of nuclear warhead modernization under the Comprehensive Test Ban Treaty (CTBT) regime, but it has officially refrained from pursuing a massive nuclear modernization.

China's self-restrain vindicates its belief in the limited political utility of nuclear weapons. China believes that it can handle international relations primarily with overall national strength, with nuclear weapons only serving to deter their first use by another party. Though such nuclear first attack could never be excluded, its real chance of first use is highly improbable. As long as China does not aspire to pursue an aggressive global policy, it is unnecessary to build a full-scale counterforce capability and a limited deterrence strategy is sufficient.

Space: New Balance of Power

There exists an unsymmetrical balance of nuclear deterrence between China and the U.S. over the past half a century. On the one hand, with the fast process of globalization as well as China-U.S. economic integration, the worst-case scenario of a nuclear confrontation between the two countries is very remote. On the other hand, in a realistic world where the nation-state is still the dominant unit to account for interstate relations, the nuclear power is far from being eliminated from international politics. It is against this backdrop, and given the push of the Clinton Administration for national missile defense and the Bush Administration effort of space weaponization, that China views the effectiveness of its nuclear deterrence eroding since the 1990s.

America's logic of building missile defense is the expanding threat of missile proliferation. Indeed, there is a phenomenon of missile proliferation around the world. America and other Western countries used to share missiles among their friends. Given the spread of missiles in the developing world, the West has spearheaded international control of missile transfer, making various codes of conducts, such as Missile Technology Control Regime (MTCR).

In this regard, China and the U.S. have developed a complex relationship. China used to export conventional missiles to states in Middle East and South Asia, including Sandi Arabia and Pakistan. Under U.S. pressures and

[18]Information Office of the State Council of the People's Republic of China, "*China's National Defense in 2008,*" January 2009, Beijing. The White Paper has reiterated China's no-first-use policy of nuclear weapons.

sanctions, China has modified its behavior throughout the 1990s, making more stringent commitment to refraining from such transfers.

In the meantime, the U.S. has continued weapons sale to Taiwan, which is viewed by China as provocative. Ideological differences aside, the thorny issue of Taiwan's quest for independence, China's vow to thwart a *de jure* independence by Taiwan, as well as America's threat through intervention in accordance with the *Taiwan Relations Act*, all bode ill for a physical confrontation between China and the U.S. China therefore deems an effective nuclear deterrence, despite its moderate size, necessary to keep America more cautious. Nevertheless, national missile defense, as well as ambitious space militarization by the U.S. DOD, serves to neutralize the effectiveness of China's deterrence.

China has raised, time and again, the seriousness of such development, in violation of Anti-Ballistic Missile (ABM) Treaty and other international treaties to ban space weaponization. For much of the 1990s, China had been working in the United Nations-based Conference on Disarmament, to propose to set up an ad hoc committee negotiating an international instrument on the "prevention of arms race in outer space" (PAROS), and even has attempted to link this to the American initiative to negotiate a separate international Fissile Material Cutoff Treaty (FMCT).[19] Under the Bush Administration, in particular, China's efforts were in vain– America abrogated the ABM, embarked on an aggressive space weapons program, and opposed PAROS. This may change with the Obama Administration in the U.S. that has called for "a worldwide ban on weapons that interfere with military and commercial satellites."[20]

International politics have prompted China to take realistic responses in kind, to attain "mutually assured space vulnerability."[21] Though China has voiced opposition to space weapons, it is understood that it might have kept its own R&D program of such. In regard to the January 2007 ASAT test, which created international repercussions, China has promised not to repeat tests.[22] However, this may not allay concerns over China's continuing effort to build a space-based defense capability to offset American unilateral superiority that threats the effectiveness of nuclear deterrence.[23]

If the history of nuclear proliferation serves any lessons, the current initiation of a space race of a military nature ought to be avoided as early as possible. America's pursuit of absolute security through dominating space will only pressure other countries, China and India, for instance, to join this expensive competition. Will the U.S. Government realize

[19] See, "Chinese CD PAROS Working Paper", February 8, 2000, *Disarmament Diplomacy*, Issue No.43, January-February 2000, http://www.acronym.org.uk/dd/dd43/43paros.htm.

[20] See http://www.whitehouse.gov/agenda/defense (accessed 2 February 2009). "The Obama-Biden Administration will restore American leadership on space issues, seeking a worldwide ban on weapons that interfere with military and commercial satellites. They will thoroughly assess possible threats to U.S. space assets and the best options, military and diplomatic, for countering them, establishing contingency plans to ensure that U.S. forces can maintain or duplicate access to information from space assets and accelerating programs to harden U.S. satellites against attack."

[21] Eric Hagt, "Mutually Assured Space Vulnerability", *China Security* 2: 2 (2006), pp. 84-106.

[22] "Chinese authority promised to the U.S. that it would not test missile against satellite again," *China Times* (in Chinese), Taipei, 27 October 2008.

[23] For more description from a Western perspective, see Ashley J. Tellis, "China's Military Space Strategy," *Survival* 49: 3 (2007): 41–72, and "Punching the U.S. Military's 'Soft Ribs': China's Anti-satellite Weapon Test in Strategic Perspective," Policy Brief 51, Carnegie Endowment for International Peace, Washington, DC, June 2007.

that it is highly undesirable to quest for space monopoly through building a military capacity vis-à-vis space?

Recommendations: Packaged Program of Cooperation

It is highly undesirable and unhelpful if China and the U.S. would enter a military space race, while being unable to collaborate in civilian space cooperation.[24] In fact, the more they hedge against militarily, the less likely the two countries will endeavor to undertake civilian cooperation as it intrinsically carries a possibility of dual-use diversion. Reversely, the build-up of political and military trust shall help nurture cooperation in civilian and dual-use space programs.

To this end, China and the U.S. ought to address their political objectives and security concerns frankly and aspire to collaborate strategically. The change of the international political and economic climate– President Obama's distancing to missile defense and support to prevent space weaponization, global call to nuclear zero (an elimination of nuclear arms), improvement of political ties across the Taiwan straits after Ma Ying-jeou's coming into power, and ongoing global financial crisis and subsequent need for cooperation– sheds some hope for a better China-U.S. space relationship.

In fact, President Obama's political view of missile defense is quite different from his predecessor, but echoed President Clinton.[25] During his presidential campaign, Obama had voiced distance with missile defense.[26] As President, he has asked for prudence in regard to the current program, somehow relieving tensions with Russia. Obama may have not expected that his cautious position could soften China's strategic suspicion of the U.S. as well, and, in turn, can make America safer if he can help foreclose Chinese development.

In fact, Obama could decide not only to hold-off on further American missile defense and space weapons programs, but also lead an effort to global nuclear disarmament effort. Though it is still distant to foresee a nuclear weapons free world, a world with thousands of deployed U.S. strategic weapons could only harm America− there is no enemy at that magnitude to check and too many nuclear weapons only make America less able to demand that North Korea and Iran abandon their nuclear aspirations.[27]

President Obama could lead to both curtail American nuclear defense and offense, but still enhance America security significantly. The U.S. freeze of strategic defense shall help speak to China to suspend Chinese programs and ambitions of a similar nature. China has appreciated the Bush Administration's distancing of Chen Shui-bian government in Taiwan in 2008, when the political campaign eventually led to the change of leadership to Ma Ying-jeou. The U.S. political gesture helps assure China that America has no strategic intention to confront China. It will be

[24]Bruce W. MacDonald, "China, Space Weapons, and U.S. Security," Council on Foreign Relations Special Report 38, New York, September 2008; and Peter Brown, **"**A fresh start or a protracted showdown?" *Asia Times Online* (3 December 2008), http://www.atimes.com/atimes/China/JL03Ad01.html (accessed 2 February 2009).

[25]William Walker, "President-elect Obama and Nuclear Disarmament: between Elimination and Restrain," *IFRI Security Studies Pape*r, Winter 2009.

[26]President-elect Obama considered that missile defense has to be proven to work before being deployed, and the system in Europe has to be supported by allies. See, "Arms Control Today 2008 Presidential Q&A: President-elect Barack Obama," *Arms Control Today*, December 2008.

[27]See, George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn，"A World Free of Nuclear Weapons," *The Wall Street Journal* (4 January 2007), and "Toward A Nuclear-Free World", *The Wall Street Journal* (15 January 2008).

desirable if the Obama Administration will carry this momentum to build a cooperative partnership with China, including collaboration with the current financial crisis and strategic space exploration.

China-U.S. talks on space relations could possibly include three elements that are highlighted below.

1. At political level, China and the U.S. should re-affirm that space will be preserved only for peaceful purpose of all mankind. At present, both sides shall freeze space weapons programs at current levels in a transparent way. Such a commitment would not cut U.S space defense programs and would help assure that China would not make progress in this regard. The U.S. has been worrying that China could challenge America's space dominance by laser blinding of space sensors, disrupting space-based communications, and launching ASAT weapons to destroy orbital satellites. China shall benefit in a similar fashion.

   President Obama would run a major risk in his Presidency if he would push American missile defense and space weapons programs forward. In doing so, Obama could pressure countries like China to respond in kind and they could afford such response financially and technically. Eventually, America would not end with a safer world, but open up outer space as a new frontier to militarily compete. This would be a strategic mistake as America might not be able to sustain its space dominance in the new century anymore.

2. The U.S. and China shall address threats of mutual and common concern in a collaborative way, especially to tackle missile proliferation in the context of building trust for space cooperation. The rise of China with an ever apparent global presence is increasingly exposed to an international environment of missile threats. As such, China and the U.S. shall define more common interests in dealing with missile threats together, and be able to understand and accept some kind of point or area missile defense. Over time, the Bush Administration's Proliferation Security Initiative (PSI) may be more acceptable in building security cooperation and trust, while catering to China's concern of PSI's compatibility with existing international legal system and practice, especially in the context of North Korea. China and the U.S. may find a way to constructively address their respective national security in dealing with the level of acceptability of mutual missile vulnerability.

3. China and the U.S. could set moderate goals in civil space cooperation, on the aforementioned two principles of non-diversion and reciprocity. Initial stages of civil space cooperation could include joint academic endeavors to address civil space objectives, space personnel safety, space debris, and space science and medicine. Various space education efforts, such as to launch joint student summer camps for space science, space modeling, and space vehicle design could be considered.

   The two countries could design some civil space exchange programs that would lead to least disclosure of space technology, but maximum build-up of trust and confidence. An incremental program, to add to step-by-step, could be conceived to exchange information on crew training and lunar topography at this stage. When China is to launch its space station, the two countries shall work more closely to build their systems with compatibility, so as to maximize their chance to collaborate

in the future, for space transportation or rescue missions.

It is necessary as well to envisage the legal dimension.[28] As legal instruments are necessary on the Earth to avoid conflict on the high seas and in the air, a space engagement code globally is necessary as well. The U.S. and China could take the lead to start their talks on making such an international law on space affairs.

This convention or code for space will address the identification and protection of national assets in the space, and non-intrusion of each other's assets. It shall establish the code of conduct of astronauts and taikonauts to engage in space through procedures and courtesy. The International Institute of Space Law (IISL) is important to this purpose, but as an international non-governmental organization, it is not in a position to efficiently make an all-encompassing international law to regulate human behavior in space. Similarly, the International Astronautical Federation (IAF) shall not be enough to administer an international law regulating all human behavior in space. It is necessary that state governments associate themselves in conducting their programs in space, or to entrust their national space agencies to form an international organization with government authority for this matter.

In the spirit of Sino-U.S. cooperation, China and the U.S. could engage in drafting such a code of promoting international civil space exchange and collaboration, as well as to freeze, and to ban eventually, space weaponization activities for their bilateral interests and global benefits.[29] It is not difficult to realize that they are the two most important states in the world for the 21st century. So, they bear the responsibility of mutual respect and accommodation of each other's interests, as well as to lead the world into a more secure order.

[28]Regina Hagen and Jüergen Scheffran, "*International Space Law and Space Security– Expectations and Criteria for a Sustainable and Peaceful Use of Outer Space,*" in M. Benko and K.-U. Schrogl, eds., *Space Law: Current Problems for Future Regulations* (Eleven International Publishing: The Netherlands, 2005): 273-301; and Nancy Gallagher and John D. Steinbruner, "Reconsidering the Rules for Space Security," American Academy of Arts and Sciences, 2008.

[29]The Council of European Union already approved a "Draft Code of Conduct for Outer Space Activities," 8-9 December 2008, http://register.consilium.europa.eu/pdf/en /08/st17/st17175.en08.pdf (accessed 2 February 2009).

Notes for Contributors to *Space and Defense*

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Providing the manuscript submitted meets editorial standards, i.e., relevant to aims and scope, analytical rigor, spelling, grammar, properly noted and 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.

For research articles, the manuscript will be sent to reviewers for peer review. In the peer review process, the author(s) and reviewers shall remain unknown to each other to ensure impartiality. On the basis of the peer reviews, 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 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

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Listed below are some additional style and writing guides:

- Dates in the form: 1 January 2009.
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- Headings (bold title case and centered).
- Subheadings (bold title case and aligned left).
- Acronyms and abbreviations should always be spelled out in full on first use.
- The 24-hour clock is used for time: 0800 or 1300.
- Use percent rather than % except in figures and tables.
- For numbers, spell out numbers less than 10.
- Make use of 21st 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.
- 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.
- Use the following sparingly: additionally, finally, further, furthermore, however, in addition, in fact, moreover, thus, etc…
- 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.