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The emerging China–EU space partnership: A geotechnological balancer

Joan Johnson-Freese*,[1], Andrew S. Erickson[2]

US Naval War College, 686 Cushing Road, Newport, RI 02841-1207, USA

Abstract

Through a techno-nationalist lens, this paper will assess the growing China–European Union (EU) space partnership, and its implications for international space cooperation and competition. Techno-nationalism (*jishu minzuzhuyi*), the idea that technological strength is an effective determinant of national power in a harshly competitive world,[3] informs both Chinese and US perceptions of China's space development. Using this lens elevates all space activities—manned, unmanned, military and scientific—to the strategic level. It is our contention that because of the increasing China–EU space partnership, the USA must re-evaluate its approach to China—away from the containment approach, which has thus far predominated, toward an approach which would offer the USA the opportunity to influence and, thereby, decrease the importance of the emerging partnership.

1. Introduction

China's 5 day *Shenzhou VI* manned mission of 12–17 October 2005 firmly established China's place as a major space player.[4] Having studied the *Apollo* playbook, China understands that there are multiple rewards to be reaped from a successful manned space program. Like Europe earlier, China sees a space program as generating technology, and technology as spurring economic development. First and foremost, Chinese space activities are part of Beijing's overall economic development program. Success in space is a highly visible demonstration that China can produce more than cheap sneakers and faux designer clothing. The manned space program also generates international prestige, as evidenced by the wringing of hands in India and Japan over Chinese space achievements, and domestic credibility for the communist government. Additionally, student interest in science and engineering programs is heightened, and technical jobs are created, all valuable to Beijing's overall economic development plan. Further, dual-use technology is generated, valuable to both the civil and military sectors. China and Europe share the philosophical view that investing in dual-use technology allows the maximization of returns on scarce resources. And, last but not least, being able to use these high-cost assets for not merely one mission but

*Corresponding author.
E-mail addresses: joan.johnsonj@nwc.navy.mil, johnsonj@nwc.navy.mil (J. Johnson-Freese), andrew.erickson@nwc.navy.mil (A.S. Erickson).

[1]The views expressed herein are solely those of the authors and do not represent those of the US Navy or any other element of the US government.

[2]When not otherwise cited, information concerning China in this article comes in part from interviews conducted by Andrew Erickson at the Chinese Academy of Social Sciences, Beijing in September 2004. The following interpretations of interviews conducted in Chinese should not be construed as representing the official policy of the PRC. A previous version of this paper, IAC-05-E3.1.03, was presented at the 56th International Astronautical Congress in Fukuoka, Japan on 17 October 2005.

[3]See Shen Hao. "*Woguo tuliaoye de 'jishu minzuzhuyi' yu guoji de zhiding*" ['Techno-nationalism and the establishment of national standards in china's coatings industry]. China Paint 2004;8:8–9; Jiang Qiping. "'*Xin jishu minzuzhuyi' jiang xingqi—jishu qiangguo luxian tu fenxi zhiyi*" ['New techno-nationalism' is on the rise-an analysis of one path to techno-national power]. China Internet Weekly 2004;20:58–9; Zhang Yuan, Chang Guangyi. "*Jishu xinxi buneng shuzhigaoge*" [Technology information must not be neglected]. *Developing* 1996;4: 12–3.

[4]For a detailed summary of the technology involved in China's *Shenzhou* program, see Qi Faren, Zhu Renzhang, Li Yili, editors. *Zairen hangtianqi jishu* [Manned spacecraft technology], 2nd ed. Beijing:*Guofang gongye chubanshe* [National Defense Industry Press];2003. p.365–66, 466–68, 486–88, 517–19, 554–556, 560.

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potentially two makes their political justification substantially easier.[5]

Driving Beijing's recent space achievement is a long-term commitment "to propel China's high technology development"[6] fueled by the ideology of techno-nationalism.[7] Techno-nationalism is the 21st century equivalent of the earlier developmental nationalism that had stemmed from colonial subjugation and left many populations willing to accept national discipline—such as the Chinese one child policy—to produce independent national power. While even China is not governed by a single guiding ideology today, the increasing salience of space and of other advanced technologies is bringing techno-nationalism to the fore as a useful framework for understanding the motivations of developing great powers such as China. It helps to answer such questions as "Why would China, with over 1.3 billion people to feed, house and keep employed, spend money on a manned space program?"[8]

The development of advanced technology with its corresponding (and overlapping) economic and military benefits has replaced the dynamic of political alignment, which was prevalent during the Cold War, as a major international system variable. This century's analogue to Cold War geopolitical competition is geotechnological maneuvering. Numerous China experts have recently pointed out two realities that need to be factored into future world order considerations.[9] First, China's rise in world affairs is inevitable. While Washington would like to maintain the status quo in Asia for as long as possible, for its benefits to the USA, Beijing is no longer satisfied with being a passive non-player in world events. Furthermore, China increasingly has the clout to demand to be a player.

The second reality is that China has been largely successful in transforming its image from that of a dissatisfied and defensive power to that of a regional power with which other countries want to co-operate. During China's diplomatic transformation, the image of the USA has changed as well, from that of a public goods provider worthy of emulation, to—at least in some quarters—that of an 'empire-building' unilateralist power. A poll released in June 2005 by the Pew Research Center found that in six out of nine Western publics China received higher percentages of favorable ratings than did the USA.[10] That being the case, growing Sino–European cooperation, particularly in space, can be partially explained by those great powers' strategic interests in (1) maximizing their respective economic positions vis-à-vis competitors such as the USA and Japan and (2) to some extent, balancing against preponderant American power. As of 1 May 2004, the EU overtook Japan as China's largest trading partner. China has imported over $75 billion in technology from Europe, more than from any other source. At over $160 billion in 2004,[11] Sino–EU trade is already three times of that of Sino–Russian trade.

1.1. Co-operative examples

China's technological co-operation with Europe is part of a larger strategy to prioritize "science and technology diplomacy" [*keji waijiao*] over traditional "economic diplomacy" [*jingji waijiao*]. From Beijing's viewpoint, this prioritization is part of a larger process in which the boundary between the "high politics" of military and technology affairs and the "low politics" of trade is becoming blurred, thereby increasing the importance of a nation's capacity for technological innovation. A prime example is the European *Galileo* observation satellite network project, in which China has a 5% investment. Sino–European co-operation facilitates China's progress in national science and technology initiatives, such as the 863 Program of technological development, the 973 Plan emphasizing theoretical science and Project 921—Beijing's human space program.

China today looks to Europe for space expertise that would be difficult to obtain from the USA, because of politically charged export restrictions.[12] The UK's Surrey Satellite Technology Ltd. (SSTL), e.g., is a world-renowned microsatellite R and D center. "*Galileo* is an incredibly important system for Europe, and the UK is playing a very large role," SSTL's CEO Sir Martin Sweeting states, referring to the system's *GSTB-V2/A* test bed satellite that his company is building.[13] SSTL has ties to countries, organizations and projects including the US

[5]For the European view on this subject, see European Commission. Progress report on the Galileo research programme. February 2004, p.5, http://www.europa.eu.int/comm/dgs/energy_transport/galileo/doc/com_2004_0112_en.pdf.

[6]Qi Faren, et al. Manned spacecraft technology, p. 3.

[7]For a French analysis that makes this connection, see Frédéric Guérin. Taikonaute: Le géant chinois s'éveille. Journal de l'astronomie et de l'espace 27 November, 2003, http://www.cite-sciences.fr/francais/ala_cite/science_actualites/sitesactu/magazine/article.php?id_mag=1&lang=fr&id_article=1643.

[8]For an analysis of China's space program prioritization and development, see Andrew S. Erickson. Seizing the highest high ground: PRC aerospace development and its larger implications. East–West center working paper series no. 3, December 2004, http://www.eastwestcenter.org/res-rp-publicationdetails.asp?pub_ID=1574&SearchString=;Joan Johnson-Freese; Scorpions in a bottle: China and the U.S. in Space. The Nonproliferation Review Summer 2004; Space Wei Qi: the launch of *Shenzhou* V. Naval War College Review Spring 2004; China's manned space program: Sun Tzu or *Apollo* redux? Naval War College Review Summer 2003.

[9]Joshua Cooper Ramos. The Beijing consensus. The Foreign Policy Centre; Spring 2004; David Shambaugh. The new strategic triangle: U.S. and European reactions to China's rise. Washington Quarterly Summer 2005; Robert Kaplan. How we would fight China. Atlantic Monthly June 2005.

[10]Pew Global Attitudes Project. American character gets mixed reviews: U.S. image up slightly, but still negative. 23 June 2005. p.2.

[11]The future of EU–China relations. Centre for European Reform, http://www.cer.org.uk/world/china.html.

[12]These include the U.S. State Department's International Traffic in Arms Regulations (ITAR) and the U.S. Commerce Department's Export Administration Regulations (EAR).

[13]Jonathan Amos. UK engineers navigate Europe's future. BBC News. 3 June 2005, http://newsvote.bbc.co.uk.

Air Force (PICOSat);[14] the European Space Agency (*Galileo*); Algeria, Turkey and Nigeria (*Disaster Monitoring Constellation*, *DMC*) and Tsinghua University in China. Already, China has collaborated with Surrey to develop two highly successful microsatellites. These include *Hangtian Qinghua* [*HTQH*] *−1*[15] and the 4 m resolution *DMC* satellite *Beijing-1*, launched successfully on 27 October 2005.[16] Surrey has attempted to refute the widespread perception that its assistance is helping China to develop microsatellite technologies with military applications.[17] China has also collaborated with ESA in developing the *Doublestar Equator* [*DSP-E*] and *Doublestar Polar* [*DSP-P*] small satellites.[18] ESA's Dragon Program is improving China's Earth observation applications with "data primarily from the [European Space Agency]'s *ERS* and *Envisat* satellites."[19] China's *Sinosat-2* communications satellite, originally scheduled for launch in early 2005,[20] was manufactured in Europe. In the near future, Chinese and German scientists plan to launch a $60 million solar telescope to conduct research intended to reduce radiation risks to space-based platforms.

China still values US trade and technology and would doubtless be interested in expanding cooperation in space, but Europe is a more amenable partner. While Europeans do sometimes nettle China's leadership by attempting to engage in economic protectionism and to 'softly' encourage human rights reforms, Europe's space interests are clearly more closely aligned with China's than are those of the USA. Washington tends to view space primarily through a military lens, creating a zero-sum approach which considers virtually all Chinese space advances as threatening. In the Pentagon's 2004 report on Chinese space "breakthroughs" in 2003, e.g., five out of six Chinese launches were considered militarily relevant breakthroughs, though all but one were civilian launches.

2. Techno-nationalism and geotechnological maneuvering: 21st century power politics

Developing powers such as China—those becoming advanced enough to compete with their established counterparts in at least some areas—tend to take an especially nationalistic approach to technological development, perhaps because their leading elites are acutely conscious of the costs of exclusion from economic and military world leadership. Competition, however, is not a uniform concept. Because of the overwhelming military power of the United States, challenges to Washington are inherently asymmetric. Countries understand that they cannot challenge the USA directly.

Parity, therefore, need not be sought; rather, perceptions of advancement relative to the USA, and comparatively low-tech capabilities to thwart high-tech US capabilities often suffice. In taking a nationalistic approach to technology development, countries are following the path taken by the first (and to date only) non-Western power to successfully join the 'West', Japan.[21] But, while Japan was an isolated precursor, current global trends emphasizing high-technology, and its aerospace subset in particular, lead the more advanced developing nations to see progress in these areas as being an indispensable means of achieving the national status that their frustrated ambition and resulting nationalism has convinced them that they deserve.

The term 'techno-nationalism' has been imprecisely used, and this causes confusion regarding its meaning.[22] Clearly, techno-nationalism as a view of technology as the

[14]Space test program *PICOSat* satellite. United States Air Force fact sheet. January 2001, http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/PICOSat.htm.

[15]See Hu Ruzhong. An introduction to the 'Astronautics *Qinghua-1*' microsatellite. National Territory Resources Remote Sensing. January 2002; Xu Xin, Sun Diqing. '*Qinghua-1*' microsatellite. Spaceflight Technology & Civilian Products. June 2000; Su Jun, Lin Miao, You Zheng, Gong Ke. Spaceflight *Qinghua-1* microsatellite innovation practices. Qinghua University Journal (natural sciences version) February 2001;2:Beijing 100084.

[16]Microsatellite successfully launched, http://www.china.org.cn/english/2005/Oct/146835.htm.

[17]Statement to press from Sir Martin Sweeting regarding PR China. Surrey Satellite Technology Ltd.; 23 March 2005, http://www.sstl.co.uk/index.php?loc=27&id=804.

[18]For a detailed overview of this and other Chinese satellite research and development, see Yu Dengyun. The development state and prospect of micro & small satellites in China. China Academy of Space Technology. July 2005; Chang Xianqi, et al., editors. *Junshi hangtianxue, dierban* [Military spaceflight studies] *Quanjun junshi keyan gongzuo 'shiwu' jihua zhongdian keti* [Army-wide military affairs research work '15' plan focal point study subject], vol. 2. Beijing:National Defense Industry Press;2005.p.207; Wang Yonggang, Liu Yuwen. *Junshi weixing ji yingyong gailun* [An introduction to military satellites and their applications]. Beijing:National Defense Industry Press;2003.p.247; Huang Bencheng, Ma Youli, editors. *Hangtianqi kongjian huanjing shiyan jishu* [Spacecraft space environment test technology]. Beijing:National Defense Industry Press;2002.p.120–7, 201–2, 235; Li Yong, Zhang Chunqing, Liu Liangdong. Observability of measurement bias for nonlinear systems arising from satellite autonomous navigation and attitude determination. Beijing:China Academy of Space Technology;October 2005. IAC-05-C1.P.25; Dong Jiping. Discussion of the frequency range of sems for satellite remote sensing. Beijing:China Academy of Space Technology;October 2005. For a comprehensive technical monograph on satellite subsystems, see Yuan Jiajun. *Weixing jiegou sheji yu fenxi* [Design and analysis of satellite structures]. Beijing:*Zhongguo yuhang chubanshe* [China Astronautics Press];2004. For an overview of Chinese rocket development, see Ruan Chongzhi, Li Jing. Twenty years of apogee kick motor applications in China, 1984–2004. Xian, China:Academy of Solid Propulsion Technology;October 2005. IAC-05-E4.3.06. All papers dated October 2005 were presented at the 56th International Astronautical Federation Congress in Fukuoka, Japan, 17–22 October 2005.

[19]Vincent G. Sabathier. Europe and China. *Ad Astra*, Spring 2005, www.space.com/adastra/china_europe_0505.html.

[20]*Xinnuo erhao weixing* [*Sinosat-2*], http://www.sinosatcom.com/chinese/satellite/index.htm.

[21]For a discussion of Japan's "political commitment to realize the national slogan *fukoku kyohei* ('Enrichment of the Nation, strengthening of the Army')" see Paul Kennedy. The rise and fall of the great powers: economic change and military conflict from 1500 to 2000. New York:Vintage Books;1989.p. 206–9.

[22]Evan A. Feigenbaum. China's techno-warriors: national security and strategic competition from the nuclear to the information age. Stanford, CA:Stanford University Press;2003.p.266–9.

source of national security differs from 'techno-protectionism,'[23] which implies an economically misguided plan to satisfy political interest groups or to support a discredited strategy. Examples include the more ambitious forms of import substitution industrialization (ISI) pursued by Latin American countries during the Cold War. China has rightly rejected such counterproductive strategies as being inadequate to support its ambitious economic development goals, which require substantial imports, and ultimately indigenization, of western technology. According to one Chinese scholar:

> Extreme techno-globalism and extreme techno-nationalism inevitably exist in conflict, but inevitably develop together, probably balancing technological globalization and localization. Therefore, only by pursuing a positive new techno-nationalism policy ([by] start[ing to use] technological globalization leverage, [while] safeguard[ing the] national interest), can [China through] technological localization establish a genuine foothold, [and] by means of international cooperation meet the challenge of technological globalization.[24]

Any Chinese inability to acquire foreign expertise has resulted not from wholesale rejection of western ideas (in the Qing Dynasty tradition of "keeping the Chinese elements as the value basis, and absorbing those western elements suitable for instrumental purposes," *zhongxue wei ti, xixue wei yong*) but rather from western, particularly American, unwillingness to share military or sensitive dual-use technology. As the late military technocrat Nie Rongzhen emphasized, since 1949 "Adhering to self-reliance does not mean to close [China's] doors. We must seek all assistance possible, learn from and absorb advanced sciences and technologies in the world and apply successful foreign experiences to our country's reality."[25]

The Chinese believe in learning from others rather than reinventing the wheel, but in the past they have had few countries willing to work with them, and now, while they do work with Russia and others, they cannot afford—nor do they want—to simply buy hardware. Where have they learned from others? It is not coincidental that one of the three Chinese launch sites (Xichang) is almost parallel to the US Kennedy Space Center (28°N latitude). This was designed to allow the Chinese initially to repeat the launch parameters of early US flights, as reported in open source journals such as Aviation Week & Space Technology. China's *Shenzhou* spacecraft bears a striking resemblance to Russia's *Soyuz*; but the Chinese insist they have taken a basic design, improved on it, and made it their own. Design and engineering comparisons seem to support this claim.[26]

China specialists John Lewis and Xue Litai point out that China's military industrial complex heralded the rise of techno-nationalism by leading Beijing's transition from politics to science in command—"For the first time—ironically coming during the high tide of the political furor and ideological torment of the Cultural Revolution—technology and Western military concepts had begun to displace politics and ideology as the underpinnings of China's military policies."[27] Starting with Deng Xiaoping, China's recent leaders broadened the scope of techno-nationalism to guide all aspects of China's comprehensive national development [*jiehe guojia fazhan*]. Techno-nationalism holds that technological development is not a superpower luxury. When it comes to such key national interests as space development, all potential great powers, believing that they must depend only on themselves, engage in techno-nationalist realpolitik.

Thanks to the collapse of European colonialism, the 20th century heralded the establishment of many new independent states whose political allegiance appeared to be in flux. For much of this time, particularly during the Cold War, international politics was dominated by geopolitical maneuvering—competition between the capitalist and communist blocs for the support of these and other 'non-aligned' countries. With technological development replacing political alignment as a leading international system variable, this century's analogue is geotechnological maneuvering. "Interstate rivalry, especially among super powers, often takes the form of a race for technological superiority," Vally Koubi explains. "The emphasis on military technology is bound to become more pronounced in the future as R&D becomes the main arena for interstate competition."[28] Following this geotechnological paradigm, states will continue the realist actions that have promoted their security for centuries, only this time with technological development as the decisive competitive realm. Space development represents a critical means of increasing a nation's comprehensive national power. Aspiring great powers therefore compete for mastery of this 'highest high ground' [*zuigao de gaodimian*], as they forge alliances and foment challenges.

[23]Richard J. Samuels. Rich nation strong army: national security and the technological transformation of Japan. Ithaca, NY:Cornell University Press;1994.p.31; Li Cheng. China's leaders. Lanham, MD:Rowman & Littlefield;2001.p.195.

[24]Li Sanhu. *Jishu quanqiuhua he jishu bentuhua: chongtuzhong de hezuo–liangzhong jishu kongjian jinlu de jiaohu guanxi fenxi* [Technological globalization and technological localization: cooperation during conflict-an analysis of two types of roads forward and their relationship]. Exploration2004;3;29–37.

[25]Nie Rongzhen. Preface. In: Yu Yongbo, et al. China today: defense science and technology, vol. 1. Beijing:National Defense Industry Press;1993.p.2.

[26]"Physics is the same for everybody," former Grumman President Joseph Gavin points out, recalling a misguided FBI probe into his corporation that sought to trace technology leakage from government surveillance satellite programs only to discover that Grumman engineers had made parallel discoveries themselves. Joseph Gavin, personal interview, August 2005.

[27]John Wilson Lewis, Xue Litai. China's strategic seapower: the politics of force modernization in the nuclear age. Stanford, CA:Stanford University Press;1994.p.165.

[28]Vally Koubi. Military technology races. International organization Summer 1999;53(3):537.

Some scholars contend that, in attempting unprecedented supranational federation, Europe has transcended the realist paradigm and, thereby, has ushered in a new era of co-operation based on shared norms and world views.[29] It is certainly true that Europeans have made heroic efforts to move beyond the horrors of the twentieth century's two world wars, and are determined never to repeat the bloodshed of that era. But, while Europeans have rejected the worst excesses of yesterday's geopolitical competition, they remain at the forefront of today's geotechnological competition. In fact, *both* individual European nations *and* their collective organizations follow patterns of international competition that, while far more peaceful, are at least somewhat analogous in scope and dynamism to those that European states followed at the height of their great power competition. Technology is no exception. Despite globalization, many firms rely on government support to enhance their competitiveness.

Initially, there was marked intra-European geotechnological competition in aerospace. In recent years, however, Brussels has begun federation-based geotechnological maneuvering, and intra-European competition has decreased accordingly. EU aerospace cooperation is tied to other areas of integration, thus placing it in an overall context of EU interest that has begun to transcend the parochial concerns[30] of specific member states. As the EU's latest Space Policy White Paper emphasizes, "Space technologies are set to play a key role in helping the Union achieve its main objectives: faster economic growth, job creation and industrial competitiveness, enlargement and cohesion, sustainable development and security and defence."[31]

3. Changing geotechnological space gameboard

The evolution of NASA–ESA relations, and more recently European–US relations—more broadly defined to include the EU and the US State Department and Defense Department—can be traced through a series of programs: *Spacelab*, the *International Space Station* (*ISS*), and *Galileo*.[32] Each of these represents a different point in the evolution of a relationship between friends and allies with markedly different motivations, resources and goals. Because of the technological imbalance between Europe and the USA, it has always been an asymmetric co-operative 'partnership'. The USA has traditionally led, and Europe followed—including on some originally European ideas. More recently, however, Europe has decided to pursue—lead—some initiatives on its own, a shift which the USA has seen as potentially competitive, even threatening.

The 1990–1991 Gulf War was dubbed the 'first space war' because it was then that the value of space assets as force enhancers was first realized. Beijing noted "that the USA employed more than 50 military-specific satellites plus numerous commercial satellites…"[33] While many coalition countries recognized the value of space assets, the ability to reap their benefits was largely limited to the USA and those to whom Washington parceled out the benefits. Coalition members, e.g., were largely dependent on the USA for remotely sensed imagery, and many allies felt that Washington was often parsimonious.

Subsequent to the Gulf War, several countries—including some that had previously defined the 'peaceful' use of space as meaning explicitly non-military—changed their view and began to develop dual-use space technology such as imagery for uses including military. The UK has enjoyed special access to US imagery and has, consequently, been less interested in an autonomous development of capabilities than have other countries. Germany, by contrast, is building a series of radar observation satellites. France launched its third military surveillance satellite into orbit in December 2004. *Helios 2A* is reportedly able to spot textbook-sized objects anywhere on Earth. It is equipped with infrared sensors, which allow it to gather information both in daylight and at night. French President Jacques Chirac argued that without its own satellite capabilities, Europe would remain little more than a "vassal" of America.[34]

The USA has not encouraged Europe in the development of military space hardware. Washington's argument has been that European military needs are great in so many other areas, such as transport planes and precision guided munitions, that Europeans should prioritize spending there rather than on surveillance satellites. The US view has also been that there is no need for such European development, since high-resolution imagery is now commercially available. When ordering imagery from a US-affiliated company, however, countries inevitably reveal what they are interested in looking at, and that information can find its way to the US government. Furthermore, many countries

[29]The rejection of an EU constitution in France and the Netherlands, on 29 May and 1 June 2005, respectively, already suggests that the process of unification may be slower and more uneven than originally anticipated by many proponents of a united Europe.

[30]Employment policy is one of the greatest remaining concerns of EU members. European aerospace projects are often designed to spread the benefits of job creation among participating member states.

[31]EU Space Policy White Paper. Space: a new European frontier for an expanding union—an action plan for implementing the European Space policy, 11 November 2003, Brussels. p.1, www.globalsecurity.org/space/library/policy/int/eu_white-paper_nov2003.htm.

[32]Much of this discussion on these programs is from Joan Johnson-Freese. Heavenly ambitions. New York:Columbia University Press [chapter 7, forthcoming].

[33]Phillip C. Saunders. China's future in space: implications for U.S. security. Ad Astra. Spring 2005, http://www.space.com/adastra/china_implications_0505.html.

[34]Chris Morris. EU rebuffs U.S. over satellite project. BBC News. 8 March 2002, http://news.bbc.co.uk/1/hi/world/europe/1862779.stm. For further French concerns about U.S. aerospace hegemony, see Paul de Brem. Politique spatiale: comment l'Europe résiste-t-elle à la concurrence? Journal de l'astronomie et de l'espace 27 August 2003, http://www.cite-sciences.fr/francais/ala_cite/science_actualites/sitesactu/magazine/article.php?id_mag=1&lang=fr&id_article=963.

simply do not trust the USA to refrain from exercising shutter control and buying up or switching off commercial imagery during a crisis.[35] Europe's prioritization for development of its *Global Monitoring and Environmental Security* (*GMES*) system, an autonomous European dual-use global satellite monitoring capability, reflects this distrust. Self-sufficiency in space is an increasingly important European goal. *GMES*, *Galileo* and *Ariane*, all programs to provide autonomous capabilities, represent the three pillars of Europe's current space strategy.

It should be pointed out that Europe is not alone in its desire for self-sufficiency in space capabilities. Tokyo too has changed its attitude about dependence. Japanese politicians were unhappy with their access to information from the USA after the 1998 North Korean *Taepo Dong* missile launch.[36] They have since invested over $2 billion in the *Information Gathering Satellite* (*IGS*) dual-use system. Achieving greater autonomy was their key motivation—*IGS* provides imagery no better than that available commercially, but is under Japan's exclusive control.[37]

A November 2003 EU White Paper posited that autonomous capabilities in space are critical to securing European interests in areas ranging from environmental protection to internal security. That view is further reflected in the December 2003 EU report Space and Security Policy in Europe, which concludes that "Space is a strategic asset, and its importance both in terms of technology and security cannot be overstated."[38] Security can be defined in many ways, however. Whereas the USA defines it primarily in military terms, the same is not true elsewhere, particularly in Europe—"Space technology is linked to collective security, with the term 'security' referring to the protection of European citizens from potential risks of both military and non-military origin."[39] This broad definition recognizes basic human needs—freedom from pervasive threats to people's rights, safety and lives. It includes clean air, clean water, food, the potential for economic growth and physical protection. All of these security elements are of considerable interest to China as a developing country.

Where economic growth is concerned, in the new, globalized economy that is emerging, developed nations cannot rely on the routine production jobs of the past to maintain a middle class. Those jobs are in many cases moving to developing countries where wages are lower. More important, however, is the notion that, in the future, strong economies will be "knowledge-based." Europe has stated that it will develop a knowledge-based society by 2010.[40] In knowledge-based societies, worker input is measured in value-added by knowledge, rather than by manual labor. Because of the linkages between space, information technology, and sharing and transmitting knowledge and its work-products, countries seeking to keep up with the new 'millennial capitalism' deem access to space technology as essential.

It is also hoped that development of *GMES* and *Galileo* will slow the brain drain that has plagued Europe. Almost 70% of Europeans who receive doctoral degrees in the USA in the science and engineering fields opt to stay there. Reversing that trend would be of considerable long-term value to Europe in building its knowledge-based society. *Galileo* alone is projected to create more than 100,000 European jobs[41] and will provide highly trained individuals with work in their chosen fields. EU officials hope that *Galileo* will be the first of many such programs.

Part of the problem involves Europe's deciding precisely what it wants to do and then determining how to pay for it. Whereas the USA takes a 'do it all' approach, increasingly expanding to include space control and potentially the use of space for force projection, Europe's military space ambitions are narrower. Space control technology is, e.g., arguably irrelevant for the kind of conflict prevention and crisis management missions that Europe envisions. European missile defense concerns are also much narrower. They focus on short and medium range missiles, rather than on the long-range missiles of greatest concern to the USA. Observation and telecommunications are first on European priority lists for intended missions.

Clearly, divergence in US and European defense priorities stems from differences in their strategic perspectives. The USA maintains a truly global strategic outlook. Whether that is an inherent responsibility based on its position as the sole remaining superpower, or a conscious choice, can be debated. Before 9/11 some Americans, and many Europeans and others, feared that the USA was becoming neo-isolationist. After 9/11, however, the neo-conservative perspective of being duty-bound to bring security and democracy to a dangerous world quickly gained dominance in Washington. In any event, the USA clearly seeks the ability to project force worldwide. Europe, on the other hand, has far more limited ambitions and hence requirements for force projection, focused on relatively proximate threats. While such a regional focus does not exclude the possibility of force commitments on a broader scale, such commitments would most likely be in support of US efforts.

[35]Daniel Keohane. Introduction. In: Bild, et al. Europe in space. Centre for European Reform:October 2004. p.4–5.

[36]Joan Johnson-Freese, Lance Gatling. Security implications of Japan's information gathering satellite system. Intelligence and National Security 2004;19(3).

[37]Joan Johnson-Freese, Lance Gatling. Security implications of Japan's information gathering satellite system. Intelligence and National Security 2004;19(3).

[38]Stefano Silvestri, rapporteur. Occasional papers. no.48.Institute for Security Studies, Paris:European Union;2003.p.3.

[39]Stefano Silvestri. Rapporteur. Occasional papers. no.48.Institute for Security Studies, Paris:European Union;2003.p.9.

[40]Space and security policy in Europe, no. 48. Executive summary. European Union:Institute for Security Studies;December 2003.p.9.

[41]European Commission. Progress report on the *Galileo* research programme. February 2004, http://www.europa.eu.int/comm/dgs/energy_transport/galileo/doc/com_2004_0112_en.pdf.

Differing goals are reflected in the comparative space spending of the USA, Europe and China. US spending accounts for some 90% of the world's spending on military space programs—about $48 billion annually. Europe collectively spends about $6.5 billion annually on its national and supranational civilian and military space programs. While Europe's space spending is expected to grow from 2% to 3% of its GDP by 2010, Brussels clearly has neither the desire nor the resources to attempt parity with the USA. Chinese space expenditures remain extremely opaque. We do know, however, that China has spent around $2.2 billion on its manned program to date.

In developing future capabilities, whereas the USA sees the dual-use nature of space technology as problematic, Europe sees it as opportune. Space assets are viewed as a means to protect populations, resources and territories, as well as for maintaining the integrity and capabilities of the technological base. Dual-use national programs are planned, and some are already in existence. In 2001, e.g., France and Italy agreed to develop *Pleiades-Cosmos* as a civil satellite observation system, while acknowledging that it could also be used for military purposes. Being able to use these high-cost assets for multiple missions makes political justification substantially easier:

> The development of dual-use technologies calls for a "European" approach to space security, linking the present national defence programs with mainly civilian European programs. The functions and means of security and defence uses of space overlap considerably. In fact, space operations can be seen as a continuum, including civilian and military functions as well as security and defence operations.[42]

As Washington is increasingly perceived to be taking a 'hegemonic' view of dual use technology, European and American attitudes about dual-use technology have diverged. European views are much closer to those of China, which also seeks to maximize resources and views space as a global commons.

Europe's *GMES* program and *Galileo* are the most ambitious European autonomous space initiatives to date, both with military implications. Both are also 'exceptions to the rule' in terms of Europe's ability to join together to develop space programs of this magnitude. Previously—when it came to initiating, and taking the lead on, large-scale space programs with military implications—Europe has staggered, plagued with funding, political and institutional fragmentation challenges. That Europe was able to unite politically in support of these programs, largely to reduce reliance on the US and to build indigenous industrial capability, reflects their perceived importance.

While *Galileo* provides Europe with a seat at the table of those countries capable of high-technology programs of strategic value, it is important to point out that Europe does not view *Galileo*'s strategic value in the same sense as, for instance, nuclear weapons. From a techno-nationalist, geostrategic perspective *Galileo* is an indicator of power. But it does not, nor is it intended to, place Europe in competition with the USA as a global military power. It does, however, impinge on a strategically important area in which the USA has previously dominated.

4. *Galileo* and the Sino–EU space partnership

Europe is not seeking parity with the USA in space. Quite the contrary—it has neither the resources nor the ambition to do so. A combination of autonomous capability development, and co-ordinated and co-operative programs with the USA and others can be expected. The question becomes, however, just how much of a betrayal Washington will see in this agenda, and how successful it will be in stifling European plans of which it does not approve. While potentially effective concerning individual programs or in the short term, Washington's efforts could also provide further impetus toward European space autonomy. *Galileo*, "like its predecessors *Ariane* and Airbus,"[43] has become both a technology driver and a strategic lever.[44]

The USA is also very concerned about potential international co-operation in the *Galileo* program. China, India, Israel, Mexico and Brazil have all expressed interest in partnerships, while Russia seeks to create "synergies" between *Galileo* and the Russian *Glonass* (military) navigation satellite system. It is China about which the USA worries most.[45] Brussels and Beijing signed the "Sino–European *Galileo* Plan Technology Cooperation Agreement" [*Zhong ou qielilue jihua jishu hezuo xieyi*] on 18 September 2003,[46] with the Chinese contributing about $265 million (€200 million) to the program.[47] As mentioned above, China has also developed a close partnership with SSTL, a British company which has produced

[42]European Commission. Progress report on the *Galileo* research programme. February 2004, http://www.europa.eu.int/comm/dgs/energy_transport/galileo/doc/com_2004_0112_en.pdf.p.5.

[43]Gustav Lindstrom and Giovanni Gasparini. The *Galileo* satellite system and its security implications. Occasional paper no. 44. Paris:European Union Institute for Security Studies;2003.p.30, http://www.iss-eu.org/occasion/occ44.pdf).

[44]For a Chinese article that makes a very strong version of this argument, see Wu Siping. '*Qielilue*' *jihua shi oumeng dui meiguo de tiaozhan* [The 'Galileo' project is the European Union's challenge to America]. *Dangdai Haijun* [Modern Navy]. September 2002.p.8–9.

[45]Many U.S. analysts are concerned that European aerospace assistance may strengthen China's military. See, e.g., Richard Fisher Jr. How may Europe strengthen China's military. International Assessment & Strategy Center;15 January 2005.

[46]*Oumeng zhengshi pizhun qielilue jihua shouke weixing mingnian fashe sheng kong* [The EU officially approves launching the first *Galileo* satellite next year]. *Zhongguo kexuejishu xinxi yanjiusuo* [China Science & Technology Information Research Institute];13 December 2004, http://www.cistc.gov.cn/info/infoview.asp?id=477.

[47]China joins EU's satellite network. BBC News. 19 September 2003, http://news.bbc.co.uk/1/hi/business/3121682.stm.

world-class microsatellites and is now building *Galileo*'s *GSTB-V2/A* test bed satellite.[48]

While there is no evidence that any country has yet used GPS-guided equipment against US forces in combat, that situation could soon change. Iraq attempted to jam GPS signals in 2003. That turned out to be a dire mistake for the Iraqi jammers—the US Air Force was able to lock onto their signals and subsequently target missiles on their location. But China is no Iraq. Pentagon officials worry that China could use GPS to guide weapons directed against the US in the event of a conflict over Taiwan. The USA is reportedly developing a new signal that would give the Pentagon the option of maintaining use of its own military signal while jamming the commercial signal potentially being used by enemy forces.[49] Having an alternative source like *Galileo* available, however, could negate the value of the new US code.

China is also developing its own rudimentary *Beidou* satellite navigation system,[50] and is seeking to maximize its civilian[51] and military applications,[52] but has yet to develop a comprehensive indigenous network. In the meantime, China's first priority is to balance against reliance on the USA's satellite navigation system. In 2002, therefore, PRC Prime Minister Zhu Rongji "expressed China's interest in being fully involved in the *Galileo* project at the financial, technical and political level."[53] The EU recently contracted "a group of Chinese companies to develop commercial applications" for *Galileo*.[54] Such geotechnological posturing may be seen as a high-technology version of great power balancing.

Because Galileo has "potential military uses", China's participation in the system represents an issue of concern to US policymakers.[55] Indeed, as two EU experts acknowledge,

> While cooperation [with third country members such as China] will help to facilitate financial and technical solutions for *Galileo*, there should be caution with respect to sharing applications that may be used for defence purposes. …the focus on *Galileo* as a civilian tool by the EC and ESA does not mean that other countries share that position. Particular areas of concern relate to the PRS [Public Regulated Service] technology, PRS receivers and the encryption methodology used. While the actual receivers are planned to be tightly controlled, there is a possibility that third parties might be able to tap into PRS independently once they have a good understanding of the system's architecture. The transfer of this technology to unauthorized hands—whether intentional or not—needs to be avoided at all costs.[56]

The country of most concern to Washington in this regard is, of course, China.[57]

Currently, lacking truly global security interests,[58] particularly in East Asia, European leaders tend not to share the USA's concerns about arms and strategic technology exports to China[59]. The majority of European efforts to assist China technologically, it must be emphasized, are unco-ordinated and economically driven.[60] Some European leaders, however, may see an opportunity to

[48]Jonathan Amos. UK engineers navigate Europe's future. BBC News. 3 June 2005, http://newsvote.bbc.co.uk.

[49]Chinese firms join *Galileo* project. Washington Post. 29 July 2005.p.D5.

[50]See "*Zhongguo shuangxing dingwei xitong*" [China's two-satellite positioning system]. She Jinpei, Yang Genqing, Liang Xuwen, editors. *Xiandai xiao weixing jishu yu yingyong* [Modern small satellite technology and application]. Shanghai:Shanghai Universal Science Press;2004.p.252; "'*Beidou yihao*' *wei zhongguo daohang*" [Beidou-1 and China's Navigation]., Remote Sensing and Information 2003;2; "*Beidou weixing shi zenyang daohang dingwei de*," [This is how the *Beidou* satellites' navigation positioning works]. Computer Automated Measurement & Control 2003;6.

[51]See "*Beidou weixing wei shenzhou daohang*" [*Beidou* satellites and *Shenzhou*'s navigation]. China Surveying and Mapping 2003;4; "*Beidou weixing tongxin gongneng zai shuiwen zidong cebao xitongzhong de yingyong*" [*Beidou* satellites' communication capacity for use in an automatic hydrological survey system]. Hydrology 2003;5; "*Beidou weixing zai xianan yuliang jiance xitongzhong de yingyong*" [The use of *Beidou* satellites in the South Shaanxi Province rainfall monitoring system]. Journal of Northwest Hydroelectric Power 2004;S1; "*Dayouzuowei de weixing yidong xinxi guanli yingyong xitong*" [There is great potential for the use of satellite motion information management]. Auto and Safety 2002;7.

[52]See "*You* '*zhongguo tese*' *de GPS xitong*—'*beidou*' *weixing xitong de zhanlue yunyong*" [There is a GPS system with 'Chinese characteristics'—the *Beidou* satellite system's strategic use]. *Guoji Zhanwang* [World Outlook] 2004;8.

[53]Gustav Lindstrom, Giovanni Gasparini. The *Galileo* satellite system and its security implications. Occasional paper no. 44. Paris:European Union Institute for Security Studies;2003.p.29, http://www.iss-eu.org/occasion/occ44.pdf.

[54]Chinese firms join *Galileo* project. Washington Post 29 July 2005, p. D5.

[55]For a discussion of *Galileo*'s dual-use potential, see Tomas Valasek, *Galileo*'s 'strategic' role. chapter In: Carl Bildt, et al., Europe in space. London:Centre for European Reform;2004, www.cer.org.uk/pdf/p572_space_pol_eu.pdf.

[56]Gustav Lindstrom and Giovanni Gasparini, The Galileo satellite system and its security implications. Occasional paper no. 44. Paris:European Union Institute for Security Studies;2003.p.29, http://www.iss-eu.org/occasion/occ44.pdf.

[57]Chinese analysts follow *Galileo*'s progress carefully. See, e.g., Yu Xiang. "*Oumeng* '*qielilue*' *jihua de shishi jinru xiayi jieduan*" [Implementation of the EU's '*Galileo*' project enters the next stage]. *Hangtian Dianzi Duikang* [Aerospace Electronic Warfare] 2005;2. For perceived Chinese benefits from *Galileo*, see Sun Yefei, Pu Xianbin. "'Qielilue jihua' zhongguo hangtian jishu fazhan de 'zhutuiqi'" [The '*Galileo* project': a 'helpful impetus' for China's space technology development]. *Guofang Keji* [National Defense Science & Technology] December 2004:12–6.

[58]Stefano Silvestri, rapporteur. Space and security policy in Europe. Occasional paper no. 48. Paris:European Union Institute for Security Studies;2003. Executive summary, p.29.

[59]For analysis of general differences in European and American attitudes toward China, see Bates Gill and Gudrun Wacker (eds.). China's rise: diverging US-EU perceptions and approaches. Berlin: German Institute for International and Security Affairs; p. 5–65.

[60]For a nuanced explanation of European actions in this regard, see Katinka Barysch, et al. Embracing the dragon: the EU's partnership with China. London:Centre for European Reform;2005.

enhance Europe's economic security, foreign policy flexibility and "technological and strategic autonomy,"[61] as well as negotiating leverage with the USA.[62] Strategic exports might thus offer European leaders a means of restraining America from further military 'unilateralism' by facilitating China's military development and, thus, preoccupying the 'hyperpower' with moderate security competition on the East Asian littoral. China's leaders—whose actions are far more deliberate in this regard given their greater comfort with realpolitik strategy and far more pessimistic view of their bilateral relationship with Washington—anticipate tremendous benefits from facilitating the strengthening and consolidation of a new "pole" to balance the USA.

An important aspect of this new trading of European military products and technology for Chinese money and market access is the gradual erosion of a European embargo on the sale of military weapons and technology to China, imposed following the Tiananmen crisis of 4 June 1989.[63] In response to even the suggestion that Europe might lift its arms embargo, on February 2005 the US House of Representatives passed a resolution declaring that such an act would be inconsistent with transatlantic defense cooperation. On 17 March 2005, the US Senate passed a similar resolution. [64] It also threatened to impose constraints on the US–NATO defense relationship, "cut off technology transfers to Europe's defence industry and apply sanctions to its companies".[65] Not surprisingly, France and Germany have been the foremost champions of lifting the embargo.[66] Because the USA views China as a strategic competitor, it sees Europe's act as a betrayal. Europe recognizes that a potential strategic partnership with China is not without limitations and pitfalls, but sees the potential benefits as worthwhile. The USA sees many risks and few benefits.

The idea of immediately lifting the arms embargo was abandoned when China seemed to deviate from its emerging constructive posture of 'peaceful development' [*heping fazhan*] with its announcement of a new Taiwan policy in April 2005, and government facilitation of anti-Japanese demonstrations, which quickly threatened to spin out of control. Seemingly unable at times to resist recalcitrant reactions to regional issues, China was apparently undermining its own best laid plans for international co-operation.

Washington's concerns over *Galileo* are several. First and foremost, there is simply the issue of losing control. Any increase in capabilities by another country is viewed as a relative decrease in capabilities by the USA, because space is considered to be a zero-sum arena—if Europe (or any country) gains, the USA must lose. Space assets are so important to the US military that space dominance, rather than mere space superiority, is deemed critical, and any increase in capabilities by others is seen as diminishing the US ability to dominate. There are more specific economic, technological and military concerns as well.

Initially, American apprehension stemmed from European plans to overlap Galileo's commercial radio frequency signal with that of the US military's classified signal. Meetings on that topic, over a 4 yr period, provoked heated statements from both sides. The USA wanted to be able to jam *Galileo* signals without affecting its own GPS military signals. An agreement reached in November 2003 was regarded as a first step toward reaching a mutually amenable policy. Europe agreed to modify *Galileo*'s signals. The USA agreed to give Europe technical assistance for developing *Galileo*, and to make sure that the third generation of GPS—to be deployed in 2012—will be compatible with *Galileo*. This will facilitate the interoperability of the two systems, which is a commercial goal of both sides. It could also, however, give Europe the ability to jam the American signals in the event of a crisis in which the two sides' interests diverge. That might be where US counterspace operations—and reports of Washington threatening to disable *Galileo* in the event of hostilities[67]—would come into play.

The final US–European agreement on *Galileo* and *GPS* was signed in June 2004. It included provisions on commercial interoperability—both systems utilize the same frequencies for their free signals. This will allow the use of dual system receivers (receivers able to pick up signals from both systems, not only one or the other). The USA was very concerned that *Galileo*, since it is being built to be commercial user-friendly, not do to *GPS* what in the video world universally compatible VCRs did to proprietary-technology-restricted Betamax—essentially render the

[61]Burkard Schmitt. From cooperation to integration: defense and aerospace industries in Europe. Chaillot paper 40. Paris:Institute for Security Studies, Western European Union;2000.p.78.

[62]Gustav Lindstrom, Giovanni Gasparini. The *Galileo* satellite system and its security implications. Occasional paper no. 44. Paris:European Union Institute for Security Studies;2003.p.16–22, http://www.iss-eu.org/occasion/occ44.pdf; Ezio Bonsignore and Eugene Kogan. Fatal attraction: The EU defence industry and China. Military Technology June 2005; p. 9.

[63]For evidence that the embargo already fails to prevent European firms from selling important nice products (e.g. radar systems, aero- and marine engines, communication systems and satellite technology) to China, see Eugene Kogan. The European Union defence industry and the appeal of the Chinese market. Schriftenreihe der Landesverteidigungsakademie. January 2005; p. 7–36.

[64]Kristin Archick, Richard F. Grimmett and Shirley Kan. European Union's Arms Embargo on China: Implications and Options for U.S. Policy. Washington, DC: Congressional Research Service, 27 May 2005; p. 36.

[65]Charles Grant. The lure of Beijing: Europe's U.S.-inspired suspension of plans to lift its arms embargo on China offers a chance to think through its own strategic interests in Asia. Guardian 25 May 2005.

[66]Gudrun Wacker. Should the EU arms embargo against China be lifted? SWP Comments April 2004. German Institute for International and Security Affairs; p.1.

[67]Christopher Booker. Star wars: continents clash in outer space. Sunday Telegraph (London) 31 October 2004; Allister Heath. U.S. threatens to take space war to third dimension. The Business 31 October 2004; U.S. could shoot down EU satellites if used by foes in wartime. Agence France Presse 24 October 2004.

system defunct. With over three billion receivers predicted to be in use by 2010, navigation satellite industries are growing rapidly and nobody wants to be shut out.

The Sino–European *Galileo* agreement is, in some respects, part of a plan of broader co-operation between Europe and China. Regarding space, it is also not without precedent. For 20 yr China and Europe have worked together on space-based Earth observation programs, and the launch of observation satellites. China and Europe are working together on China's Double Star project. As its name indicates, the mission consists of two satellites in complementary orbits, designed to simultaneously gather data on the changing magnetic field. China designed, built, launched (in 2002 and 2003) and now operates the satellites.[68] The intent is to have China's satellites work in concert with four ESA satellites, which were launched in summer 2000 into elliptical Earth orbits and are collectively called the '*Cluster*' mission.

The French satellite manufacturer Alcatel, which ranks third in the world and first in Europe, has had a commercial presence in China since 1983 and earns 10% of its income there. In 2002, Alcatel and the China Aerospace Science and Technology Corporation (CASC) signed a contract for the joint development of the first Chinese high-capacity communications satellite. Buoyed by this achievement, Alcatel further intends to double its business in the region over the next several years. Consequent to the Cox Report and current export control laws, US satellite manufacturers cannot sell communication satellites to China.

These restrictions have caused Beijing to adopt standards that minimize vulnerability to US embargo by increasing compatibility with European technologies. China has opted for the European standard for its GSM mobile telephone technology, which is important for future contracts. Regarding space missions, researchers from China Satellite Launch & Tracking Control General (CLTC), which oversees all China's launch sites as well as launch and tracking activities, emphasize that "ESA standards have been playing a very important role" in such areas as "PCM telemetry, PCM remote control, telemetry channel coding, emission frequency and modulation and space-carried data management systems."[69] Clearly Europe has made significant inroads into the potentially lucrative China market and intends to expand them. More broadly, "the EU has expressed the intention of developing its strategic partnership with [China]."[70]

Despite such recent progress, many issues concerning potentially increased Sino–European space co-operation largely remain to be addressed. Observation satellites, e.g., are considered to be military products by France's Interministerial Committee on the export of war equipment. While not necessarily banned from export, they face certain bureaucratic hurdles. It seems, however, that China will be able to obtain the metric observation hardware that it apparently seeks—if not from Europe, then from Russia, Israel or Brazil. Unlike the USA, Europe is reluctant to attempt control of that which it does not monopolize.

4.1. European concerns

Europe has its own issues with China. Most fundamentally, both individual European nations and elements of their respective civil societies disagree about how best to engage China, both on Earth and in space.[71] At the collective level, the European Union has stated that Sino–European space co-operation would be greatly facilitated if China would make "good faith" efforts in several areas. First, like the rest of the West, Europe wants China to become more transparent and forthcoming about its space programs, in terms of both activities and intentions. Second, Europe wants China to join the Missile Technology Control Regime (MTCR), an organization intended to stop the proliferation of missile technology. Europe has also encouraged China to make greater efforts to reach an understanding with the USA regarding potential Chinese inclusion in the *ISS*, though resistance has been primarily from the USA. There have also been calls for China to set up a civilian space structure equivalent to that of Europe.[72] And, finally, Europe has pushed for Chinese ratification of the United Nations Covenant on Civil and Political Rights. It has encouraged the latter by reminding China of the linkage Europeans see between China's human rights situation and potential European willingness to lift the arms embargo instated following the Tiananmen crisis.[73] Finally, an enduring challenge for European governmental engagement of China lies in personnel—"China specialists in the US government substantially outnumber their European counterparts, and they receive a significantly greater amount of training in contemporary Chinese affairs."[74]

The agreement that was signed between Europe and China on *Galileo* co-operation still lacks specifics. Conceptually, there is an agreement for co-operation. How that will actually occur, however, remains to be determined.

[68]Shi Yuan. "*Zhongguo* '*shuangxing*' *shanshuo taikong*" [China's 'Double Star' glitters in outer space]. Aerospace China 2004;2, http://www.space.cetin.net.cn/docs/ht0402/ht0402zgbd07.htm.

[69]Zhai Zheng'an, Luo Lun. Utilization of CCSDS protocols for inter-satellite links. Beijing, China:China Satellite Launch and Tracking Control General (CLTC);October 2005, IAC-05-D1.P.01.

[70]Aerospace cooperation between Europe and China. Assembly of Western European Union, Document A/1853, 3 June 2004, p. 2.

[71]Human rights conditions in China remain a major concern for Northern European parliaments and for NGOs throughout Europe. See, for example, Alfredo Pastor and David Gossett. The EU-China relationship: A Key to the 21st Century Order. Madrid: Real Instituto Elcano de Estudios Internacionales y Estratégicos, 30 November 2005; p. 3–4.

[72]This is somewhat ironic given European discussions regarding the inefficiencies of cold war structures that separated civil and military space activities.

[73]Aerospace Cooperation between Europe and China, p.2.

[74]David Shambaugh. The new strategic triangle, p.16.

China wanted to use its Long March rockets to launch the *Galileo* satellites into orbit. The USA objected, however, because of potential technology transfer issues that involved the satellites themselves. Since certain ESA programs, including *Galileo*, include critical US components, the USA essentially has a veto over Europe's plans. Europe bridles at this dependence, yet fears retaliation should it defy Washington:

> …if Europe pursues cooperation with China on the *Galileo* programme, we run the risk of encountering opposition from the United States, which could mean having to envisage the possibility of producing the critical components ourselves, unless a way can be found of reconciling everyone's interests before the United States decides to adopt retaliatory measures in other areas.[75]

Europe is, therefore, left with the dilemma of either not expanding co-operation with China, a restriction that it hopes to avoid, or of risking the wrath of the USA, which it neither wants, nor most probably can afford, to do.

The Europeans' desire to have the option to work with the USA, while maintaining their own autonomy and the option to work with other countries, including those potentially subject to American suspicion, will clearly create problems with Washington. The alternative, however, from their perspective, is to put their fate into the hands of USA. Co-operation with the USA is perceived as being inherently difficult, because it can never result in a true partnership—such a partnership is economically impossible from a European perspective and politically unacceptable to the USA. It is unrealistic to expect Europe not to be interested in exploring other options, especially when past co-operation with the USA has not always met expectations.

5. Implications for the USA

The USA cannot continue to dismiss other nations' aerospace aspirations. Washington should rather attempt to co-opt potential rival aerospace development and technology transfer partnerships, such as that now emerging between Europe and China. While these great powers share many legitimate space interests, previous aerospace axes and their technology end users' intentions have not been so benign. The former Condor II missile program, for instance, partnered Egypt and Argentina with Iraq. Critical to thwarting the emergence of exclusive aerospace alignments will be American acknowledgement of relevant nations' interests.

China, limited in aerospace co-operation with the USA, has developed not only a robust Sino–European aerospace partnership but also a Sino–Brazilian satellite, *SLV*, and commercial aircraft production partnership; and a Sino–Russian military aircraft, weapons systems and technology acquisition partnership. While some have advocated draconian technology control policies to arrest China's aerospace progress, such efforts are likely to fail, given both the lack of co-operation therein from Europe and other international actors, and the inherent difficulty in controlling dual use of aerospace technology. The USA's best strategy is to stay as far ahead as possible technologically, and to avoid taking steps that might prove counterproductive to the security of its numerous space assets.

Some experts have suggested that the USA and China need to initiate a strengthened dialogue to achieve greater transparency concerning their civil space activities. In return for increasing transparency and shifting its manned space program from military control to a civilian space agency more appropriate for partnering with NASA, China might be brought into international projects in which it has long been interested, such as the *ISS*.[76]

[75] Aerospace cooperation between Europe and China, p.13.

[76] John C. Baker, Kevin Pollpeter. A future for U.S.–China space cooperation? Space News 13 December 2004.