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CHINA'S SPACE PROGRAM: A NEW TOOL FOR PRC "SOFT POWER" IN INTERNATIONAL RELATIONS?

by

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When China launched an anti-satellite (ASAT) weapon in January 2007 to destroy one of its aging weather satellites, most reactions from academics and U.S. space experts focused on a potential military 'space race' between the United States and China. Overlooked, however, is China's growing role as global competitor on the *non-military* side of space. China's space program goes far beyond military counterspace applications and manifests manned space aspirations, including lunar exploration. Its pursuit of both commercial and scientific international space ventures constitutes a small, yet growing, percentage of the global space launch and related satellite service industry. It also highlights China's willingness to cooperate with nations far away from Asia for political and strategic purposes. These partnerships may constitute a challenge to the United States and enhance China's "soft power" among key American allies and even in some regions traditionally dominated by U.S. influence (e.g., Latin America and Africa). Thus, an appropriate U.S. response may not lie in a "hard power" counterspace effort but instead in a revival of U.S. space outreach of the past, as well as implementation of more business-friendly export control policies.

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CHINA'S SPACE PROGRAM: A NEW TOOL FOR PRC "SOFT POWER" IN INTERNATIONAL RELATIONS?

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ABSTRACT

When China launched an anti-satellite (ASAT) weapon in January 2007 to destroy one of its aging weather satellites, most reactions from academics and U.S. space experts focused on a potential military "space race" between the United States and China. Overlooked, however, is China's growing role as global competitor on the *non-military* side of space. China's space program goes far beyond military counterspace applications and manifests manned space aspirations, including lunar exploration. Its pursuit of both commercial and scientific international space ventures constitutes a small, yet growing, percentage of the global space launch and related satellite service industry. It also highlights China's willingness to cooperate with nations far away from Asia for political and strategic purposes. These partnerships may constitute a challenge to the United States and enhance China's "soft power" among key American allies and even in some regions traditionally dominated by U.S. influence (e.g., Latin America and Africa). Thus, an appropriate U.S. response may not lie in a "hard power" counterspace effort but instead in a revival of U.S. space outreach of the past, as well as implementation of more business-friendly export control policies.

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LIST OF ABBREVIATIONS AND ACRONYMS

AP-MCSTA	Asia-Pacific Multilateral Cooperation in Space Technology and Applications
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCO	Asia-Pacific Space Cooperation Organization
ASAT	Anti-Satellite
ASEAN	Association of South East Asian Nations
CALT	Chinese Academy of Launch Vehicle Technology
CAST	China Academy of Space Technology
CBERS	China-Brazil Earth Resources Satellite
CCP	Chinese Communist Party
CD	Conference on Disarmament
CLEP	Chinese Lunar Exploration Program
CNSA	China National Space Agency
COPUOS	Committee on the Peaceful Uses of Outer Space (UN)
CSSTEAP	Center for Space Science and Technology Education in Asia and the Pacific (UN)
CZ	*Chang Zheng* ("Long March")
DFH	*Dong Fang Hong* ("The East is Red")
ESA	European Space Agency
GEO	Geosynchronous Orbit
GIS	Geographic Information System
GPS	Global Positioning System
ICBM	Intercontinental Ballistic Missile
ISRO	Indian Space Research Organization
ISS	International Space Station
ITAR	International Traffic in Arms Regulations
KKV	Kinetic Kill Vehicle
LEO	Low Earth Orbit
MEO	Medium Earth Orbit
MTCR	Missile Technology Control Regime

MoU	Memorandum of Understanding
OOSA	Office of Outer Space Affairs (UN)
PAROS	Prevention of Arms Race in Outer Space
PNT	Precision Navigation and Timing
PPWT	Prevention of the Placement of Weapons In Outer Space
PRC	People's Republic of China
RESAP	Regional Space Application Program (UN)
SCOSA	Sub-Committee On Space technology and Applications (ASEAN)
SMMS	Small Multi-Mission Satellite
TT&C	Telemetry, Tracking & Control
UN	United Nations
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific

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[1] The full version of John 15:7 says, "I am the vine, you are the branches. He who abides in Me, and I in him, bears much fruit; for without Me you can do nothing."

[2] Philippians 4:13 states, "I can do all things through Christ who strengthens me."

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I. INTRODUCTION

A. RESEARCH QUESTION

Ever since China launched an anti-satellite (ASAT) weapon in early 2007 to destroy one of its aging weather satellites, a great deal of attention has focused on prospects for a possible military "space race" between the United States and China. However, has been overlooked is China's growing role as global competitor on the *non-military* side of space. Thus, the focus of this thesis addresses the question of how is China using cooperative commercial and scientific space ventures as part of a larger strategy to increase its soft power and enhance its international reputation and influence within Asia and across the globe.

B. IMPORTANCE AND RELEVANCE TO U.S. POLICY

When one mentions "China" and "space" in the same sentence, most people proceed along several basic lines of thought. Some think of the Chinese ASAT test on January 11, 2007, and view Chinese forays into space as hostile and menacing mainly to American military interests. Others recall the Loral-Hughes "scandal" and the alleged transfer of sensitive U.S. missile technology to China's strategic rocket forces. Still others think of China's growing interest in manned space flight and lunar exploration as it develops its respective *Shenzhou* and *Chang'E* programs. However, very few people acknowledge China's commercial space ventures with Nigeria, Venezuela, and France or of the space-related scientific connections China has forged with England's Surrey Space Center and the European Space Agency (ESA) through the Dragon I/II and Double Star programs.

China's space program goes far beyond just military counterspace applications, manned space aspirations, and lunar exploration endeavors. Its pursuit of both commercial and scientific international space ventures constitutes a small, yet growing, percentage of the global space launch and related space satellite service industry and also highlights China's willingness to cooperate with nations far away from Asia for political

and strategic purposes. Thus, the importance lies in understanding how China, through greater cooperation in space-related ventures, is establishing long-term partnerships that may constitute a threat either to counter or even isolate the United States and enhance China's "soft power," amongst both key American allies as well as some developing nations in our own backyard. An appropriate U.S. response, however, may not lie in the military arena, but instead in a revival of both past U.S. space outreach efforts as well as more business-friendly export control policies.

C. OVERVIEW OF PROBLEMS AND HYPOTHESIS

Two questions lay behind the purpose of this thesis. First, why are space programs important and what is China doing to leverage them? A growing number of nations recognize the advantages of space applications. From the tangible aspects of precision navigation and timing (PNT), remote sensing, weather forecasting, monitoring for natural disasters, and telecommunications (satellite TV, cell phones, etc.) to the more abstract aspects of political prestige, "soft power," and techno-nationalism, more countries are investing in both commercial and scientific space projects. China is not simply standing idly by, but instead is promoting itself as a provider of these services to others, despite short-term economic costs. Part of the thesis problem is to assess why China has chosen certain nations in Asia as well as others far outside of its Asian backyard to market these services to and what it hopes to gain from them.

Second, is America's comparative advantage in commercial space at risk to China by failing to compete effectively in these areas? Ever since the release of the Cox Commission's report in 1999, and the subsequent addition of International Traffic in Arms Regulations (ITAR) stipulations specifically against exporting satellites and launch vehicles, the United States has suffered significant consequences, both politically and economically. Joan Johnson-Freese says that Washington is sending the wrong strategic communication message about space, in particular that the United States is loath to admit that it "no longer owns space" and cannot accept that "other countries may want to use

space for both civil and military purposes".[3] With America snubbing China's desire to join the *International Space Station* (ISS), yet extending the same invitation to South Korea and Brazil, it seems that the message is more politically motivated than a question of whether or not either nation can provide logistics or financing for the project, or even poses a potential military risk. Part of this thesis will explore China's ventures with nations that are opening their doors and actively seeking space project cooperation, often denied by the United States.

The preliminary questions that the thesis assesses are:

- How is China using its space capabilities as a strategic asset in furthering its national interests? These may include working with nations that can provide access to oil reserves to feed growing Chinese demands from its civilian and industrial sectors.
- How is Beijing using its "soft power" and space capabilities to advance its international prestige through cooperative, bilateral, and multilateral space projects? Is it purposefully playing up its role as a responsible space-faring nation through participation in relevant United Nations space organizations, regional organizations (like APSCO), and by signing important space-related UN treaties?
- Is China pursuing a strategy of creating long-term partnerships through space that may reduce American influence in Asia, Africa, and South America and that may even expand to the point that U.S. interests are compromised, degraded, or even isolated?
- Is the United States in danger of mischaracterizing the motivations and rationales behind China's space program and, as a result, pursuing counterproductive policies that actually create incentives for other countries to side with China against American interests in space?

D. LITERATURE REVIEW

The literature on China's space activities is already voluminous. A subset of this work address issues of direct relevance to this thesis: Is China pursuing a space program to enhance national unity? Or is it focused more on its economic development? It is done

[3] Joan Johnson-Freese, "Strategic Communication with China: What Message About Space?," *China Security*, World Security Institute, 2:2 (2006): 45.

for international respect? Or are the efforts at military power projection through space assets part of a larger anti-access strategy so it can retake Taiwan without interference from Washington?

A study by U.S. Air Force Lt. Col. J. Barry Patterson looked at China's space program from the perspective of the threat posed to the United States in two main areas: economic impact and security. He argues that since the Chinese space program is subsidized by the government (exaggerated further by the generally lower comparative wages for its space scientists as well the undervalued *renminbi*), Beijing is in a position to "dump" space launch services onto the world market.[4] He also cites security concerns that any assistance given to the Chinese in increasing launch reliability and apogee kick motor technologies would be directly transferable to their ICBM program and, worse yet, possibly exported to "rogue nations" and used against American interests.[5] Given that the paper was written in 1995, some of the data are not as relevant today, especially given the growing number of Chinese commercial and non-strategic (space science) launches since the Loral-Hughes scandal. However, the potential for dual-use, civilian-military space technology transfer has been consistently raised as one of main objections to Chinese-U.S. space cooperation, and the issue will likely remain a thorny issue for some time to come.

Steven Lambakis sees China's growing commercial space capabilities as having an important role to play militarily as well. He highlights Chinese recognition of space as a "new arena for competition" and a "strategic frontier" that needs to be defended.[6] Citing a number of Chinese Army generals, defense professionals, and numerous FBIS translations from Chinese military journals dating mostly from the mid-1990s, he draws the conclusion that that China fully understands and appreciates the wide array of

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[4] Lieutenant Colonel J. Barry Patterson, *China's Space Program and its Implications for the United States* (Maxwell AFB, Ala.: Air War College, April 19, 1995), 16.

[5] Ibid., 20-22. Apogee kick motors are used to boost satellites from geostationary transfer orbit (GTO, approx. 600 miles) out to geostationary (GEO, approx. 22,300 miles) but would also help Chinese military refine their solid-rocket motors.

[6] Steven J. Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY: University of Kentucky Press, 2001), 192-193.

military advantages that space offers, especially in a Taiwan Strait scenario. He asserts that "military satellites are now legitimate targets in war…and thus ASATs are legitimate weapons".[7]

Three events in recent history have shaped a decidedly negative view of the Chinese space program: the Cox Commission Report, the Wen Ho Lee scandal, and the 2007 Chinese ASAT test. The Cox Commission Report, released in 1999, painted China as a direct threat to the United States, especially with regard to space-based as well as ground-based anti-satellite systems.[8] Its genesis was the botched Chinese Long March 2E rocket launches of Hughes satellites in 1992 and 1995 and the failed Long March 3B launch of Loral's *Intelsat 708* and the subsequent efforts by these U.S. companies to help the Chinese analyze and overcome their technical problems. Although several chapters of the Cox report are concerned with possible transfers of high performance computers and U.S. nuclear weapons designs, the bulk of the report investigates Chinese acquisition of American technology for their missile and space forces and satellite launches. It details Chinese efforts to use U.S. technology to enhance their ICBM and military space program through advances in missile airframe fairing (shroud) design and reliability, improved guidance and control, staging mechanisms and associated kick motors and "smart" dispensers, stress & load tests, launch failure anomaly analysis & diagnostics, coupled loads analysis, and modeling and simulation.[9] Although there is the larger theme of Chinese technology stealing through various schemes, the report's conclusion is that American space technology wrongfully ended up in Chinese hands.[10]

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[7] Lambakis, *On the Edge of Earth: The Future of American Space Power*, 194. Also see William E. Burrows, *The Survival Imperative: Using Space to Protect Earth* (New York, NY: Forge, Tom Doherty & Associates, 2006), 217.

[8] The classified report was released on January 3, 1999, and the declassified report on May 25, 1999.

[9] Christopher Cox, *U.S. National Security and Military/Commercial Concerns with People's Republic of China* (Washington D.C.: U.S. House of Representatives, Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, 1999), Ch. 4, 225-232; Ch.5, 2-5, 76-84.

[10] For a rebuttal to the Cox Report, see Stanford University's Center for International Security and Cooperation (Alastair Iain Johnston, et al.), see: http://iis-db.stanford.edu/pubs/10331/cox.pdf. The Cox Committee Rebuttal to the "Stanford Assessment," as well as the Stanford "response" to the Cox rebuttal are also conveniently located at: http://www.people.fas.harvard.edu/~johnston/cox.html.

On the heels of the Cox Report, was the alleged theft of U.S. nuclear warhead design secrets and transfer to the Chinese by Wen Ho Lee, a naturalized U.S. citizen from Taiwan and a scientist working at the Los Alamos weapons research facility. Although he was arrested in December 1999 and spent nine months in solitary confinement, he was eventually cleared of the 59 charges against him except for having to pay a $100 fine for "mishandling classified data".[11] Nevertheless, there was a cloud of suspicion over anything dealing with Chinese space and missile technology in the late 1990s.

Although China's space program continued to grow despite the Congressional backlash after the Cox Report and resulting ban on technology exports to China, its unannounced shootdown of an aging weather satellite on January 11, 2007, by a direct-ascent kinetic-kill-vehicle (KKV), resurrected ill feelings of how China was behaving and why everyone should be suspicious of its growing space aspirations. The use of ASATs for space control or space warfare is not a new topic and has been written about extensively.[12] However, China was never seriously mentioned until the turn of the century when reports about its research and development of anti-space doctrine came to the forefront.

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[11] A copy of the 59-count indictment can be viewed at: http://www.fas.org/irp/ops/ci/docs/lee_indict.html. Also see Paul Fahri, "U.S., Media Settle with Wen Ho Lee," *Washington Post*, June 3, 2006, http://www.washingtonpost.com/wp-dyn/content/article/2006/06/02/AR2006060201060.html (accessed August 15, 2008). He sued the government for supposedly leaking sources and violating his privacy to the media, and was awarded $1.6 million in damages in June 2006. For a criticism of the media's role in the Wen Ho Lee case, see Robert Scheer's, "No Defense: How the 'New York Times' Convicted Wen Ho Lee," in *The Nation*, October 23, 2000, http://www.thenation.com/doc/20001023/scheer. Lee also co- authored a book about his ordeal, *My Country Versus Me: The First-Hand Account by the Los Alamos Scientist Who Was Falsely Accused of Being a Spy* (New York, NY: Hyperion, 2003).

[12] See Joseph S. Nye, Jr. and James A. Schear, eds., *Seeking Stability In Space: Anti-Satellite Weapons and the Evolving Space Regime* (Lanham, MD: Aspen Strategy Group and University Press of America, 1987); Steven J Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY: University of Kentucky Press, 2001); Colonel Susan M. Puska, ed., *People's Liberation Army After Next* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, August 2000); Jeffrey G. Lewis, *The Minimum Means of Reprisal: China's Search for Security in the Nuclear Age* (Cambridge, MA: MIT Press, 2007).

The RAND Corporation under *Project Air Force* published a recent study on China's "antiaccess strategies" that specifically mentioned "attacks on satellites" as part of a potential Chinese military strategy to counter U.S. military superiority.[13] Although the ASAT test demonstrated only a capability to strike a satellite in low-earth orbit (LEO), this would enable China to hit U.S. imagery intelligence satellites, which were one of the top priority targets based on RAND's assessment.[14]

Beyond a direct-ascent KKV, there have been additional writings on other aspects of a potential Chinese anti-space program, including ground-based lasers, micro-satellites or parasite satellites, as well as nuclear warhead-generated high-altitude electromagnetic pulses to disable enemy satellites.[15] In general, the defense industry-related articles tend to paint any Chinese progress in space as a menacing threat. Even China's well-publicized *Shenzhou* human space program has come under scrutiny as actually serving as a cover for reconnaissance purposes.[16]

Despite some of the military and national security concerns, the focus of this thesis is on how China is using space as a "soft power" tool in international relations and whether Washington is miscalculating the main direction of China's threat to U.S. space policy and strategy. To that end, Joan Johnson-Freese notes that one purpose of space programs is "techno-nationalism," which she defines as, "using technology to build stature and power perceptions".[17] Clearly, a country that is able to build its own satellites, launch them, and then control them to exploit the space domain is among an elite group

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[13] Roger Cliff, Mark Burles, Michael S. Chase, Derek Eaton, and Kevin Pollpeter, *Entering the Dragon's Lair: Chinese Antiaccess Strategies and Their Implications for the United States* (Santa Monica, CA: RAND, 2007), 57-58.

[14] Ibid., 59.

[15] Stacey Solomone, "China's Space Program: The Great Leap Upward," *Journal of Contemporary China* (Vol. 15, No. 47, May 2006):316-317; Richard D. Fisher, Jr., "Space to Manoevre – Satellite Attack Upsets U.S. Space Supremacy," *Jane's Intelligence Review* (March 01, 2007); Mark A. Stokes, *China's Strategic Modernization: Implications for the United States* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, 1999). For world reaction to ASAT test, see WMD Insights. "Special Report: Chinese Anti-satellite Weapon Test – The Shot Heard 'Round the World," *WMD Insights: Issues and Viewpoints in the International Media*, http://www.wmdinsights.com/I13/I13_EA1_SP_PRC_ASAT.htm (accessed July 27, 2008).

[16] Desmond Ball, "China Pursues Space-Based Intelligence Gathering Capabilities," *Jane's Intelligence Review* (December 01, 2003).

[17] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 11.

of nations and enjoys higher prestige than those that cannot. Especially for nations wishing to become "players in space" and "build knowledge-based societies, technology development…attract more global information technology jobs…and link [rural] villages and cities,"[18] some kind of national investment in space is absolutely essential.

As China dips into its state resources to pursue its space program, there are natural, tangible benefits that will result. Job creation, stimulation of national interest in science, math, aerospace, and astronomy, and "spin-off" technologies resulting from space program research and development are but a few. However, there are more intangible, yet very real, benefits as well. First, a successful space program, especially a manned-space version, brings heightened global prestige as well increased internal credibility and prowess to the supporting scientific and technical communities. Johnson-Freese likens the Chinese effort to the American success enjoyed during the heyday of the Apollo program, and adds that "a successful demonstration…in manned spaceflight carr[ies] significant geopolitical implications…technology advancements can be viewed to indicate national stature, and potentially, power".[19]

Johnson-Freese follows this theme in another work, stating that "space is one of the most globalized aspects of world commerce,"[20] inferring that non-space players are behind the power curve in the increasingly globalized world. Specifically addressing China, Johnson-Freese notes that China wants to develop space capabilities "as part of globalization efforts and to send a techno-nationalist message regionally and globally".[21]

The concept of "techno-nationalism" has some parallels to Joseph Nye's term "soft power," which he defines as "the ability to get what you want through attraction rather than coercion or payments. It arises from the attractiveness of a country's culture,

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18 Johnson-Freese, *Space as a Strategic Asset*, 169, 202.

19 Ibid., 11.

20 Johnson-Freese, "Strategic Communication with China: What Message About Space?" 44.

21 Ibid., 52.

political ideals, and policies".[22] Nye sees China's efforts in space as a way to "help increase its prestige and attraction".[23] For China's space program to attract countries in Africa and South America, some measure of soft power may have been usefully applied.

Joshua Kurlantzick cites as growing evidence of Chinese soft power the "large official delegations from…Brazil and various African nations that now regularly visit China at the government's invitation"[24] as well as "in older groupings like the Association of Southeast Asian Nations [ASEAN] and in newer pan-Asian institutions, like the East Asia summit".[25] From a space perspective, this was manifested initially in the creation of the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) and then its subsequent transformation into the Asia-Pacific Space Cooperation Organization (APSCO), conveniently headquartered in Beijing.[26]

U.S. Navy Commander John Klein assesses China's rise in space as primarily associated with national power, national strategy, international influence, and world prestige. Although his main intent is to use historical maritime strategy to address current U.S. space strategy, he notes that as China continues to expand its "celestial lines of communication," it will have a "greater say in how the most desirable communications frequencies and geostationary orbital slots are assigned and used," and thus able to use coercive diplomatic influence if needed.[27]

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[22] Joseph S. Nye, Jr., *Soft Power: The Means to Success in World Politics* (NY: Perseus Books Group, 2004), x.

[23] Nye, *Soft Power: The Means to Success in World Politics*, 88.

[24] Joshua Kurlantzick, "China's Charm Offensive," *Commentary*, 122,3 (2006): 37.

[25] Ibid., 38. See also his article, "China's Charm: Implications of Chinese Soft Power," *Carnegie Endowment for International Peace*, Policy Brief No. 47, June 2006; "China's Latin Leap Forward." *World Policy Journal*, Fall 2006; also James H. Hoey, "The Global Reach of Chinese Soft Power: China's Rise and America's Decline?" M.A. Thesis, Naval Postgraduate School, September 2007; "China's Foreign Policy and "Soft Power" in South America, Asia, and Africa," Senate Foreign Relations Committee Report, April 2008; and Phillip Saunders, "China's Global Activism: Strategy, Drivers, and Tools," *INSS Occasional Paper*, NDU Press, October 2006.

[26] See APSCO website: http://www.apmcsta.org.

[27] John J. Kelin, *Space Warfare: Strategy, Principles and Policy* (New York, NY: Rutledge, 2006), 62. CDR Klein suggests "celestial lines of communication" (CLOC) be used instead of "space lines of communication" (SLOC) to avoid acronym confusion with the standard "sea lines of communication" (SLOC).

China scholar David M. Lampton also elaborates the argument about China's "underappreciated space program" as one aspect of its power projection, economic development, and more importantly "ideational power".[28] At its foundation, ideational power does not involve financial incentives or threats of military force. Rather, it comes from "the intellectual, cultural, spiritual, leadership, and legitimacy resources that enhance a nation's capacity to efficiently define and achieve national objectives".[29] He acknowledges some similarities between "ideational power" and Joseph Nye's "soft power" and Amitai Etzioni's "normative power," but adds that his term is broader in the sense that it also "includes leadership, human resources, innovation, and culture".[30] Thus China's push into space has intellectual attraction, creates a sense of national unity, can help promote economic development and raise standards of living, and can add diplomatic legitimacy to China as its participates in international space affairs.[31]

A recent study by Kevin Pollpeter portrays China's efforts as aimed at taking "a leading role in regional space cooperation" and as having the potential for space power to contribute to China's comprehensive national power, as well as to "advance China's diplomatic interests with oil-rich countries".[32] He devotes considerable effort to documenting the rise of Chinese commercial space prowess and how that will challenge American military, political, commercial, and economic interests.

Janie Hulse highlights the gradual pullout of American clout in Argentina and its subsequent replacement with Chinese technical assistance and influence. She underscores the threat to the United States manifested in China's desire cooperate with Brazil on spy satellite technology, as well as Western hemispheric space tracking facilities, which would give China extremely convenient monitoring of U.S. satellites and improved

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[28] David Lampton, *The Three Faces of Chinese Power: Might, Money, and Minds* (Berkeley, CA: University of California Press, 2008), 56.

[29] Ibid., 118.

[30] Lampton, *The Three Faces of Chinese Power: Might, Money, and Minds*, 56.

[31] Ibid., 119.

[32] Kevin Pollpeter, *Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the U.S. Response* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, March 2008), vii, 31.

imagery of North America.[33] Although she also focuses on the telecommunications industry, she nonetheless sees the international commercial space arena in Central and South America as a vital industry where America's preeminence may be waning.

E. METHODS AND SOURCES

This thesis pursues both *historical* and *political science* methodologies in this thesis. By pursuing a "blended" approach, I mean it first examines the history of the Chinese space program briefly, concentrating on Beijing's initial forays into cooperative commercial and scientific ventures with other nations. It then highlights the current political science debate over the nature of the Chinese "threat" in space, which most analysts have assumed to be centered on hard-power and military dimensions. It then investigates possible concerns on the "soft power" side and on China's motivations in forging international partnerships through space projects and joint scientific endeavors. The thesis looks at the parallel developments in China's "soft power" approaches to commercial space, sketching the rise of AP-MCSTA and APSCO, space initiatives in ASEAN, as well as its diplomatic outreach through space ventures with Russia, and countries in the EU, Africa and South America.

Additionally, this thesis examines the various United Nations space-related organizations, treaties, and conventions of which China is a member and signatory nation. The history of these organizations, as well as the treaties, helps to sketch the rise of Chinese influence in space through international fora. As noted by CNA China Space analyst Dean Cheng, China did not have a say regarding the formation of arms control and Missile Control Technology Regime (MCTR) rules, but has "sought a seat at the table on space issues, in order to help establish the fundamental 'rules of the road'".[34] Exploring the role and contributions that Chinese have made through the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) Regional Space

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[33] Janie Hulse, *China's Expansion into and U.S. Withdrawal from Argentina's Telecommunications and Space Industries and the Implications for U.S. National Security* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, September 2007), 20-21 and 34-35.

[34] Dean Cheng, "China and the International Space Community: A Brief Overview," *Chinese Military Update*, Vol. 1, No. 5 (October 2003): 2.

Application Programme (RESAP) is useful, especially in tracking Chinese soft power efforts and ability to influence as well as "[determine] the international terms and conditions for space operations".[35]

Finally, this thesis uses both the 2000 and 2006 PRC State Council White Papers on space as baselines for what China has officially stated in regard to the intentions of its space program. Since information on most international space launches and projects that the Chinese are involved in is available through open media reporting, the thesis uses extensive open press reporting as an additional source of information.

F. ROADMAP

To understand the importance of the space medium, it is necessary to understand the background of why countries have space programs in the first place. Thus, Chapter II first covers the strategic nature of space systems and how the growth of space-faring nations potentially reflects trends of techno-nationalism, "soft power," as well as a desire to take full advantage of the space domain, and then sketches some of the motivations and current capabilities of the Chinese space program. Chapter III assesses China's space program from commercial, scientific, and government legitimacy perspectives and focuses on their role in China's *domestic* development of space-based soft power. Chapter IV focuses on China's rise *internationally*, and breaks down China's space outreach efforts by major world regions, concluding with an analysis of the Sino-U.S. relationship in space. Finally, Chapter V concludes by assessing U.S. space policy and strategy. It recommends a specific course of remedial action for U.S policy to help promote American soft power in space as well as to shape China's rise as a space-faring nation in a positive direction.

[35] Cheng, "China and the International Space Community: A Brief Overview," 2.

II. CHINESE SPACE MOTIVATIONS AND CAPABILITIES

It is easy to understand, given the ominous background of the Cold War and the initial space race between the America and then-USSR in the 1950s and 1960s, why space programs have been traditionally regarded as a "hard power" asset. In more recent times, however, that hard edge to space power has been continually dulled by the growing number of actors (both state-sponsored and private commercial entities) in space and the concurrent expansion of soft power applications of space programs. This chapter examines the reasons why many states are now entering space and what soft power abilities they obtain through space activity. It then focuses on China's specific motivations and capabilities.

A. SPACE PROGRAMS: ONLY A SUPERPOWER LUXURY?

Access to space was at one time the hallowed and exclusive ground of the great superpowers: the United States and the former Soviet Union. Looking back several decades, only these two large, powerful states with rich financial and scientific resources could muster the required effort to develop the necessary technical acumen to research, test, develop, and field rocket and satellite technology. Currently, access to space is only a matter of money and interest. Much of the technology can be obtained relatively inexpensively, and there are a host of commercial and state enterprises worldwide that are competing to help other countries gain access to space.

A recent report by the FUTRON Corporation highlights several emerging space trends with international impact, for example:

- Rise of space as a global information and communication environment;
- Growth of commercial space (e.g., cheaper boosters, more launch service providers);
- Introduction of "NewSpace" (e.g., space tourism, commercial spaceports);

- Advancement of Asian leaders (specifically referring to the Chinese, Indian, and Japanese space programs); and
- Globalization of space participation.[36]

Space-based telecommunications are no longer a luxury of the ultra-rich superpowers, but a commodity that many nations have either developed on their own or bought into through partnerships or broader consortiums. This is compounded by the fact that more nations have started up their own space agencies and are developing new vehicles and booster rockets. The last bullet on the "Globalization of space participation" captures this concept very well in its follow-on text:

> *Space is no longer the exclusive province of a handful of countries*. The 10 leaders [major space-faring nations] are now joined by scores of others with some degree of space involvement—whether a national satellite, an astronaut flown by a partner nation, membership in an intergovernmental space organization, or participation in a collaborative space project. From Colombia's *Libertad* satellite to Nigeria's *Nigcomsat*, from Australia's Hyshot suborbital test to Saudi Arabia's Riyadh Space Research Institute, *countries from all six populated continents now participate in space*.[37]

Given the upward trend for space activities, how would "country X" get started in space? What typical milestones should be reached? Nicolas Peter, in his study on the "new geography of civilian space activities," suggests a four-stage evolution for a nation's space program, as follows:

- Purchase satellites from other countries;
- Develop space systems in cooperation with other countries;
- Develop satellite systems independently; and
- Disseminate knowledge of satellite development to other countries.[38]

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[36] David Vaccaro, "Who Will Lead the Next Space Race?" *FUTRON Corporation* (October 1, 2008), emphasis mine. See also: Mark Kaufman, "U.S. Finds its Getting Crowded Out There: Dominance in Space Slips as Other Nations Step Up Their Efforts," *WashingtonPost.com*, July 9, 2008, A01.

[37] Ibid. Emphasis in italics is author's. Note: China led effort for Nigeria's NIGCOMSAT-1, further detailed in Chapter IV. The 10 leading nations were mentioned earlier in the article as: Brazil, Canada, China, Europe (as an integrated region), India, Israel, Japan, Russia, South Korea, and the United States.

[38] Nicolas Peter, "The Changing Geopolitics of Space Activities," *Space Policy*, Vol. 22, No. 2 (May 2006): 101.

Looking at China's progress in space since 1970, it seems to be following these four stages in fairly close order. China bought much of the high-tech transponder technology for its *Dongfanghong-1* ("East is Red") communication satellite from West Germany. Sanctions resulting from international condemnation of the Tiananmen Incident in 1989 forced China to look at non-Western assistance for space technology, and it chose to partner with Brazil on the China-Brazil Earth Resource Satellite (CBERS, or *Ziyuan* for "resource" in Chinese) in the mid-1990s. In addition to the CBERS program, China has had an ongoing partnership with the European Space Agency involving the Double Star/Cluster project and Dragon I/II projects, which focus on studying Earth's magnetic belts and magnetosphere, and various applications of remote sensing, respectively.[39]

Although its domestic satellite manufacturing may not have reached the level of sophistication that Washington and Moscow enjoy, Beijing nonetheless has produced its own satellites and launch vehicles with marked success (discussed below). China currently has ongoing projects for launching satellites and training engineers and space operators from Nigeria and Venezuela.[40] Clearly, according to Peter's evolutionary progression model for national space agencies, China has stepped through all four stages and continues to operate in each one of them to this day. But to what end?

B. MOTIVATIONS AND EMERGING CAPABILITIES OF THE CHINESE SPACE PROGRAM

According to the United Nation's Office for Outer Space Affairs, there are more than 50 countries that have national space programs.[41] Since the launch of Sputnik in 1957 and Yuri Gargarin's first flight into space back in 1961, the price tag of getting your

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[39] Chinese cooperation with ESA is covered in more detail in Chapter IV. For more information on the Double Star program, see: http://sci.esa.int/science-e/www/area/index.cfm?fareaid=70 (accessed February 19, 2009). Information on the Dragon program can be found at: http://earth.esa.int/dragon/ (accessed February 19, 2009).

[40] China successfully launched versions of their DHF-class communications satellite for each country, NIGCOMSAT-1 and VENESAT-1, respectively. China's international space cooperation is more thoroughly addressed in Chapter IV.

[41] United Nations Office for Outerspace (UNOOSA) See http://www.unoosa.org/oosa/en/OOSA/index.html, however it is important to note that few nations possess a truly *independent* launch capability.

own slice of the space market has been falling. As noted space historian Howard E. McCurdy commented, "Space, at least Earth's orbit, is no longer the exclusive domain of the few."[42] Louis Friedman, who is the executive director of the Pasadena-based Planetary Society, echoes similar comments about why more countries are getting into space. Once a country has its own satellite in orbit, he asserted, they "immediately become a player on the world stage".[43] He added, countries that aspire to "be an economic and technological power in their region…going to space is a way to show that."[44] The Cold War, which had "limited space cooperation to 'intra-bloc' cooperation," has ended, and there are "new and emerging relations among civilian space entities in the post-Cold War era".[45] Thus, it should come as no surprise that China, with its growing economic power and burgeoning scientific and technology capacities would be interested in exploring the possibilities of outer space and expanding its cooperation with other nations.

In October 2006, China released a key document that outlined its policy regarding space, entitled, "China's Space Activities in 2006." This white paper is divided into five sections, covering its aims and principles, a review of the last five years in space, its plans for the next five years, its development policies as well as international exchanges and cooperation.[46] While there is an emphasis on foreign cooperation at the end, there are also plans for China to set the foundation to become a "commercial space superpower…through launching dozens of domestic satellites on improved boosters".[47]

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[42] Peter Pae, "Third World Sets Sights on Space," *Los Angeles Times* (October 14, 2003): A1.

[43] Friedman.

[44] Ibid.

[45] Peter, "The Changing Geopolitics of Space Activities,"101.

[46] White Paper, "China's Space Activities in 2006," People's Republic of China, Information Office of the State Council, (October 12, 2006). This is an updated version of the original White Paper released in 2000. Both versions are more thoroughly analyzed for their domestic and international impacts in Chapters III and IV respectively.

[47] Andy Pasztor, "China's Rocket Service Makes Inroads, Irks U.S.," *Wall Street Journal* (October 5, 2007): A13.

Looking at the other major Asian space contenders, to include Japan, India, and now an ambitious South Korea, none have been able to match China's success either in its manned program or in its recent launch record. The following table shows China's recent space activity compared with the other major space-faring nations:

Reported Spaceflights Launched by Country, 2003-2007

	Russia	U.S.	China	EU	Japan	India
2003	21	26	7	4	3	2
2004	23	19	8	3	0	1
2005	26	16	5	5	2	1
2006	25	23	6	5	6	1
2007	22	16	10	5	2	3

Table 1. Reported Spaceflight Launched by Country, 2003-2007[48]

Figure 1 below shows future predicted launches by the Chinese government and covers their domestic communications satellite launches as well as support for both their lunar exploration and manned space launch programs:

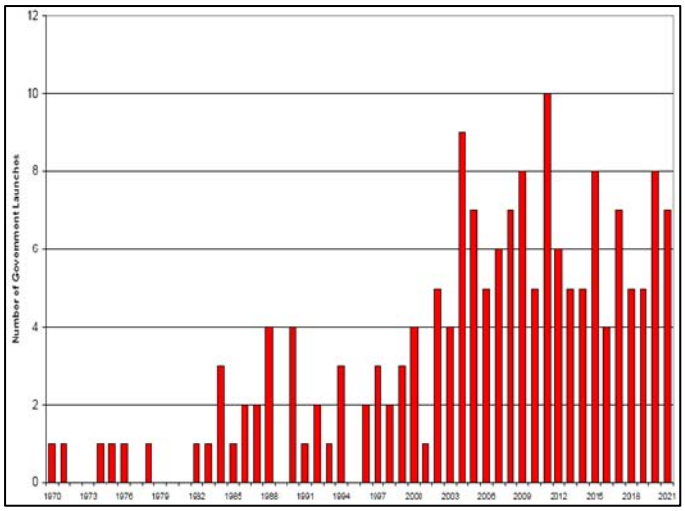

Figure 1. Chinese Government Launches (1970-2021): Future Launch Projection from Futron's ASCENT Study[49]

[48] Source: Jeffrey Logan, CRS Report for Congress RS22777, "China's Space Program: Options for U.S.-China Cooperation," May 21, 2008.

[49] FUTRON, "China and the Second Space Age," October 15, 2003, available online at: http://www.futron.com/pdf/resource_center/white_papers/China_White_paper.pdf (accessed March 6, 2009).

With 115th of its Long March rockets last December, China achieved 11 successful flights in 2008, surpassing the number predicted above by four launches and establishing a new domestic record. It is also interesting to note that China also surpassed the total number of U.S. launches (10) for 2008.

A more recent study by FUTRON covered the world's top 10 leading nations involved in space activities, and analyzed them "using 40 measures of government spending, human expertise, and the private sector".[50] The resulting document became known as a "Space Competitive Index," with one telling illustration as follows:

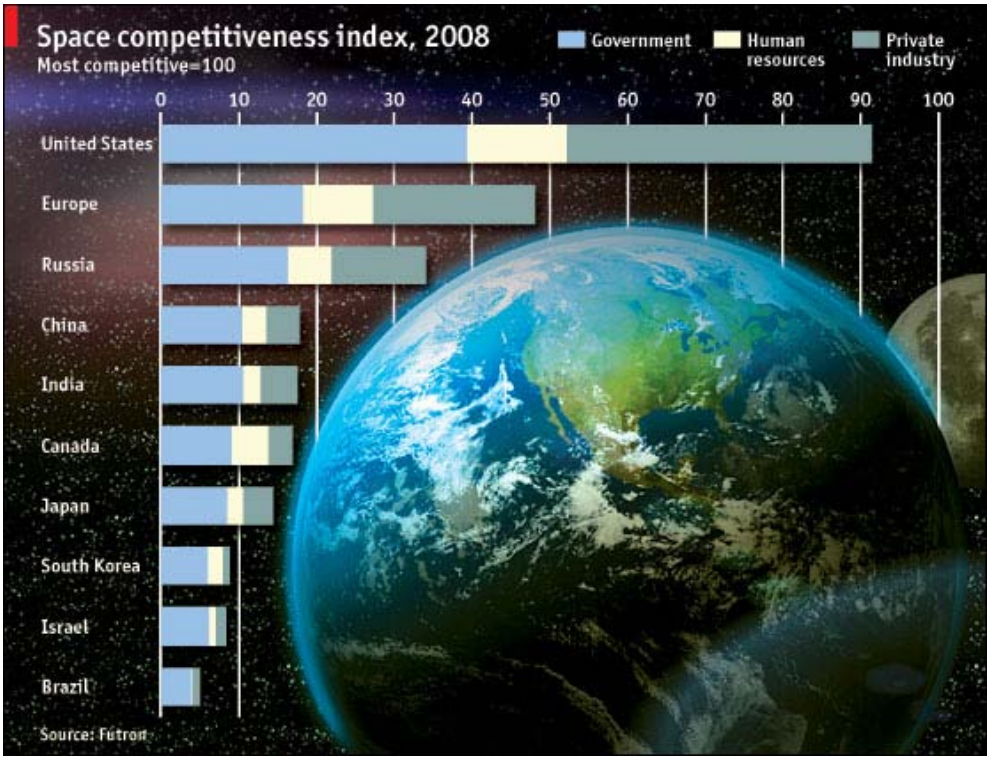

Figure 2. FUTRON Corporation's Space Competiveness Index, 2008[51]

China was specifically highlighted as, "emerging as a major space power with ambitious and visionary goals backed by heavy investment, centralized decision making, and

[50] Unattributed, "Stars in Their Eyes," *The Economist.com*, April 7, 2008.

[51] Ibid. The full version of the report is available at FUTRON's website: http://www.futron.com/resource_center/store/Space_Competitiveness_Index/FSCI-2008.htm

techno-nationalistic programs".[52] Although it is clear from Figure 2 that China has a way to go before it comes close to the United States, it's also noteworthy that it enjoys a fourth-place ranking ahead of U.S. space allies Canada and Japan.

1. China's Space Launch Facilities

As clearly illustrated from the above figures, China is going to be a major (and increasing) space launch provider in the future. Where will all this occur? China currently has three main facilities to conduct space launches, with a fourth site (Wenchang) under construction on Hainan Island just off China's southern coast. Table 2 breaks down each site's location and type of launch capability it provides:

Name (alternate name)	Location	Orbit Type	Associated Launch Vehicles	Other comments
Jiuquan (Base 20) (Shuangchengzi)	Gansu province (Gobi desert) South of Mongolia	LEO	CZ/LM-2 variants CZ/LM-2F (manned)	- China's 1st launch site - Manned space - Previous missile test base for DF-4/5 - FSW recoverable satellites
Xichang (Base 27)	Southern China near Chengdu, Sichuan province	GEO	CZ/LM-2/3	- Communication satellites - Chang-E lunar probe - Commercial satellites - Will serve as backup to Wenchang
Taiyuan (Base 25) (Wuzhai)	South of Beijing	Polar Sun-synch	CZ/LM-2C CZ/LM-4 CZ/LM-1D (small launch) KT-1 (2 unsuccessful)	- Weather satellites - Earth Observation - Motorola Iridium launches - Military reconnaissance - DF-5 ICBM
Wenchang	NE Hainan Island (only 19 deg. north of equator)	GEO	CZ/LM-5 (heavy-lift)	- 1st-phase construction done by 2010; will replace Xichang - large GEO communication satellites - space station modules - deep space exploration

Table 2. Overview of China's Space Launch Centers[53]

[52] "Insight: The FUTRON Competitiveness Index," *Satmagazine.com*, May 2008.

[53] Derived from: Marcia S. Smith, *China's Space Program: An Overview*, CRS Report RS21641, October 18, 2005; various Sinodefence.com pages on Chinese space launch centers.

The addition of Wenchang was specifically designed to give the Chinese a favorable site close to the Equator for geosynchronous launches. Since it will be a coastal facility, it will be able to take advantage of ship-borne rocket stages and avoid having to negotiate China's cramped domestic railways. Wenchang will also likely serve as the permanent launch facility for the *Long March-5* heavy booster when it comes on line. This new design, which will be able to boost 25-ton payloads (lunar program projects, large satellites, and space station modules) by 2014, will also "compete for launching commercial satellites on the international market".[54]

2. China's Space Tracking Capability

Beyond the ability to launch a satellite into orbit, it is even more important to be able to manipulate and control it to actually derive any benefit from it. Otherwise, it will be just another piece of floating debris in space and of no use to anyone. In order to establish satellite control, a network of Telemetry, Tracking and Control (TT&C) stations are required. This is especially critical for a manned-space program where a global network is needed to ensure consistent communications all at times with the capsule. Currently, China operates 10 ground observation sites and TT&C stations in China, and has agreements with other nations (France, Norway, Chile, for example) to complement their domestic capability. It also employs a small fleet of space tracking ships, called "*Yuan Wang"* (literally, "far observe"), that "conduct surveying and controlling operations for spaceship's orbit transfer and maintenance, attitude adjustment, and video and audio transmission".[55] Altogether, China has five *Yuanwang* ships in the Pacific, Atlantic, and Indian oceans to provide worldwide coverage of its space assets. It also recently launched a *Tianlian* (literally, "heaven/sky link") satellite that will provide

[54] Unattributed, "China to Start Making Trial Model of 'Long March 5' Carrier Rocket," China Radio International (March 28, 2008). One space enthusiast has his own well-maintained website tracking China's space launches at: http://www.sworld.com.au/steven/space/china-rec.txt.

[55] Unattributed, "New Space Tracking Ship to Serve Shenzhou VII," Xinhua News Agency, (April 13, 2008).

improved data relay between its satellites and manned space capsules with its supporting ground stations, and help to quickly diagnose any malfunctions that may occur while astronauts are on board.[56]

3. China's Manned Space Program

China began "Project 921" in 1992 in an earnest effort to send humans into space. It is somewhat mirrored on the U.S. and Soviet manned space programs and broken into three distinct phases:

- **Phase I**: Technology demonstration; launch *Shenzhou 1-5* to test capsule design, highlighted by Lt Col Yang Liwei becoming the first Chinese man in space on October 15, 2003.[57]
- **Phase II**: Docking, maneuvering, extra-vehicular activities (EVA); launch *Shenzhou 6-10* to establish space station and docking capability; practice spacewalk activities.
- **Phase III**: Establish permanent space station (less defined currently).[58]

Figure 3. Lieutenant Colonel Yang Liwei, China's First "Taikonaut" in Space[59]

[56] Unattributed, "China Launches First Data Relay Satellite," Xinhua News Agency, (April 26, 2008).

[57] Note: The Chinese borrowed the Russian Soyuz design for their own Shenzhou modules, making them able to dock with the ISS if that option becomes politically viable in the future.

[58] Dean Cheng, "China's Space Program: Civilian, Commercial, & Military Aspects," CAN Conference Report, (May 2006), 6; also Marcia S. Smith, *China's Space Program: An Overview*, CRS Report RS21641 (October 18, 2005), 3.

[59] Image from: http://www.futron.com/pdf/resource_center/white_papers/China_White_paper.pdf, 7 (accessed January 29, 2009).

China has taken a step-by-step approach in flying its astronauts, mimicking the American program along the way. They started with a single-person flight in 2003, similar to the *Mercury* (1962) single-seat missions. They followed that with a two-person launch in 2005 for five days, akin to the *Gemini* missions (1965). In September 2008, they flew a three-person crew with a successful spacewalk attempt, akin to the *Apollo* missions of 1968. Now, the Chinese are looking to establish a *Spacelab*-type of orbiting observatory to conduct follow-on experiments for an eventual permanently manned space station.[60]

4. China's Satellites

Table 3, below, provides an overview of the current family of Chinese satellite types, their names and functions, orbits, and other comments about each particular system. Most started out as direct purchases from abroad or jointly developed with another country. However, the recent trend is that many of these, especially those that have direct military application, are designed and manufactured solely in China. Currently, China ranks fourth in the world in number of satellite payloads in space with 64, trailing Russia (1398), the United States (1042), and Japan (111) respectively.[61]

[60] See "China Plans Space Station With Module Launch in 2010," *SpaceDaily.com*, March 1, 2009, for more on this relatively new program. Also see Chapter III for more analysis of this program.

[61] From: http://www.celestrak.com/satcat/boxscore.asp (accessed February 19, 2009). Rounding out the top ten are: France (44), India (34), Germany (27), United Kingdom and Canada (tied at 25 each), and Luxembourg (15).

Name	Function	Orbit	Other comments
Fengyun ("Wind & Cloud")	Meteorological	Polar GEO	– FY-1D polar orbit – FY-2C geostationary – FY-3 series polar, sun-synch
Beidou ("Northern Dipper")	Navigation	GEO (4) MEO (1)	– All-weather, two positional navigation; 5 on orbit – Will include 5 GEO and 30 MEO satellites
Yaogan ("Remote Sensing")	Land survey, crop yield assessment, disaster monitoring	LEO(?)	– Synthetic Aperture Array (SAR); 2 on orbit – All-weather imaging through clouds, certain materials – Likely reconnaissance role for military
Tianlian ("Sky Link")	Data relay (similar to U.S. TDRSS)	GEO	– Data relay to support space launch, manned space – Augments *Yuanwang* space support ships & TT&C stations – Provides 50% global coverage; 2nd satellite launch = 85%
Shentong ("Divine Communication")	Secure comms	GEO	– Secure Ku-band communications – Primarily for military and high-level leadership – Secure uplink; 1st comms with multiple steerable spot beams
Fenghuo ("Beacon Fire")	Tactical military comms	GEO	– 1st-ever tactical comms; digital voice & data for C3I network – Based on Dongfanghong-3 vehicle
Ziyuan ("Resource")	Remote sensing & earth observation	LEO	– Three on orbit; Joint development with Brazil – Also called "Jianbing", used for military reconnaissance(?)
Dongfanghong ("East is Red")	Telecommunications	GEO	– C-, Ku-, Ka-, L-band transponders – Dedicated high-capacity comms; direct TV broadcasting – Sold system to Nigeria and Venezuela
Shijian ("Practice")	Scientific experiments	LEO	– Used for space experiments, e.g. plant seeds in zero-gravity – SJ-2 possible ELINT capability;
Haiyang ("Ocean")	Oceanographic microsatellite	GEO	– Carry radar altimeters, ocean color scanners, multichannel ocean radiometers, etc. – HY-1 & 2, high circular sun-synch

Table 3. Overview of Chinese Satellites[62]

C. CONCLUSION

Space is no longer merely the playground of the Cold War superpowers. Nor is it anymore about a race between two competing ideologies than a logical response to the current global demand for worldwide information and telecommunication services. More and more nations see the need to either develop their own capability or buy their way into space access. As noted in the 2008 Space Competitiveness Index:

[62] Data from: Daphne Burleson, *Space Programs Outside the United States: All Exploration and Research Efforts, Country By Country* (Jefferson, North Carolina: McFarland & Company, Inc. Publishers, 2005); Sinodefence.com: http://www.sinodefence.com/strategic/spacecraft/default.asp; and Global Security: http://www.globalsecurity.org/space/world/china/index.html . See Chapter IV for more information on China's satellite projects with other nations.

> A convergence of space technologies combined with a divergence of space actors—among both national space agencies and commercial space companies—is stimulating competition, creating new products and services, and driving innovation throughout government, business, and society. As a result of these dramatic and worldwide changes to the information and communication landscape, access to space and space-based assets are no longer viewed as a luxury, but rather as a strategic necessity.[63]

China, noting the distinct benefits of space-based technology and assets, has embarked on an ambitious space program. The next chapter looks at the domestic side of Chinese space and the soft power aspects of how it is marketing its national investment and intense efforts in space to its own citizens.

[63] "Insight: The FUTRON Competitiveness Index," *Satmagazine.com* (May 2008).

III. CHINA'S "SOFT POWER" IN SPACE: DOMESTIC ASPECTS

Figure 4. Poster Promoting Space Science in China[64]

With an understanding of the background of China's space program and how countries seek soft power advantages from their own space programs from the previous chapter, this chapter now focuses directly at how China is "selling" its space program domestically. It covers China's space program as a legitimizing tool for the Chinese Communist Party (CCP), how it is played up in order to recruit future space scientists and

[64] Image from: Scott Pace, "China's Human Spaceflight Program: Achievements and Prospects," PowerPoint slides, Space Policy Institute, Elliot School of International Affairs, George Washington University, October 17, 2008, http://www.gwu.edu/~cistp/news/PACE101708/Pandas%20in%20Orbit%20100808-presented.pdf (accessed January 22, 2009), slide 11. The Chinese text says "Esteeming Science, Doing Away with Blind Faith (or "Superstition")" (*chongxiang kexue, pochu mixin*). The rocket looks like a Long March 2E or 3C based on the size and number of strap-on boosters. It is unclear why the U.S. space shuttle is also included, unless it is an overt hint at Chinese desires for expanded Sino-U.S. space cooperation?

technicians needed to fulfill its ambitions plans for manned space and unmanned Martian exploration with Russia, and also highlights some of the domestic applications and spin-off technologies that it hopes to reap from its space program effort.

To date, the Chinese government has only released two white papers concerning its space activities, respectively released in 2000 and updated in 2006. In both versions, there are clear goals directed at the domestic Chinese audience. The 2000 version, under "Aims and Principles," notes that "the Chinese government has all along regarded the space industry as an integral part of the state's comprehensive development strategy (*guojia zhengti fazhan zhanlue*)," and lists some of the following key principles:[65]

- Revitalizing the country with science and education;
- [sic] Self-reliance, self-innovation, breakthroughs in space technology on its own strength (*kao ziji de liliang*);
- Selecting projects vital to the national economy and social development; and
- Enhancing the social and economic returns of space activities.[66]

This opening section of "Aims and Principles" speaks more to China's own citizens then to an outside audience. While there is brief mention of international cooperation and exchanges, the real thrust of this document clearly outlines that China's space program will help it modernize and have stable progress into the 21st century. It calls upon the Chinese to blaze this trail mostly on their own, and that they can expect to reap a host of benefits from space.

How does China get there from here? Under "Development Concepts," the White Paper outlines several points, to include "speeding up the development of 'talented people in the space industry' (*hangtian rencai*), developing space education (*fazhan hangtian jiaoyu*), training qualified personnel, and motivating 'all levels of society'

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[65] White Paper, "China's Space Activities," People's Republic of China, Information Office of the State Council (November 2000). Chinese pinyin in parentheses hereafter where I am comparing the English version to the original Chinese version, available from the CNSA website at: http://www.cnsa.gov.cn/n615708/n620168/n750545/index.html (accessed February 16, 2009).

[66] Ibid.

(*shehui gejie*) to support the development of the space industry".[67] Clearly, China is reaching out to its massive populace to enlist its support for their ambitious space program.

The White Paper released in 2006 has some upgrades from its 2000 counterpart, but still carries a heavy focus on the domestic purposes behind China's space program. The standard ideas of "economic construction (*jingji jianshe*), development of science and technology (*keji fazhan*)…social progress (*shehui jinbu*)"[68] remain, but a slight variation on the 2000 version's "comprehensive national strategy (*zhengti guojia zhanlue*)" is simply rendered as "comprehensive national strength (*zonghe guoli*)".[69] In strong contrast to the 2000 version, it goes into much greater detail on how China expects to make all this happen by listing some specific "Development Policies and Measures":

- Construct a comprehensive chain of space industry covering satellite manufacturing, launching services, ground equipment, and operational services;
- Give support to key laboratories and engineering research centers of space science and technology;
- Accelerate building of world-class (*guoji yiliu*) large space corporations;
- Increase funding for space and establish a diverse, multi-channel space investment system (*duoyuanhua duoqudao de hangtian touzi tixi*);
- Encourage industrial enterprises, scientific research institutes, *commercial corporations*…to play an active part in space activities; and
- Foster talented people for the space industry. In particular, pay attention to fostering *young and highly qualified space scientists and engineers.*[70]

In addition to these two White Papers, the Chinese government also recently released a report on "China's National Defense in 2008." While most of the White Paper focuses on non-space military items, there are several portions that connote space-derived capabilities, such as "surveying and mapping, navigation, weather forecasting,

[67] White Paper, "China's Space Activities," (2000).

[68] White Paper, "China's Space Activities in 2006."

[69] Ibid.

[70] Ibid. Italics emphasis added.

hydrological observation and space environment support systems have been further optimized".[71] Thus, space assets contribute to not only the national economy but also to national security as well.

A. SHENZHOU: LEADERSHIP LEGITIMIZER?

Out of all the projects one could embark upon regarding space exploration, it is *manned space* that is by far the most expensive and challenging. It is much easier, safer, and less risky to send robots, computers, or rodents into space for experiments and applications, rather than humans. Given the high cost of entry and other risk factors, it can be said the idea of a manned space program is more of a luxury than a real beneficial commodity.

High costs and unknown risks did not prevent Russia or America from launching long-term, expensive, national programs whose sole purpose was to put mankind into the heavens. These efforts, however, took place against the backdrop of the Cold War and represented the ideological challenge of communism versus capitalism. With the breakup of the former Soviet Union in the early 1990s and the current trend of globalization, why would China want to put people into space?

There are a variety of reasons behind Chinese motivations for manned spaceflight, and one of them has a domestic political spin: the Chinese Communist Party (CCP). Dean Cheng comments, "Just because there aren't elections, doesn't mean that there are no means for the population to express its displeasure".[72] As Peter Aldhous notes:

> Its [the Chinese space program] value in promoting a domestic feel-good factor should not be underestimated. Even China's authoritarian rulers have to worry about keeping the country's billion-strong population reasonably happy. A successful space program could paper over the cracks for a while.[73]

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[71] White Paper, *China's National Defense in 2008*, People's Republic of China, Information Office of the State Council (January 2009).

[72] Peter Aldhous & Anil Ananthaswamy, "Asia Blazes Trail to the Final Frontier," *New Scientist*, Vol. 188, No. 2522 (October 22-28, 2005): 8.

[73] Ibid.

Noting China's semi-obsessive behavior with its national image and prestige, as well as the CCP's determination to retain absolute control of the country, William Martel and Toshi Yoshihara echo the conventional wisdom:

> Success in China's manned space program will confer a strong sense of national dignity and international status on the country, which are viewed as crucial elements to sustain the legitimacy of the Communist Party and replace its declining ideological appeal. This intangible yet powerful expression of Chinese nationalism partially explains why Beijing invests substantial resources into its space program.[74]

Morris Jones, an Australian-based space analyst says, "China's space program reflects the power and legitimacy of the Communist Party. They are using manned space exploration as a political demonstration of their legitimacy".[75] Jones also notes that the launch date of the *Shenzhou-7* came on the heels of not only the Beijing Olympics, but also close to the conclusion of the Paralympics and Chinese National Day on October 1, "making the space mission a nice bridge between two major nationalistic events".[76]

Roger Launius, senior curator of space history at the National Air and Space Museum, focuses more on the symbolism of Chinese technological achievements in his perspective:

> It [China's space program] is a prestige program, no question. I think China has entered the [manned spaceflight] arena for the same reasons that the United States and Soviet Union did in 1961. It is a demonstration of technological virtuosity. It's a method for showing the world they are second to none – which is a very important objective for them.[77]

David Chandler echoes similar sentiments in his analysis:

> The Chinese government expects its manned space program to enhance the reputation of China's high-tech exports, giving it greater diplomatic

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74 William C Martel & Toshi Yoshihara, "Averting a Sino-U.S. Space Race," *The Washington Quarterly* (Autumn 2003): 23.

75 Unattributed, "China's Rulers Look to Space to Maintain Olympic Pride." *SpaceDaily.com*, September 9, 2008.

76 Ibid. Note that both previous manned flights were in October as well. *Shenzhou-5* was launched on October 13, 2003, and *Shenzhou-6* was launched on October 17, 2005.

77 Paul Rincon, "What's Driving China Space Efforts?" *BBC News* (September 25, 2008).

> and commercial power. It also sees space technology as critical to achieving technological parity with western nations and Japan. Specifically, it hopes the manned space programme will raise standards in computing, materials science, manufacturing and electronics.[78]

With the tumultuous events of the Sichuan earthquake, inflation at decades-high levels, a stock market that was at a 21-month low, and seemingly incessant protests over government corruption and social injustice, Willy Lam, a Hong Kong-based political scientist, said that "a successful *Shenzhou-7* mission would help distract China's 1.3 billion people from serious economic and social concerns…and will further consolidate the [Chinese Communist] Party's claim that they can get things moving".[79] Lam also commented that, "the leadership is banking on patriotism and nationalism to pull them through".[80]

Whether China's first spacewalk truly "distracted" China's massive population from their woes or not may never be truly known, but the event was certainly maximized for full propaganda value. Most newspapers carried "two or three pages devoted to the spacewalk," and tens of millions watched the 15-minute spacewalk live broadcast on government-run CCTV, "witnessing the symbolic moment when he [Zhai Zhigang] waved a Chinese flag in the weightlessness of low orbit".[81] Internet blogs were full of patriotic postings, such as, "I'm proud of the great achievement of the motherland" and "I'm full of confidence in the future of the motherland!"[82]

Quoting the old Chinese idiom of, "When riding a tiger, it is difficult to get off" (*qihu nanxia*), Stacey Solomone notes that:

> The CCP, and subsequently, the PLA would lose face should they decide to back off from developing the space program. It would appear to as if the CCP and PLA were conceding to the Chinese people that they were

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[78] Paul Rincon, "What's Driving China Space Efforts?" The domestic aspects of China's space program is more developed in Chapter III.

[79] Ibid.

[80] Ibid.

[81] Unattributed, "China Hails Spacewalk 'Heroes' and Sets Eyes on Moon." *SpaceDaily.com*, September 29, 2008.

[82] Ibid.

> not advanced as the United States or Russia. The CCP and PLA would risk losing face in the international community and popular support at home. The Chinese space program provides an ample amount of legitimacy to the CCP which so often totes how the space program is aiding the national economy and security.[83]

Perhaps another reason the Chinese were willing to get into the manned space business was confidence in their Shenzhou capsule. Man-rated capsules and their associated carrier rockets typically go through long series of expensive testing and "dummy launches" to ensure their space worthiness before actual humans are brought on board. Usually this requires a dozen flights, but the Chinese sent Col. Yang Liwei on only the fifth flight of the Shenzhou.[84] Clearly, the Chinese thought their capsule was ready and fully man-rated well ahead of the typical schedule for placing humans in new spacecraft.

Shortly after the successful Shenzhou-5 flight, China not only received a hearty congratulatory telegram from then Russian President Vladimir Putin emphasizing "Russian-Chinese space cooperation is an important tren [that] will bear more fruit for the benefit of our nations," but the European Space Agency's director-general offered congratulations and expressed, "this mission could open a new era of wider cooperation in the world's space community".[85]

Although much has been written about the *Shenzhou* being a mere copy of the Russian *Soyuz* design, closer inspection reveals significant differences. Dean Cheng noted, "*Shenzhou* is not so much a copy of the *Soyuz* as the next evolutionary step".[86] First, it is larger by approximately 13% (see Figure 5 below), and has an additional capability for increased onboard electricity generation. While the *Soyuz* used only one main engine and a backup, the *Shenzhou* boasts four separate engines. Perhaps most

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[83] Stacey Solomone, "China's Space Program: The Great Leap Upward," *Journal of Contemporary China*, Vol. 15, No. 47 (May 2006):322.

[84] David L. Chandler, "Confident China Joins Space Elite," *New Scientist*, Vol. 180, No. 2418 (October 25-31, 2003): 6.

[85] Ibid., 12. Europe briefly considered lifting the arms embargo against China (in place at U.S. leading post-1989 Tiananmen Square) in 2005.

[86] Ibid.

significant in its design was the placing of additional solar panels and a guidance system *on the orbital module*, "…allowing it to remain on orbit as an autonomous satellite. This could provide a target for rendezvous and docking practice, and over time, several modules could be linked as part of a developing space station".[87]

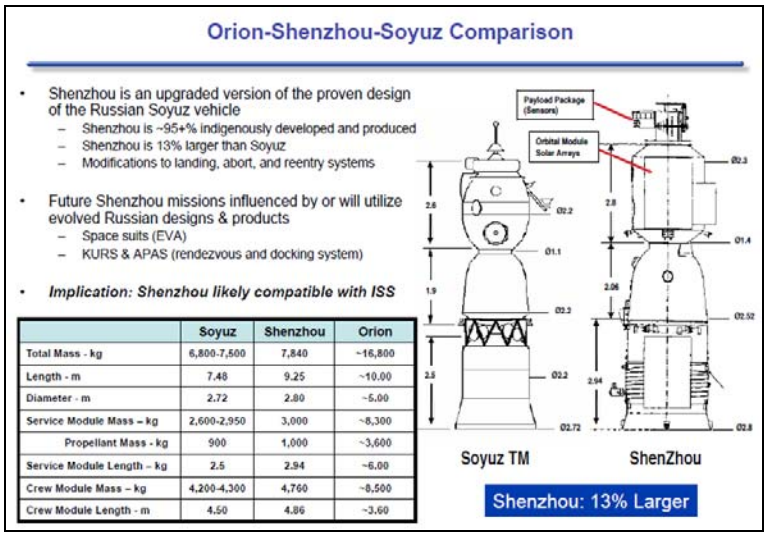

Figure 5. Russian *Soyuz*, Chinese *Shenzhou*, and U.S. *Orion* Capsules Comparison[88]

B. AMBITIONS FOR THE MOON, MARS & A SPACE STATION

1. Shooting for the Moon

China is not just resting on its laurels of becoming only the third nation in history to successfully send someone to space, but also has plans for lunar exploration, research on Mars, as well as establishing a permanent presence in space. Luan Enjie, director of Chinese counterpart to NASA, the China National Space Administration (CNSA), said, "Exploring the Moon is the first step in exploring deep space".[89] But it is important to note that China is not on a "Moon or bust" trajectory and is moving at a measured pace towards fulfillment of its lofty space ambitions. Hu Shixiang, deputy in charge of China's manned space flight program, said "I think about 10 to 15 years later, we will have the

[87] Chandler, "Confident China Joins Space Elite," 6.

[88] Pace, "China's Human Spaceflight Program: Achievements and Prospects," slide 4.

[89] Chandler, "Confident China Joins Space Elite,"6.

ability to build our own space station and carry out a manned Moon landing".[90] Hu also added that, "China is developing its space program at its own pace, not competing with the U.S. It's not the competition of the Cold War era".[91]

Figure 6. Chinese Moon Goddess, *Chang'E* (and Jade Rabbit)[92]

On October 24, 2007, the Chinese launched the *Chang'E-1* lunar probe, which was designed to map the Moon's surface and serve as the first of three stages for follow-on lunar missions.[93] After orbiting the Moon for over a year, its "charged-coupled device (CCD) camera was able to create a high-resolution map of the Moon, to include the dark side of the Moon".[94] A second probe, the *Chang'E-2*, is slated for launch sometime before the end of 2011, and will "conduct experiments involving five core technologies

[90] Min Lee, "China Aims to Put Man on Moon by 2020,." *Space.com* , November 27, 2005.

[91] Ibid.

[92] Image from: "China to Launch Second Lunar Probe Before End of 2011." *Spacedaily.com*, November 13, 2008.

[93] Unattributed, "China Launches Its First Moon Orbiter," *Xinhua News Agency*, October 24, 2007. *Chang' E* is the name of the mythical "moon goddess." For several stories describing how she landed there, see: http://en.wikipedia.org/wiki/Chang%27e_(mythology)

[94] Unattributed, "China Reveals its 1st Full Map of Moon Surface," *Xinhuanet.com*, November 12, 2008.

such as orbital adjustments and soft landings".[95] As part of this second stage of lunar research, it will be followed by another probe, *Chang'E-3*, which will also be used to test "soft landings and inspection of the lunar surface".[96]

The final stage of lunar exploration will involve a "Moon landing and launch of a Moon rover [which] will land on the Moon and return to Earth with lunar soil and stone samples for scientific research in about 2017."[97]

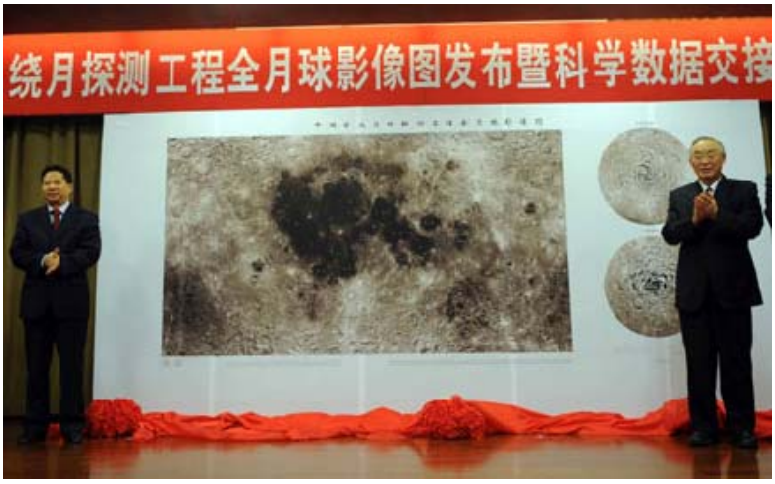

Figure 7. Chinese Publish Full Map of the Moon[98]

Follow-on analysis of *Chang'E-1*-derived data will be carried out by unusual partnership between Macao's University of Science and Technology (MUST) and the National Astronomical Observatories, Chinese Academy of Sciences (NAOC).[99] This joint lab will be involved in "data analysis, develop relevant software," and "also launch another two projects concerning the water detection [sic] on the Moon surface and data

95 Unattributed, "China to Launch Second Lunar Probe Before End of 2011," *Spacedaily.com*, November 13, 2008. The *Chang'E-2* is noted as an improved design from the first probe.

96 Unattributed, "China to Launch Second Lunar Probe Before End of 2011," *Spacedaily.com*, November 13, 2008.

97 Ibid.

98 Image from: "China Reveals its 1st Full Map of Moon Surface." *Xinhuanet.com*, November 12, 2008.

99 Unattributed, "Macao University to Analyze Data from China's Moon Probe." *SpaceDaily.com*, December 15, 2008.

processing".[100] So, not only is Hong Kong working directly with Beijing on space projects, but now Macao has joined the Chinese "space team" and can start garnering prestige from the lunar exploration program. With Macao's and Hong Kong's joint participation in China's space program, here is another clear example of China using space for soft power and political (nationalistic) purposes.

2. Aiming for Mars

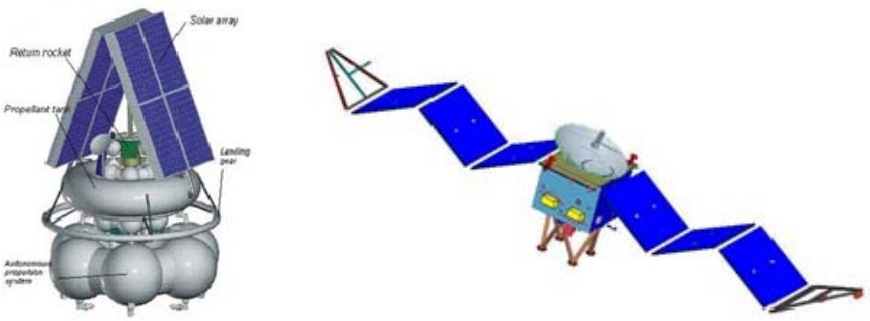

Figure 8. Mars Missions: (L) *Phobos-Grunt* and (R) *Yinghuo-1*[101]

Since Chinese ambitions for a Mars project have only recently surfaced, there is not a lot of information on the topic. What is notable about the Martian mission is that it will be a joint Sino-Russian endeavor that is scheduled for August 2010. The Chinese payload is called the *Yinghuo-1* ("Firefly"), which will ride piggyback on a Russian-designed module called *Phobos-Grunt* ("Phobos-Soil").[102] The Russian portion is actually going to the Martian satellite Phobos to take a soil sample and then return to Earth, but will drop the *Yinghuo* payload into a Mars orbit.[103] Figure 8, above, from the Planetary Society's website, shows early design models for both of these payloads. Figure 9, below, shows a composite payload.

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[100] Unattributed, "Macao University to Analyze Data from China's Moon Probe." *SpaceDaily.com*, December 15, 2008.

[101] Image from Planetary Society's website: http://planetary.org/explore/topics/our_solar_system/mars/missions.html (accessed January 23, 2009).

[102] Unattributed, "China-Russia Mars Mission Set for Takeoff," *MarsDaily.com*, January 5, 2009. "*Yinghuo*" can also be a play on the Chinese pronunciation for "welcome to Mars" ([*huan*]*ying huo*[*xing*]).

[103] Data from Planetary Society's website: http://planetary.org/explore/topics/our_solar_system/mars/missions.html (accessed January 23, 2009).

Figure 9. Artist Illustration of Sino-Russian Mars Probe[104]

Since this will be China's first attempt at a Mars mission, any success will be "another noteworthy achievement for the Shanghai Institute of Satellite Engineering".[105] Once successfully placed in a Martian orbit, *Yinghuo-1* photographs and data will allow "Chinese space researchers to…study the magnetic field of Mars and the interaction between ionospheres, escape particles, and solar wind".[106] Chen Changya, chief designer on the project, commented that several hurdles need to cleared, namely overcoming Mars' shadow obscuring the Sun and blocking faint solar energy from reaching the spacecraft, and designing the components to withstand "extremely low temperatures, plunging to minus 200 degrees Celsius (minus 328 degrees Fahrenheit)".[107]

3. A "Heavenly Palace": The Chinese Spacelab

Now that the Chinese have demonstrated a successful spacewalk, or "extra vehicular activity" (EVA), on the *Shenzhou-7* mission, it seems like putting up a space station is the next logical step. Shortly after the *Shenzhou-7* capsule returned to Earth, Wang Zhaoyao, a spokesman for the Chinese manned program, said, "The ability to

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[104] Image from: "China-Russia Mars Mission Set for Takeoff," *MarsDaily.com* (January 5, 2009). Disclaimer on image: For illustration purposes only.

[105] Peter J. Brown, "China Making Leaps in Space." *Asia Times Online* (January 9, 2009).

[106] Unattributed, "China to Launch Probe to Mars With Russian Help in 2009." *RIA Novosti* (May 12, 2008).

[107] Unattributed, "China-Russia Mars Mission Set for Takeoff," *MarsDaily.com* (January 5, 2009).

maneuver and work outside a spacecraft is essential to China's goal of putting an astronaut on the Moon and having a permanent outpost in space".[108]

Figure 10. Three "Taikonauts" Prepare for *Shenzhou-7* Launch[109]

Conventional thinking on China's space station was that once the Long March-5 heavy-lift rockets came online in 2014, which are purportedly capable of launching over 20 tons into LEO, China could "launch a modest space lab—a "baby-Mir"—weighing about 8 tons and capable of housing a crew for three months".[110] Many thought it would be the combined launches of the *Shenzhou-8* and *Shenzhou-9*, which would be joined together, followed by the *Shenzhou-10*, which would actually bring three taikonauts to the station. Recent reporting, however, suggests that China is actually working on a separate, "small space laboratory module called *Tiangong-1*, launched around 2010 or 2011," and would be docked with a future *Shenzhou* mission.[111] Although Morris Jones suggests three options for how the Chinese would go about the creation of a space station,

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[108] Ed Johnson, "China, Following Astronauts' Return, Plans Space Lab for 2011," *Bloomberg.com*, (September 28, 2008).

[109] Image from: http://features.csmonitor.com/innovation/2008/09/25/china's-first-spacewalk-no-cold-war-race-this-time/ (accessed January 28, 2009).

[110] Aldhous & Ananthaswamy, "Asia Blazes Trail to the Final Frontier," 8.

[111] Morris Jones, "China Sets Sights on First Space Station," *SpaceDaily.com*, (October 3, 2008). "Tian Gong" means "Heavenly Palace," a fanciful Chinese rendering for its space lab.

the bottom line is that China still needs to conduct some form of long-duration testing of docked *Shenzhou* components as well as seeing how the capsule would work as a resupply vehicle.[112]

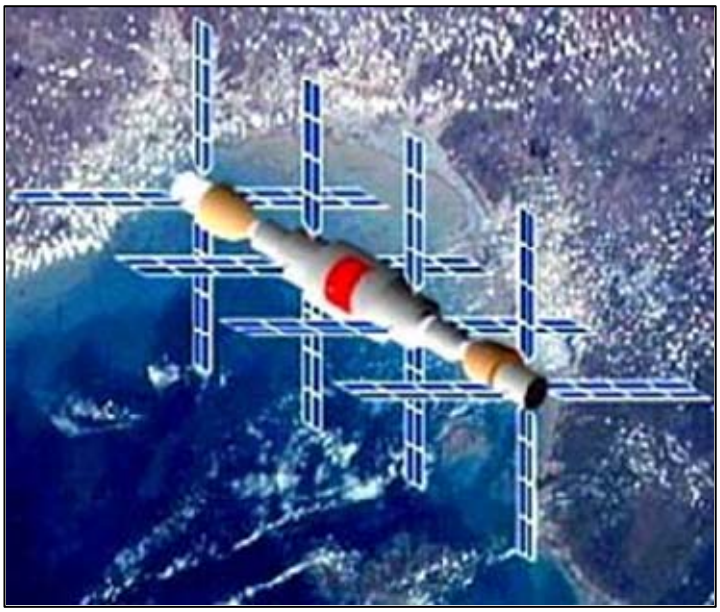

Figure 11. Artist Illustration of Possible Chinese Space Station[113]

Like many aspects of the Chinese space program, explicit plans for the space station remain fairly opaque. On the "China Manned Space Engineering" website under "Future Development Plans" (*weilai fazhan jihua*), there are a few lines that provide some possible insight:

> According to the second stage of mission planning for manned space engineering, our country will launch *Tiangong-1* target aircraft (*mubiao feixingqi*) and two space labs, *Tiangong-2* and *Tiangong-3* between 2010 and 2015. [We] will separately launch two unmanned spacecraft (*wuren feichuan*) and carry out unmanned docking experiments, and then launch

[112] Jones, "China Sets Sights on First Space Station." Jones compared *Shenzhou* to the *Progress* spacecraft used by Russia to resupply the ISS. He also noted that the Russians tested their *Soyuz* for a six-month period docked to a module first before they sent a manned mission, so the *Shenzhou-8* may follow the same pattern.

[113] Unattributed, "China-Russia Mars Mission Set for Takeoff," *MarsDaily.com* (January 5, 2009). Illustration of several Shenzhou capsules docked on either side of separate lab module. See also Morris Jones, "Souped Up Rockets for Shenzhou," *SpaceDaily.com* (October 29, 2008), for more analysis on the Chinese space lab.

> five unmanned spacecraft to carry out manned docking experiments (*zairen duijie shiyan*) and manned "presence" [endurance?] experiments (*zairen zhuliu shiyan*).[114]

Although this appears to be from an authoritative source, it would be unwise to take this as serious as a government directive issued from the Politburo Standing Committee. Nevertheless, it does reflect China's growing ambition and strong desire to have a permanent place in space.

C. DOMESTIC SPACE APPLICATIONS & SPINOFFS

Given the resource constraints on its budget and personnel, China needed to find the proverbial "biggest bang for the yuan" for space technology investment. It smartly chose communication satellites to start with, which could support a wide range of government services as well numerous civilian and commercial applications. Yardley writes, "Satellites have become status symbols and technological necessities for many countries that want an ownership stake in the digital world dominated by the West."[115] Earth-imaging (or "remote sensing") and weather satellites, which can also support a variety of applications are of almost equal importance. Growth in these areas, as well as other space-related industries, have had positive side-effects for the Chinese economy, commercial growth, and laid a solid foundation for space science and high-technological research and development.

In the mid-1990s, China was losing its own market for telecommunications. Zhu Yilin, then-Secretary-General of the Science and Technology Commission from the Chinese Academy of Space Technology, commented, "…about 80% of the domestic communication transponder market is occupied by foreign satellites. There is indeed a danger of losing whole domestic markets if China cannot build and launch its satellites

[114] Text from: http://www.cmse.gov.cn/cha_xtzc/show.php?itemid=120 (accessed February 16, 2009), my English translation with pinyin added in parentheses to reflect original characters.

[115] Jim Yardley, "Blocked by U.S., China Finds Its Own Way to Space," *International Herald Tribune*, May 23, 2007.

better, faster, and cheaper".[116] Looking at the present state of domestic Chinese space capabilities, it seems that the telecommunications satellite and carrier rocket industries have responded well. Not only is China basically self-sufficient to meet the needs of its domestic customer base, but it also has exported its satellites to other nations.[117]

China also intends on developing its own version of the U.S. Global Positioning System (GPS), called *Beidou* ("Big Dipper"). Zhang Xiaojin, CAST director of astronautics, commented that "the [*Beidou*] system will shake off the dependence on foreign systems".[118] While the implied "dependence" likely refers to GPS, it may also be viewed as freeing China from having to buy into either the European *Galileo* program or the Russian GLONASS GPS variants. Currently, there are only five *Beidou* satellites providing regional PNT services, but 10 more will be launched over the next two years with a total of 30 additional satellites to be in orbit by 2015, providing full coverage for China.[119]

In addition to space-based navigation, remote sensing has also seen a recent growth spurt in applications and an ever-growing list of countries that want access to space-derived *geological* data. In the Chinese case, this is particularly acute. Since China has "a relatively small proportion of arable land to feed its one billion population, assessing the health of the small fields that dominate Chinese agriculture is critical to the country's economic development".[120] China already had limited access to U.S. *LANDSAT* data, but with the launch of its own recoverable remote sensing satellites in the mid-1980s, it was able to exploit its own imagery and "no longer rely on the United States for satellite imagery of arable land within China's borders".[121] The results were remarkable with some illustrative examples as follows:

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[116] Yilin Zhu, "Fast-track Development of Space Technology in China," *Space Policy*, Vol. 12, No. 2 (May 1996): 139.

[117] China has sold telecommunications satellites and their associated ground segment components to Nigeria and Venezuela. This is covered more in-depth in Chapter IV.

[118] Unattributed, "China Plans Own Satellite Navigation System by 2015," *SpaceDaily.com* (January 19, 2009).

[119] Ibid.

[120] Gilks, "China's Space Policy: Review and Prospects," 219.

[121] Solomone, "China's Space Program: The Great Leap Upward," 318.

- Saved scarce financial resources by producing a geological study on 55,000 square kilometer area of Beijing, Tianjin, and Tangshan, which allowed for analysis of cultivated land, residential areas, and soil erosion at 1/13 to 1/3 the cost of typical processes;
- Opened new areas for natural resource extraction by space-based mineral and geological prospecting analysis, to include discovery of oil in Tarim Basin, division of the Datong coal fields and discovery of seven new ones in Beijing suburbs, as well as the discovery of chromite and iron ores in Inner Mongolia;
- Revised maps of major river deltas, which enabled analysis of mud-sand flow in the Yellow, Luanhe, and Haihe rivers and aided port and river course construction; and
- Uncovered heretofore unknown historical artifacts with discovery of an ancient boundary moat from Jin Dynasty (265 – 420 A.D.) and ruins of ancient city of Yingchang from Yuan Dynasty (1271 – 1368 A.D.) in Inner Mongolia.[122]

Chinese *Fengyun* weather satellites were also crucial in the run-up to the Beijing Olympics. According to the Chinese Meteorological Administration, *Fengyun*-derived data "provided detailed mapping of the algae outbreak at the sailing competition site in Qingdao".[123] Armed with accurate data, Chinese authorities proactively managed to clear the algae from the sailing regatta course and avoid a loss of face.

Space-borne experimentation with seeds is also bearing much fruit. Over the course of seven years during the late 1980s and early 1990s, Chinese sent "more than 300 varieties of seeds of 51 kinds of plants" on recoverable satellites.[124] Once back on Earth, these seeds were out through a series of breeding tests that "can produce a favorable genetic variation that might greatly increase the outputs".[125] These purported "giant pumpkins, tomatoes, cucumbers" grown from space-bred seeds had "281.5 percent higher

[122] Zhu Yilin and Xu Fuxiang, "Status and Prospects of China's Space Programme," *Space Policy*, Vol. 13, No. 1 (February 1997): 71.

[123] Unattributed, "China's Fengyun-3A Satellite Starts Trial Business Operation," *SpaceDaily.com*, November 20, 2008. For more coverage on the algae cleanup, see: http://www.nbcolympics.com/sailing/news/newsid=194762.html

[124] Zhu and Xu, "Fast-track Development of Space Technology in China," 71.

[125] Zhu and Xu, "Fast-track Development of Space Technology in China," 71.

[vitamin content] than that of ordinary vegetables".[126] One may see these agricultural applications, which have not yet reached a mature stage to date, through a skeptical lens and dismiss them as nothing more than wildly exaggerated and unverifiable claims. Nevertheless, even the small and remote potential promise of strains of "super seeds" would have a major political impact in trying to appear to be addressing the continual problem of feeding the world's most populous nation.

In order to consolidate and achieve greater output of civil applications of space-related technologies, China has started to construct two main aerospace industrial bases. The first one is the Shanghai Aerospace Science and Technology Industrial Base, and will support a space science park, an aerospace museum, and an aerospace research and development center.[127] It will "jointly promote the growth of civil aerospace business, technological innovation and the application of such technologies".[128] The second one is going to be built in Xi'an, which is already home to China's Satellite Control Center and "more than 200 aerospace research centers and enterprises in the city",[129] to include China Academy of Space Technology (CAST) and its associated research institutes. The Xi'an center will "focus on developing satellites, new materials, energies, IT and other technologies for the benefit of civil application".[130] With hopes of attracting future space-related businesses and research facilities to plant roots there, Zhao Hongzhuan, currently the director overseeing the Xi'an base construction, said, "We will build it into a world-class aerospace base".[131]

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[126] Jill Drew, "Space Inspires Passion and Practicality in China," *Washingtonpost.com*, September 25, 2008. Also, Stacey Solomone, "China's Space Program: The Great Leap Upward," *Journal of Contemporary China*, Vol. 15, No. 47 (May 2006):324, adds rice, wheat, and asparagus to the list of vegetables the Chinese are experimenting with.

[127] Unattributed, "Space Sci-Tech Industrial Base Launched in Shanghai," *People's Daily* (January 23, 2006).See also: http://www.shanghaidaily.com/minhang/business2.asp

[128] Unattributed, "China's 2nd Civil Aerospace Industrial Base to be Established in Xi'an" *China Radio International*, April 8, 2008.

[129] Ibid. For an excellent history of China's space program, see Brian Harvey's, *China's Space Program – From Conception to Manned Spaceflight*, (UK: Praxis Publishing, 2004).

[130] Ibid.

[131] Unattributed, "China's 2nd Civil Aerospace Industrial Base to be Established in Xi'an" *China Radio International*, April 8, 2008.

This "build it [aerospace base] and they will come" approach is also being supported by a slightly different, "capitalist" tactic. During the 11th Convention of Overseas Chinese Scholars held in Guangzhou last December, there was an announcement that a "financial incentive of up to 5 million yuan (US$731,000), among other things, will be offered to overseas Chinese entrepreneurs and professionals who settle in Guangzhou and open new [space-related] businesses".[132] What is unclear is whether this was devised at the Guangzhou provincial-level to attract high-tech firms to the area, or a more strategic decision made back in Beijing.

In addition to the creation of civilian-focused space research centers, China is also reaching out to the civilian space scientific community for future missions in space. Although the first taikonauts were PLA Air Force pilots, it seems China realizes the need for putting civilians in space, and may mark the beginning of a departure from what has historically been a military-led effort. Zhang Jianqi, deputy chief commander of China's manned space program, said "China's manned space project will start setting up space laboratories and stations after 2012, and by that time [civilian] scientists will be needed for a large number of experiments in space".[133] Zhang also extended the invitation to scientists from both Hong Kong and Macao Special Administrative Regions, since the *Shenzhou-8* "still had the space for more experiments".[134] Thus, Beijing is trying to recruit from all parts of China, especially those with high-technology connections.

In December, 2008, only a few months after the successful *Shenzhou-7* mission, Zhang Jianqi headed a small delegation of several taikonauts to Hong Kong. During an open session with reporters, he announced that "…one day, by which I mean some day in the near future, Hong Kong will have its [own] astronaut in space on our [Chinese] spacecraft."[135] He also noted that there has already been cooperation between Beijing and Hong Kong on several space projects, and even alluded to having China's "first women

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[132] Brown, "China Making Leaps in Space."

[133] Unattributed, "China's Future Astronauts Will Be Scientists," *SpaceDaily.com*, December 5, 2008.

[134] Ibid. See also, "HK [Hong Kong], Macao Scientists Expected to Participate in China's Aerospace Project." *SpaceDaily.com*, December 11, 2008.

[135] Unattributed, "Space Mission Commander Gives Clues on First Hong Kong Astronaut." *Spacedaily.com*, December 8, 2008.

astronaut in the future phases of strategy that are expected to involve more laboratory works [sic]".[136] Betty Fung, director of information services in Hong Kong, commented that "People in Hong Kong are proud of the success [of the Chinese space program]".[137] The trip seemed to serve both as a propaganda effort promoting China's recent success in space as well as a recruiting campaign aimed at younger scientists and engineers currently studying at Hong Kong's prestigious universities.

In order to support future *Shenzhou*, *Tiangong* and future lunar-related missions, China needs to develop a new heavy-launch booster. On March, 2008, the Chinese Academy of Launch Vehicle Technology (CALT) announced that it "finished most of the designing work for the country's Long March-5 large thrust carrier rocket and will soon present an initial model".[138] CALT Vice President Liang Xiaohong said that the Long March-5 will have a "maximum payload capacity up to 25 tons…is expected to be able to send lunar rovers, large satellites and space stations into space after 2014".[139] What the article also noted was that this new heavy-lift rocket was not just for domestic satellites and supporting CNSA's lunar and deep space programs, but that it will position China to "compete for launching commercial satellites on the international market".[140] Thus, China will be able to offer complete "cradle to grave" space services packages for the now-in-demand large GEO communications satellites, from design, manufacture, launch, and follow-on TT&C ground segment services.

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[136] Unattributed, "Space Mission Commander Gives Clues on First Hong Kong Astronaut." *Spacedaily.com*, December 8, 2008.

[137] Ibid.

[138] Unattributed, "China's Future Astronauts Will Be Scientists," *SpaceDaily.com*, December 5, 2008. See also "China to Start Making Trial Model of 'Long March 5' Carrier Rocket," *China Radio International*, March 28, 2008.

[139] "China to Start Making Trial Model of 'Long March 5' Carrier Rocket." *China Radio International*, March 28, 2008.

[140] Ibid.

Figure 12. Map of Hainan Island and Wenchang Satellite Launch Facility[141]

Liang Xiaohong confirmed that, "The Long March-5 rockets will be made in Tianjin and launched in Hainan".[142] Since Tianjin is a port city close to Beijing, it will be easy to transport the mammoth 5-meter fairing of the new carrier rockets via cargo ship down to Hainan Island and avoid the narrow network of railways and tunnels that sometimes constrain rocket and payload size. The new Wenchang space launch facility, which will replace Xichang, is slated to be finished by 2012, and will give China its southernmost launch facility. Being only 19 degrees off the equator has the added benefit of the Earth's rotation, or "Earth assist," which means it can convert that extra kinetic "push" into greater payload mass (satellite bus size or extra fuel). Given the launch

[141] Data pulled from Google Earth. Small balloon with "A" marks future location of launch site. I zoomed in on the location and created a smaller inset map. Photo in lower center from: "China Completes Enclosure of Land for Fourth Satellite Launch Center," *SpaceDaily.com*, November 19, 2007.

[142] Unattributed, "China's New Carrier Rocket to Debut in 2014." *Xinhuanet.com*, March 2, 2008.

facility's far eastern location and the prevailing trend to launch prograde (eastward), there will be minimal risk to the neighboring communities about fallout or other launch-related hazards.

Wenchang will boast China's newest rocket command center, rocket-launch pad, rocket assembly plant, and China's first-ever visitor center.[143] The actual rocket-launching site will be in Longlou Town, with the launch tower "800 meters (just under half a mile) away from the seaside".[144] One nice spin-off from the Wenchang launch center will be the construction of "China's sole space-science theme park, at a cost of seven billion yuan (approx. $1,023,593,570 USD)".[145] Although the article did not go into detail as to what the space park would consist of, such a large plan that is almost triple the expenditure allotted for the Shanghai aerospace industrial base (Wenchang will receive seven billion yuan compared to only 2.2 billion for Shanghai) will have a major impact in the local economy and may attract both domestic and international aerospace businesses to the southern Chinese island.

China's space program has brought immense benefits to its industrial, commercial, and agricultural programs. Johnson-Freese notes, "Having studied the *Apollo* playbook, China understands there are multiple rewards to be reaped from a successful manned space program. China sees a space program as generating technology, and technology as spurring economic development".[146] As the demand on "telecommunications industry and demand for remote sensing services continue to grow," China will see an "increase [in] future financial revenues, as well as the quality and number of available jobs produced in China".[147]

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[143] Jill Drew, "Space Inspires Passion and Practicality in China."

[144] Unattributed, "China Completes Enclosure of Land for Fourth Satellite Launch Center," *SpaceDaily.com*, November 19, 2007.

[145] Ibid.

[146] Joan Johnson-Freese and Andrew S. Erickson, "The Emerging China-EU Space Partnership: A Geotechnological Balancer," *Space Policy*, Vol. 22, No. 1 (February 2006):12.

[147] John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York, NY: Rutledge 2006), 38.

Figure 13. Two variants of the "Space Cup" (*Taikong Bei*)[148]

The manned space program alone has brought significant benefits, to include "new capabilities in computers, aerospace materials, fabrication technologies, electronics and integration and test as well as experience in developing major subsystems such as guidance, attitude control, propulsion and life support".[149] One recent article boasts that "nearly 80 percent of new materials developed by Chinese scientists were first used in space…and almost 2,000 space-related inventions have been used in other sectors".[150] One example of this was the "Outer Space Cup" or "Dislin Cup" that the first Chinese taikonaut, Yang Liwei, drank tea from during his journey in outer space.[151] As the cup was "designed to withstand extreme temperatures and the rugged environment of space" as well as being "leakproof which alleviates problems in microgravity," the special cup was an immediate hit after Yang landed back on Earth and is still being marketed today.[152]

In addition to the technical side of space-derived products, there have been a number of cultural spin-offs from the space program as well. Prior to the spacewalk of *Shenzhou-7*, there were nationwide contests for "schoolchildren to create artwork to

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[148] Images from the Dislin website: http://www.chinadislin.com/products1.asp

[149] Craig Covault, "Manned Program Advances Chinese Space Technology," *Aviation Week & Space Technology*, Vol. 151, No. 22 (November 29, 1999): 28. The recent *Shenzhou-7* also provided Chinese scientists with samples of solid lubricants and experiments for space tribology.

[150] Unattributed, "China's Space Industry Takes Off," *SpaceDaily.com*, November 6, 2008.

[151] "Dislin" refers to the Shanghai-based "Taizhou Huangyan Disilin Plastic Co. Ltd" that manufactured the cup.

[152] Solomone, "China's Space Program: The Great Leap Upward," 317-318.

commemorate the feat".[153] Clearly, the Chinese government aimed to plant seeds in the young minds that will hopefully grow up to be pioneering CNSA space scientists! On a slightly more offbeat angle, there was also a "black-market cell phone handset maker…doing brisk business selling a rocket-shaped mobile device painted red with '*Shenzhou VII*' stamped on the side".[154]

Beyond economic impact, China's manned space program has created more general domestic interest in space sciences. According to Yan Feng, chief editor of the Chinese edition of *Science & Vie*, a popular European science magazine, the *Shenzhou* program has helped astronomy become "the top interest of science readers the past two years".[155] Most of the manned space launches have been by ardently watched live by junior astronomic buffs that make the long trek to the launch site in Hebei province to see each launch with their own eyes.[156] China's spacewalk in 2008 left an especially deep impression on China's massive population. The event, estimated by AGB Nielsen Media Research to have been watched by more than half of available Chinese households, compelled Shanghai-based computer technician Qu Yin to say, "I really wanted to cry when I saw the national flag Zhai [Zhigang] wave in space and the red characters 'Fei Tian' on the [sic] homemade [Chinese-made] spacesuit he wore".[157] Li Lunchang, who currently lives in Qiqihar, Heilongjiang Province, beamed, "I feel very proud of the three taikonauts on board the craft [Shenzhou-7], especially because two of them [Zhai Zhigang and Liu Boming] came from Qiqihar".[158]

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[153] Drew, "Space Inspires Passion and Practicality in China."

[154] Ibid.

[155] Unattributed, "China's 'Divine Vessel' Carries Nation to Space of Wonder," *People'sDaily.com* (English), September 28, 2008.

[156] Ibid.

[157] Ibid. "*Fei*" means "flying" and "*tian*" means "heaven" or "space." The Chinese were proud that they did not have to borrow a Russian spacesuit but rather used a Chinese-engineered (albeit likely based on Russian designs) spacesuit for this flight. See http://www.agbnielsen.net/aboutus/aboutus.asp (accessed February 28, 2009) for more info on AGB Nielsen in Asia.

[158] Cong Wang, "China Beams With Pride, Joy After Successful Space Mission," *People's Daily.com* (English), September 29, 2008.

Success of the *Shenzhou-7* space walk also spurred Chinese youth to launch their own rockets to commemorate the flight. A group of students from the Harbin Institute of Technology launched 16 "self-made micro-rockets" from a *Shenzhou-7* capsule-shaped launch pad. He Mingjie, one of the participants, said, "The success of the Shenzhou-7 mission has made us even more enthusiastic about the space programs [sic]. I hope someday I can join the program, too".[159]

China's burgeoning online community, now the largest in the world, also avidly watch space launches and use weblogs to show their enthusiasm and support.[160] Online forums were "packed with warm remarks left by Chinese netizens, many of whom watched the landing of the Shenzhou-7 vessel through live video broadcast at major portals".[161] One patriotic netizen wrote, "Even though China's space technology is still not as strong as the United States and Russia [sic], our future is bright. Just look at how many young people are interested in the [sic] space technology".[162]

D. CONCLUSION

China's space program has far-reaching impacts across the nation. From helping the Chinese Communist Party garner prestige and legitimacy, serving as a beacon for attracting and inspiring the next generation of space scientists and engineers, to having numerous positive civilian applications, the space program indeed is living up to its role as "an integral part of the state's comprehensive development strategy".[163] Speaking at Harvard's Fairbank Center China Current Events Workshop in November 2005, Johnson-Freese noted:

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[159] Wang, "China Beams With Pride, Joy After Successful Space Mission."

[160] See http://www.cnn.com/2009/TECH/01/14/china.internet/index.html (accessed February 28, 2009) for estimates that China's online community is almost 300 million, closing in the on the entire U.S. population!

[161] Wang, "China Beams With Pride, Joy After Successful Space Mission." "Netizens" is a clever English rendering of the Chinese "*wang min*" or literally "(Inter)net people."

[162] Ibid.

[163] White Paper, "China's Space Activities," (2000).

> The Chinese government…[is] banking on the effort generating a burst of economic development from spin-off technologies. The program itself is an employment program as well as a space program, providing work and training for thousands in the Chinese technology sector.[164]

Indeed, China has been successfully marketing its space program for domestic consumption and is reaping its rewards. China, however, also realizes that a successful space program can also bring potential rewards beyond its borders. Thus, the next chapter shifts focus to the *international* dimension of the Chinese space program and how China is maximizing its rising clout in space to have a *global* impact as it interacts with other nations.

[164] Joan Johnson-Freese, quoted in Alvin Powell, "Questions Remain About China in Space," *Harvard University Gazette*, November 3, 2005.

IV. CHINA'S "SOFT POWER" IN SPACE: INTERNATIONAL ASPECTS

China's space program got its initial start with Russian assistance back in the 1950s, but has come a long way since then, becoming a global exporter of space technologies and applications. Since announcing that it would be "entering the [international] commercial satellite launch market at the UNISPACE Conference in Geneva in August 1982,"[165] its growing space-related research, development, and industrial bases have allowed it to build "sophisticated launchers and satellites…conservatively aiming to capture 15 percent of the global market for such services".[166] Looking out from its ambitious 1982 mandate, this chapter will analyze who China has been working with in space internationally, in what capacities, and how it applies space-focused soft power to maintain and exploit its international relations agenda. It will also examine how other countries, especially in Asia, view its rapid rise as a space power. Finally, it concludes by assessing three different U.S. perspectives on the rise of Chinese space activities.

Since there are only two official Chinese government documents concerning its own space program that also contain language concerning its role in the international arena, it makes sense to use these key documents as a starting point. Specifically, the 2000 version spells out some of the key guiding concepts and principles and sheds light on Chinese intent to:

- Emphasize international exchanges and cooperation in the area of space [technology] (*zhongshi hangtianlingyu de guoji jiaoliu yu hezuo*);
- Renovate [space science and technology] institutions and technology and establish an operational mechanism geared toward both domestic *and international markets*;
- Increase simultaneously the capability of space development of all countries, *especially the developing countries*, and enable all countries to enjoy the benefits of space technology;

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[165] Wayne C Thompson & Steven W. Guerrier, ed., *Space: National Programs and International Cooperation* (Boulder, CO: Westview Press, 1989), 93.

[166] Drew, "Space Inspires Passion and Practicality in China."

- Emphasize Asia-Pacific regional space cooperation; and
- Support Chinese space enterprises to participate in *international space commercial launch services* in line with the principles of equality, equity and reciprocity.[167]

Although the 2006 White Paper does not deviate from these points, it does highlight more of the cooperative projects in the intervening years (2000-05) with other countries. It also boasts that China has:

- Signed cooperation agreements on the peaceful use of outer space and space project cooperation agreements with Argentina, Brazil, Canada, France, Malaysia, Pakistan, Russia, Ukraine, ESA, and the European Commission;
- Signed space cooperation memorandums with space organizations of India, and Great Britain; and
- Conducted exchanges with space-related bodies of Algeria, Chile, Germany, Italy, Japan, Peru, and the United States.[168]

What is more curious is that China's recently published "White Paper on National Defense" contained the following language: "Major breakthroughs have been made in developing the international market for space products. China has exported its first satellite, and the Earth resources satellite project with Brazil [CBERS] has played an important role in both countries' economic development".[169] It seems slightly out of place for a primarily defense-focused white paper to contain any reference to a joint space project. While hawkish-minded China watchers may see this as confirmation as to the true military intent driving the space program, I see it more as a poke in eye for America as well as a point to brag about. The sentence right before it is, "China's defense-related science, technology, and industry actively conduct cooperation with other countries in the field of hi-tech industries, combining military and civilian needs, and

[167] White Paper, "China's Space Activities," (2000). Original white paper (Chinese "*baipishu*") in Chinese at: http://www.cnsa.gov.cn/n615708/n620168/n750545/index.html (accessed February 16, 2009). Italics emphasis mine. Pinyin in parentheses hereafter for terms as I compared the original Chinese text to the English translation.

[168] White Paper, "China's Space Activities" (2006). See also, "China Signs 16 Int'l Space Cooperation Agreements, Memorandums in Five Years." *People's Daily (Online)*, October 12, 2006.

[169] White Paper. *China's National Defense in 2008*. People's Republic of China, Information Office of the State Council, January, 2009, 33. See section under "Enhancing Cooperation with Other Countries."

makes great efforts to develop hi-tech civilian products with high added value,"[170] thus it seems like China is merely highlighting one of its showcase cooperative ventures with another country, which happens to be space-related. Kevin Pollpeter echoes this idea behind the 2006 White Paper as he notes that, "…the document serves as a venue to tout China's accomplishments in space not only for domestic political and bureaucratic reasons, but also to advertise China's viability as an international partner in space".[171] He also noted China's space program will help it "achieve great power status within a system dominated by the United States and to increase its international influence without triggering a counterbalancing reaction".[172]

Clearly, for a nation to successfully achieve manned spaceflight is a tremendous accomplishment with significant second-order impacts. Dean Cheng, CNA China space expert, notes, "At the very least it seems the manned programme is about international prestige. China's space capability says to the world, 'We are an advanced nation'".[173] Cheng also asserts that "Another driver is diplomacy. A wide-ranging space programme showed the rest of the world that China had arrived on the international stage. That fits with hosting the Olympics, that fits with a burgeoning economy, and that fits with the world's largest foreign capital reserves".[174] William Burrows offers the label of "international power," and that for China to develop such a complex, multi-faceted program with ambitions for a space station and the Moon "requires a huge, advanced scientific and technological base that suggests a stable and powerful political system; what used to be called national 'might'".[175]

Below is a region-by-region breakdown of Chinese international cooperation and joint ventures in space.

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[170] White Paper, *China's National Defense in 2008*.

[171] Kevin Pollpeter, "Competing Perceptions of the U.S. and Chinese Space Programs," *China Brief*, Vol. 7, No. 1 (January 10, 2007): 4.

[172] Ibid, 6.

[173] David L. Chandler, "Why Do the Chinese Want to Conquer Space?" *New Scientist*, Vol. 180, No. 2418, (October 25-31, 2003): 8.

[174] Rincon, "What's Driving China Space Efforts?"

[175] William E Burrows, *The Survival Imperative: Using Space to Protect Earth* (New York, NY: Forge, Tom Doherty & Associates, 2006), 217.

A. CHINA WITH EUROPE

China has had a long history of space project interaction and cooperation with European countries. Its first satellite, the *Dongfanghong-1* ("East is Red," communications satellite) was built largely with German-engineered high-technology subsystems, to include power-generation and attitude control, along with French assistance.[176] Vincent Sabathier, a former Space Attaché at the French Embassy, sees a growing trend of space cooperation between the European Space Agency (ESA) and China, especially since "European manufacturers have now invested in ITAR-free technology that allows them to export systems with the previous tedious, and some say prohibitive, ITAR rules".[177]

In July 2001, the Chinese National Space Administration (CNSA, similar to NASA) partnered with ESA to collaborate on a joint mission to study the Earth's magnetic environment, China's first cooperative international project with another space agency. ESA provided a four-satellite *Cluster* mission while the Chinese provided two small *Double Star* satellites.[178] One of the *Double Star* satellites circles the poles while the other remains in equatorial orbit to collect data. As an incentive for Chinese cooperation and data sharing, ESA has "handed over 10 spare *Cluster* instruments worth $6.8 million".[179]

In 2004, ESA joined with the National Remote Sensing Center of China (NRSCC, under the PRC Ministry of Science and Technology, or "MOST") and started the ESA-MOST Dragon program, which is a "three-year science and exploitation…in the field of

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[176] Chris Bulloch, "China's Satcoms: Relying on the West," Interavia, (April 1998), 44. Deutsch Aerospace Airbus (DASA), successor to Messerschmitt-Bölkow-Blohm (MBB) worked closely with Alenia Aerospazio on the Sinosat program, with most of the actual construction taking place at the Aerospatiale facility in Cannes, France.

[177] Vincent G. Sabathier, "Europe and China," *adAstra*, Spring 2005, online at: http://www.space.com/adastra/china_europe_0505.html (accessed March 6, 2009). See Chapter V for more discussion on ITAR.

[178] Constance Holden, "East of ESA," *Science*, Vol. 293, No. 5529 (July 20, 2001): 423.

[179] Ibid.

Earth observation application development".[180] This program was so successful that it has been expanded for another four years under the "Dragon 2" title, and now includes "25 projects exploiting ESA, TPM, and Chinese EO [electro-optical] data for land, ocean, and atmospheric science and application development".[181] Also in 2004, the EU surpassed Japan as China's largest trading partner with Sino-EU trade accounting for over $160 billion.[182] Although the economic ties are very strong, China's grander strategy with Europe is based on "science and technology diplomacy" (*keiji waijiao*) over normal "economic diplomacy" (*jingji waijiao),* since much of the technical space know-how that China lacks can be found in Europe and is free from U.S. export restrictions.[183] It seemed to be in that spirit that China recently purchased a satellite made by the French firm, Alcatel, which was proudly announced to be "ITAR-free" and impervious to U.S. badgering.[184]

Beyond mere satellite purchases, China recently scored what some space industry analysts are calling a "commercial coup" with its recent agreement to launch a five-ton French satellite for Eutelsat Communications. Since the satellite has no U.S.-made components, it is not bound by U.S. policy restrictions and will mark the first Chinese launch of a Western satellite in more than a decade. Although the launch will not take place until late 2010, it "could prompt owners of other large commercial satellite fleets to enter similar arrangements with Chinese launch providers".[185] Citing China's comparative advantage in lift services and strong launch record, which is usually "40%

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[180] See the project website at: http://earth.esa.int/dragon/. Results from this initial cooperation can be viewed at: http://earth.esa.int/dragon/symp2008/proceedings/.

[181] See http://dragon2.esa.int/objectives.html and http://dragon2.esa.int/ for more details. TPM stands for "ESA Third Party Missions."

[182] Johnson-Freese and Erickson, "The Emerging China-EU Space Partnership: A Geotechnological Balancer," 13.

[183] Ibid. The U.S. has two main bodies that control trade restrictions with China, the U.S. State Department International Traffic in Arms Regulations (ITAR) and the U.S. Commerce Department Export Administration Regulations (EAR).

[184] Carl E. Behrens, *Space Launch Vehicles: Government Activities, Commercial Competition, and* Satellite Exports, Congressional Research Service Report IB93062 (March 20, 2006): 9.

[185] Andy Pasztor, "China to Launch Satellite For France's Eutelsat," *WallStreetJournal.com*, February 25, 2009. There was an interesting "Comment" on this article online, which read: "Good for China and the world. US can choose to isolate itself or engage the world." Admittedly, this is but one opinion, but nonetheless reflects a powerful sentiment that the U.S. space policies may actually be self-defeating.

less than the $100 million [price tag] for the most expensive launches on European rockets," there is a chance to lure other potential customers away from considering more expensive and, perhaps more politically complicated, U.S. launch options.[186]

Shortly after this deal was announced, Congressman Dana Rohrabacher (R-California) launched a lowbrow attack on China. He referred to China as a proliferator of weapons of mass destruction and stated, "Ten years ago, the Cox Report clearly demonstrated that U.S. technology transfers to the PRC helped to improve and enhance the efficiency of China's arsenal of missiles that were aimed at us".[187] He also added that despite needed changes to ITAR, America should ensure "that these scofflaw and rogue nations are barred from receiving our high tech systems,"[188] and called for sanctions on Eutelsat. While one can expect some measure of high-level political response in order to show patriotic support for the U.S. aerospace industry, his comments may end up driving more business away from America.[189] Only time will tell to see if either France-based Eutelsat, or the French-Italian space consortium of Thales Alenia Space, which currently has several contracts for Pentagon satellites and military communications, will end up being "punished" by Congress for "promoting Chinese space interests".[190]

Chinese space relations with Europe, despite potential political fallout with the United States, seem to be moving along at an excellent pace well into the next decade. With the expansion of the successful Dragon program with ESA, purchases of French-built satellites, and the upcoming launch of the Sino-German jointly-developed Solar

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[186] Pasztor, "China to Launch Satellite For France's Eutelsat."

[187] Unattributed, "Rohrabacher Condemns Use of Chinese Rockets," *SpaceMart.com*, February 26, 2009, http://www.spacemart.com/reports/Rohrabacher_Condemns_Use_Of_Chinese_Rockets_999.html (accessed February 28, 2009).

[188] Ibid.

[189] As noted in Chapter I, a rebuttal to the Cox Report from Stanford University's Center for International Security and Cooperation largely dismissed this notion (see: http://iis-db.stanford.edu/pubs/10331/cox.pdf, accessed February 28, 2009). The Cox Committee Rebuttal to the "Stanford Assessment," as well as the Stanford "response" to the Cox rebuttal are also conveniently located at: http://www.people.fas.harvard.edu/~johnston/cox.html (accessed February 28, 2009).

[190] Pasztor, "China to Launch Satellite For France's Eutelsat."

Space telescope and French Eutelsat satellites, China has established a significant foothold on the European continent for some time to come.[191]

B. CHINA WITH SOUTH AMERICA

After China was hit with sanctions following the 1989 Tiananmen Square incident, it had to look for non-Western partners to help its then-nascent aerospace industry. Its search led to it to South America, starting with Brazil's National Institute of Space Investigations (INEP).

Brazil started researching space in the 1960s and launched its first satellite, the *SCD-1 Data Collection Satellite*, on February 9, 1993.[192] When the United States decided to switch the management of LANDSAT data from NASA and NOAA over to the Earth Observation Satellite Company (EOSAT, a joint venture of Hughes and RCA) and financial problems that affected data availability started to emerge, Brazil, among other nations, started to look elsewhere for reliable remote sensing data.[193] With a focus on joint development rather than trying to go it alone, they joined forces with the Chinese and started work on the Chinese-Brazilian Earth Resources Satellite (CBERS, also called "*Ziyuan*" by the Chinese) in July, 1988, after President José Sarney visited China.[194] This marked China's "first international cooperative space technology venture with another

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[191] For more on the Solar Space Telescope, see: http://www.globalsecurity.org/space/world/china/sst.htm (accessed February 16, 2009).

[192] José Monserrat Filho, "Brazilian-Chinese Space Cooperation: An Analysis," *Space Policy*, Vol. 13, No. 2 (May 1997): 153. China and Brazil signed twelve joint documents regarding space which are further detailed and analyzed in this article. See also Craig Covault's, "China's Space Encore." *World News & Analysis*, Vol. 159, No. 17 (October 27, 2003): 30.

[193] Carlos de Olivera Lino et al., "CBERS: An International Space Cooperation Program," *Acta Astronautica*, Vol. 47, Nos. 2-9 (July-November 2000): 560. See pp. 560-561 for comparison and analysis of the CBERS imagery capability versus LANDSAT and SPOT.

[194] Daphne Burleson, *Space Programs Outside the United States: All Exploration and Research Efforts, Country By Country*, 36. See pp. 36-37 for detailed breakdown of the CBERS satellite. The U.S. intelligence community refers to Chinese reconnaissance satellites as "*Jianbing-X*" series.

developing country," and eventually led to the successful launch of two satellites, *Ziyuan-1* in October 1999, and *Ziyuan-2* in September 2000.[195] The CBERS project was an effort to:

> Use advanced space remote sensing techniques to inventory, develop, manage, and monitor the Chinese and Brazilian Earth resources in agriculture, forestry, geology, hydrology, geography, cartography, meteorology, and environment, etc. [as well as] promotion [sic] of the development and application of space remote sensing and space technology in China and Brazil.[196]

Brazil saw additional benefits from this new relationship with China. First, the CBERS program offered a cheaper alternative to its original plan to build four satellites under the Brazilian Complete Mission (MECB). Given budgetary constraints, teaming on a joint project could help stretch scarce space program dollars out even further. China also benefitted for this reason as well, especially since its own indigenous capability and its "services and operations in the field of meteorology, navigation, and remote sensing were essentially dependent on foreign satellites".[197] For part of this program, China turned to England for assistance. Audrey Nice, a spokesperson for the University of Surrey, stated that "[CBERS] was built under a know-how transfer and training program between the UK and China".[198] The CBERS project also involved "ten Chinese engineers and scientists spending a full year at the Surrey Space Centre in England, working with British engineers on the design, construction, and test of the payload. British experts also installed a Space Mission Control ground station at Qinghua University in Beijing".[199] Currently, the CBERS program has successfully launched three satellites, with an

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[195] Yun Zhao, "The 2002 Space Cooperation Protocol between China and Brazil: An Excellent Example of South-South Cooperation," *Space Policy*, Vol. 21, No. 3, (August 2005): 213. The *Ziyuan-2* was not classified as a *CBERS* satellite, but simply as a Chinese launch.

[196] Burleson, *Space Programs Outside the United States: All Exploration and Research Efforts, Country By Country*, 160.

[197] Ibid.

[198] James Oberg, "Year of the Rocket," *IEEE Spectrum*, Spring 2001.

[199] Oberg, "Year of the Rocket".

agreement to launch two more through 2013. It is considered part of the world's main Earth-observation satellite constellations, comparable to the "U.S. LANDSAT, French SPOT, and the Indian ResourceSat".[200]

More recently, China has pursued greater relations with Venezuela centered on oil imports and national defense issues. Venezuela stands out as the "most prominent example" of the "leftist, anti-American governments" in the region.[201] Venezuelan President Chavez notes his country has "100 satellite technicians training in China…radars, tracking stations, and air defenses are being installed right now".[202] The satellite, officially called the *VENESAT-1*, but also named the "Simon Bolivar" after the South American revolutionary hero, will be used for "government and military communications and to give remote parts of the country access to telephones and the Internet".[203] The *VENESAT-1* marks China's "first contract for satellite manufacturing and launch service for a Latin American country".[204] Nuris Orihuela, Venezuelan Vice Minister of Science and Technology, confirmed that there will actually be 90 technicians who will be working on the satellite, to include "30 [specialists] who will carry out special studies in China".[205]

Although *VENESAT-1* was successfully launched from China's Xichang Satellite Launch Center on October 30, 2008 (watched by millions of Venezuelans), it had to first undergo several months of testing before being declared fully operational. Finally, on January 24, 2009, in a ceremony "held in one of the satellite's mainland stations in the

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[200] Unattributed, "Second Chinese-Brazilian Satellite Fulfills 5-Year Mission in Orbit." *SpaceDaily.com*, October 23, 2008. *CBERS-1* was launched on October 14, 1999; *CBERS-2A* was launched on October 21, 2003; *CBERS-2B* was launched on September 19, 2007; *CBERS-3* is scheduled for launch in March 2009. To date, there has been no mention of a launch date for *CBERS-4*.

[201] Martin Arostegui, "Chavez: Venezuela to Launch Defense Satellite," *Washington Times*, September 12, 2007.

[202] Ibid.

[203] Unattributed, "Venezuela and China to Build Satellite," *Space Daily*, November 1, 2005.

[204] Unattributed, "China to Hand Over Satellite to Venezuela," *Spacemart.com*, January 23, 2009.

[205] Ibid.

town of El Combrero, it was officially handed off to Venezuelan satellite control operators," enabling Venezuela to become only the fourth nation in Latin America with any capability in satellite communications.[206]

Now that the satellite is operational, President Chavez's $406 million-dollar investment seems to be stirring up considerable enthusiasm for future space-based applications, to include:

- Expanding the reach of the Caracas-based Telesur television network;
- Bringing telecommunications to remote and rugged areas of southeastern Venezuela where standard landlines are expensive and difficult to operate; and
- Bringing "tele-medicine" and "tele-education" to remote areas, especially the Warao Indians in the Orinoco river basin.[207]

Socorro Hernandez, Minister of Telecommunications and Information, said that "during the first year of its operation [*VENESAT-1*] will focus on domestic needs. This includes over 100 towns that have poor or no access to basic telephone services".[208] Vice Minister Orihuela also noted that "a total of 1,200 satellite land antennas have been set up and another 3,500 will be gradually installed by the end of this year [2009]".[209]

Uruguay, although coming late to the project, provided approximately ten percent of the overall $241-million project cost.[210] It will likely be able to access a proportional number of transponders for its domestic communication requirements. More importantly, however, it also "traded" its orbit slot at 78 degrees west to gain satellite access, which allows for "north-south coverage from southern Mexico to Chile and Argentina, and east-west coverage from Brasilia, Brazil, to well past Lima, Peru, in the Pacific Ocean".[211]

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[206] Jorge Rueda, "Chavez Cheers Satellite Launch," *Washington Times (online)*, October 30, 2008. Also, "China to Hand Over Satellite to Venezuela," *Spacemart.com*, January 23, 2009.

[207] Ibid. See also: Sam Logan, "Venezuela's Space Escort," *International Relations and Security Network (ISN)*, November 7, 2008. Telesur is the pan-regional news and information network that includes 24 television stations and 25 radio frequencies.

[208] Unattributed, "China to Hand Over Satellite to Venezuela," *Spacemart.com*, January 23, 2009.

[209] Ibid.

[210] Unattributed, "China to Orbit Venezuela-Uruguay Satellite in 2008." *RIA Novosti*, February 4, 2008.

[211] Logan, "Venezuela's Space Escort."

Venezuela recently asked China for assistance to obtain imagery capability after it failed to buy its way into the Israeli-led ImageSat program,. Though details are currently sketchy, it appears that China will launch an Earth-observation satellite for them sometime in 2013, giving Venezuela its first-ever organic capability of direct-downlinked imagery from space.[212]

C. CHINA WITH AFRICA

China, in what some analysts have viewed as both a display of soft power as well as natural resource diplomacy, negotiated a deal with Nigeria to build, launch, and operate a communications satellite. The Japan-based *East Asian Strategic Review 2008* cited this project as an example of "China's exploitation of space activities as a diplomatic tool".[213] Ahmed Rufai, CEO of Nigerian Communication Satellite Ltd., said that after Nigeria put the project up for international bidding in April 2004, "21 bids arrived from major aerospace companies, but nearly all of failed to meet a key requirement: a significant financial package".[214] China generously loaned Nigeria most of the money for the project, likely banking on the fact that Nigeria's rich oil deposits will serve as collateral. With a successful satellite launch on May 14, 2007, there are now talks of a possible follow-on satellite to help Nigeria break into the "digital world dominated by the West".[215] Xu Jianguo, Chinese ambassador to Nigeria commented that this launch will serve to, "[enhance] mutual political trust, and economic and trade

[212] Peter J. Brown, "China Needs Sharper Eyes in Space," *Asia Times Online*, October 16, 2008.

[213] Unattributed, "China's Space Development—A Tool for Enhancing National Strength and Prestige," *East Asian Strategic Review 2008*, National Institute for Defense Studies, Tokyo, Japan: Japan Times (2008): 26.

[214] Jim Yardley, "Blocked by U.S., China Finds Its Own Way to Space," *International Herald Tribune*, May 23, 2007.

[215] Jim Yardley, "Snubbed by U.S., China Finds New Space Partners," *New York Times*, May 24, 2007.

relations".[216] Rufai hopes to improve Nigeria's "communication quality, including Internet services," and is "actively working with its Chinese partners to prepare *NIGCOMSAT-2* and *NIGCOMSAT-3*".[217]

China's space endeavors in Nigeria have endured some criticism, though. Kayode Fayemi, who leads the Nigerian policy think tank, the Center for Democracy and Development, stated that, "It looks like what could be a white elephant. In the scale of preference, this [space program] doesn't qualify as the most-needed project".[218] A space program in a country where there is still much poverty, lack of basic infrastructure (e.g. running water, electricity, paved roads) appears to be misdirected government spending. But given the upward momentum in space-related activity and talk of future satellites to come on board, it seems like the Sino-Nigeria space cooperation will continue for some time to come, despite serious domestic political challenges.[219]

One unexpected challenge to this promising relationship occurred last November, when the *NIGCOMSAT-1* had a malfunction.[220] Nigerian Communications Satellite Limited, which is responsible for satellite TT&C, issued a statement saying, "*NIGCOMSAT-1* is not missing, but rather powered down. When we observed abnormal battery discharge in a non-eclipse situation. The satellite was put into an emergency mode operation in order to effect mitigation and repairs".[221] After further analysis was done, it

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[216] Unattributed, "China Helps Nigeria Develop Communication Technology." *Xinhua People's Daily Online*, June 14, 2008.

[217] Ibid.

[218] Peter Pae, "Third World Sets Sights on Space," *Los Angeles Times* (October 14, 2003): A1.

[219] For a detailed look at China's involvement in Africa (beyond cooperation in the space sector), see: http://www.fastcompany.com/magazine/126/special-report-china-in-africa.html; also Carmen Gentile, "Analysis: China Dedicated to Nigerian Oil," *Energy Daily*, July 18, 2008, http://www.energy-daily.com/reports/Analysis_China_dedicated_to_Nigerian_oil_999.html (accessed October 10, 2008); Chris Alden, *China in Africa*, London: Zed Books (2007); and Robert I. Rotberg, ed., *China Into Africa: Trade, Aid, and Influence*, Washington D.C.: Brookings Institution Press (2008).

[220] Unattributed, "NIGCOMSAT-2: Fifty Nigerian Engineers Back From China," August 15, 2007. The satellite was based on the Chinese *Dongfanghong-4* bus design, built in the U.K. but launched by China.

[221] Unattributed, "'Technical Problems' Shut Down Nigerian Satellite," *SpaceMart.com*, November 12, 2008.

was moved into a permanent parking orbit and was determined to be beyond recovery.[222] People are first agitating for a quicker delivery for the follow-on *NIGCOMSAT*s-2 and -3, since the satellite was supposed to last for 15 years, and was to provide not only "phone, broadband Internet and broadcasting services to rural Africa," but also was used for "intelligence, security surveillance and other sectors such as the oil and gas industry".[223]

Given the relatively recent timing of this event, it may be premature to assess whether this malfunction with ties back to China will have a negative impact on Beijing's future satellite business. The same satellite design was sold, built, and launched for Venezuela and was recently handed over in January. Perhaps the successful *VENESAT-1* project will help allay concerns over the *NIGCOMSAT-1* failure and minimize any impact to China's standing in the commercial space arena.

Politically, the *NIGCOMSAT* project still has support thus far despite the failure. The Nigerian House of Representative's Committee on Science and Technology recently concluded a two-day public hearing concerning the loss of NIGCOMAT-1. Despite having initial doubts about spending money on new space projects, both expert testimony and "a clause committing them [China Great Wall Industry Corporation] to replace the satellite in the event of failure" seemed to have carried enough weight in order to help pass a resolution asking for "more communication satellites…to strengthen Nigeria's participation in space exploration".[224]

D. CHINA WITH ASIA

One of the current problems facing the Asian region, which was highlighted in a recent conference on "Collective Security in Space: Asian Perspectives on Acceptable Approaches," is the "lack [of] any regional consensus on space security".[225] There have

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[222] Unattributed, "Damaged Nigerian Satellite Can't Be Recovered," *SpaceDaily.com*, November 12, 2008.

[223] Ibid. See also: Remmy Nweke, "Experts Agitate for NIGCOMSAT 2, 3," *ITREALMS Online*, November 26, 2008, http://itrealms.blogspot.com/2008/11/experts-agitate-for-nigcomsat-2-3.html (accessed January 23, 2009).

[224] John Ameh, "Reps Make U-Turn On *NigComSat-I* Project," *SpaceDaily.com*, February 24, 2009.

[225] James Clay Moltz & Erik Quam, "Asian Approaches to Space Security," James Martin Center for Nonproliferation Studies, May 10, 2007.

been attempts at trying to consolidate some kind of space-focused space forum in Asia, starting with the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). AP-MCSTA was born from a Memorandum of Understanding (MoU) between China, Pakistan, and Thailand in February, 1992, with the hopes of achieving greater cooperation in the region. Per its official website:

> [Viewing] the immense potential of space technology and its spin-off benefits in the socio-economic uplift of the countries resulting in the transformation of quality of life of the society as a whole, and in order to pursue and to strengthen the multilateral cooperation among the countries of the Asia-Pacific Region in the peaceful applications of Space Science and Space Technology [establish AP-MCSTA].[226]

At the initial AP-MCSTA workshop in Beijing, China, over "120 government officials, decision-makers, experts and scholars…from 16 countries including mainly Australia, China, Pakistan, India, Indonesia, Japan, Republic of Korea, Thailand and other Asia-Pacific countries and international organizations" participated and decided to establish a Liaison Committee with China serving as its coordinator.[227] The Liaison Committee was established in 1994, and a Preparatory Committee for an Asia-Pacific Space Cooperation Mechanism and a Secretariat were established in 1999, both in China. During that interim five-year period and leading up to 2003, seven more AP-MCSTA conferences were held in Thailand, Pakistan, Republic of Korea, Bahrain, Iran, China, and Thailand, and all participating nations "unanimously recommended to speed up the process of institutionalization of the Cooperation Mechanism".[228] Finally on October 28, 2005, eight nations signed the Asia-Pacific Space Cooperation Organization (APSCO) Convention.[229]

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[226] See http://www.apmcsta.org/CommonWeb/foreword.aspx for more details on AP-MCSTA or see http://www.apmcsta.org/Apsco/Motives.aspx to see the evolution of AP-MCSTA into APSCO.

[227] Background from AP-MCSTA website: http://www.apmcsta.org/CommonWeb/foreword.aspx (accessed February 16, 2009).

[228] Ibid. See also http://www.suparco.gov.pk/pages/apsco.asp (accessed February 16, 2009), website for the National Space Agency of Pakistan website (note: not current in that it does not reflect Turkey joining in 2006).

[229] Ibid. The eight nations were: Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru, and Thailand. Turkey became the ninth country to sign the APSCO Convention on 1 June, 2006.

China, by leading the initial discussion in 1992 to establish the MoU and then to host several more conferences to discuss the AP-MCSTA goals, then to serve as the coordinating nation for the AP-MCSTA Liaison Committee and Secretariat, and then offer to host the headquarters for APSCO, has firmly established itself as a leader of space-related matters in Asia. Its forward-leaning presence and foresight to take the reins in the formation, coordination, and sponsorship of an Asian-focused space organization will likely translate to an increase in soft power and prestige throughout the region. As part of his address to the 59th International Astronautical Congress held in Glasgow in October, 2008, Sun Laiyan proudly declared that "China was prepared to lead the APSCO".[230]

Before APSCO fully came online in 2005, Beijing also started a separate project titled the "Cooperation in Small Multi-Mission Satellite (SMMS) and Other Related Activities" in April, 1998, with Iran, the Republic of (North) Korea, Mongolia, Pakistan, as well as Thailand.[231] The SMMS concept is built around a "three-axis stabilized small multi-mission satellite platform [that] will support many kinds of payloads [to include a] multi-spectral CCD camera and hyper-spectrum imager that performs Earth observation, Ka-band communication experiment equipment, data collection and store and forward data transmission (DCS/SAF) and middle ultraviolet backscatter radiometer to do space science research".[232] Zhang Nu, one of the lead Chinese engineers working on the SMMS project commented, "We want the program to be a model for space cooperation in the Asia-Pacific region".[233] Despite being touted as being used for purely civilian purposes, especially in the areas of environmental and disaster

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[230]Andrei Kislyakov, "Outside View: Asian Missile Power," *Spacewar.com*, October 24, 2008. Note: Sun Laiyan is currently the head of CNSA, China's counterpart to NASA.

[231] Bangladesh joined the SMMS project over a year later, in July 1999. The resolutions of CCD camera, the infrared camera and the synthetic aperture radar are 30m, 150m, and 20m, respectively, with an average re-visit time of 32 hours. For more technical aspects on the SMMS program, see: http://www.globalsecurity.org/space/world/china/smms.htm (accessed February 16, 2009). For the official AP-MCSTA background on SMSS, see: http://www.apmcsta.org/Projects/SMMS_Management.aspx (accessed February 16, 2009).

[232] See website of the Iranian Department of International Affairs: http://dia.ict.gov.ir/english/Site.aspx?ParTree=16141412 (accessed February 16, 2009).

[233] Craig Covault, "China, Iran Pursue Imaging Spacecraft," *Aviation Week & Space Technology*, Vol. 155, No. 14 (October 1, 2001): 45.

monitoring, some people are concerned about the growth of space-imaging capability among so many nations, and to what extent the SMMS might enhance Iran's "military reconnaissance capability".[234]

China has also pushed its space agenda into the Association of South East Asian Nations (ASEAN), which by original design is more of an economic forum than one for space issues, and does not include China. Using the AP-MCSTA as top cover, China organized a "China-ASEAN Training Course on Applications of Satellite Remote-Sensing and Satellite Communication Technologies in Disaster Reduction" for nine ASEAN countries.[235] Sponsored by the China-ASEAN Cooperation Fund, the 13-day training covered a series of topics:

- Enhance the capacity of ASEAN Member Countries in applying satellite remote-sensing and satellite communication technologies in disaster reduction;
- Facilitate the role of these technologies in the practice of disaster reduction; and
- Promote the cooperation between China and ASEAN Member Countries in disaster reduction using space technology.[236]

Given the apparent success of this project, it is likely that other training courses or space-based educational opportunities will arise with China as a leading organizer, sponsor, or participant. China's continual investment in training foreign students in space applications and sharing space-derived data has huge soft power potential, such as the Thai students who trained on remote sensing applications through China's "Master Program on Space Technology and Applications" and can now take full advantage of their own Thailand Earth Observation Satellite (THEOS).[237] China is also sharing data with Myanmar so it can "better monitor opium cultivation within its borders," as well as weather data, which is "still being used by several Asian countries including Laos, Philippines, Vietnam, Indonesia, and Thailand as well as other South and Central Asian

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[234] Covault, "China, Iran Pursue Imaging Spacecraft."

[235] See http://www.apmcsta.org/CommonWeb/AriticleView.aspx?Id=73 (February 16, 2009). Although China is not an ASEAN member, it is part of the ASEAN Regional Forum (ARF).

[236] Ibid.

[237] Brown, "China Needs Sharper Eyes in Space."

countries".[238] As fellow APSCO members Thailand and Indonesia have now launched their own satellites by other nations, APSCO, "with China as its leader…has a good chance of becoming very successful [organization]".[239]

China recently solidified its position as an end-to-end satellite service provider when it concluded a deal with Pakistan last October to build and launch a telecommunication satellite. During a state visit in Beijing, newly elected Pakistan President Asif Ali Zardari negotiated a deal with Chinese President Hu Jintao for the *Paksat-1R*, which will provide "domestic telecommunication and broadcast services" for Pakistan sometime in 2011.[240] Thus, Pakistan has now joined Nigeria and Venezuela as countries for which China has provided "cradle to grave" space-based telecommunication services.

E. CHINA WITH THE UNITED NATIONS

China's 2000 White Paper on its space activities proudly declares that China "supports strengthening the function of the United Nations Office of Outer Space Affairs (OOSA) and supports the outer space application programs of the United Nations".[241] It also starts out the section on "International Cooperation" with:

> The Chinese government holds that international space cooperation should follow the fundamental principles listed in the "Deceleration [sic] on International Cooperation on Exploring and Utilizing Outer Space for the Benefits and Interests of All Countries, Especially in Consideration of Developing Countries' Demands," which was approved by the 51st General Assembly of the United Nations in 1996.[242]

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[238] Brown, "China Needs Sharper Eyes in Space."

[239] Kislyakov, "Outside View: Asian Missile Power."

[240] Unattributed, "China to Deliver Telecom Satellite to Pakistan." *SpaceDaily.com*, October 17, 2008.

[241] White Paper, "China's Space Activities" (2000), under "Section IV. International Cooperation, Guiding Principles."

[242] Ibid.

The idea that all international space cooperation and activities should follow U.N. guidelines is continued in the 2006 version, which states that China "supports activities regarding the peaceful use of outer space within the framework of the United Nations".[243] On the surface, it seems like there are noble intentions behind their statements. Digging deeper, it is more likely that China would like to use the U.N. as a counterweight to U.S. space hegemony and ideally, use the U.N. "Prevention of Arms Race in Outer Space" (PAROS) and Conference on Disarmament (CD) to gently nudge Washington away from developing space weapons. Dean Cheng furthers this idea by stating:

> Thus, unlike the Missile Technology Control Regime (MTCR), [where] China perceived itself as subject to rules it had had no hand in formulating. Beijing has sought a seat at the table on space issues, in order to help establish the fundamental "rules of the road." In essence, China is intent on being a full participant in determining the international terms and conditions for space operations.[244]

Since joining the United Nations Committee on the Peaceful Uses of Outer Space (U.N. COPUOS) in 1980, as well as participating in the U.N.-sponsored Regional Space Application Programme (RESAP), China has maintained a presence in all space-related agencies within the U.N. It has supported both the 2000 U.N. General Assembly's resolution for PAROS and the 2003 resolution calling for "negotiations toward preventing an arms race in space".[245] With America standing out as the only nation voting against *both* resolutions, China "…has taken advantage of that [opposing] stance [by the United States]" and is undercutting U.S. soft power. The U.N. venue not only gives China "positive public relations exposure" but also "offers China considerable negotiating leverage with a low risk of being held to task for potential follow-through".[246] Thus, it appears that China is in the mainstream of global opinion while Washington is isolated and opposing the majority.

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[243] White Paper, "China's Space Activities" (2006).

[244] Cheng, "China and the Int'l Space Community: A Brief Overview," 2.

[245] Johnson-Freese, "Strategic Communication with China: What Message About Space?", 47. The United States has voted no on both resolutions since 2005.

[246] Ibid.

During the 1999 CD in Geneva, China tried to further its space agenda by calling for "…a special committee for developing a treaty against space weaponization".[247] Over the subsequent years, it has followed that by submitting more working papers on "Possible Elements for a Future International Legal Agreement on the Prevention of the Deployment of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects".[248] In addition to offering a similar proposal at the March 2007 meeting of U.N. COPUOS by Chinese Ambassador Tang Guoqiang, China joined forces with Russia and offered another draft space treaty on February 12, 2008, to the U.N. CD.[249] While nothing in the language of the draft treaty appeared to be terribly inflammatory towards America, the U.S. response to the treaty was a scathing eight-page analysis that called the Sino-Russian effort "vague," a "significant departure" from a previous 2002 working paper, and seemed intended only to limit U.S. weapons in space (or the proposed U.S. National Missile Defense program), while allowing China or Russia's ground-based anti-satellite programs.[250] Some analysts feel these efforts were deliberately targeting the United States, since China "needs to place a check, even if limited, on the further expansion of those capabilities" and that this proposed ban "may just be an expediency designed to contain the United States".[251]

The 2009 CD will meet in three sessions (January 19-27, May 18–July 3, and August 3–September 18), and PAROS is currently on the draft agenda.[252] Although China has not mentioned PAROS yet in its remarks, it was actually the Egyptian

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[247] "China's Space Development—A Tool for Enhancing National Strength and Prestige," 26. China filed the papers alone in 2000, but in 2001 and 2002 was joined by Russia, Vietnam, Indonesia, Belarus, Syria, and Zimbabwe.

[248] Ibid.

[249] Ibid, 27. Draft treaty text available at: http://www.reachingcriticalwill.org/political/cd/papers08/1session/Feb12%20Draft%20PPWT.pdf (accessed February 16, 2009).

[250] U.S. response was brought to the Third Session of the CD on September 2, 2008. Text is available at: http://www.reachingcriticalwill.org/political/cd/papers08/3session/CD1847.pdf (accessed February 16, 2009).

[251] "China's Space Development—A Tool for Enhancing National Strength and Prestige," *East Asian Strategic Review 2008*.

[252] Agenda text at: http://www.reachingcriticalwill.org/political/cd/papers09/WP552.pdf (accessed February 16, 2009).

representative, Ambassador Hisham Badr, who stated that the U.N. should "establish ad hoc committees as negotiating subsidiary bodies of the Conference for the four core issues, namely: Nuclear Disarmament, Negative Security Assurances (NSAs), Prevention of an Arms Race in Outer Space (PAROS) and a Fissile Material Cutoff Treaty (FMCT)".[253] Only time will tell any future Prevention of the Placement of Weapons in Outer Space Treaty (PPWT) will be brought up for discussion this year.

F. CHINA AND POSSIBLE SPACE CHALLENGERS IN ASIA

How should countries in Asia respond to the rise of China as a space-faring power? Cooperative engagement? Hostility? Waiting cautiously and patiently in the background? For nations with poor space capabilities or little space "infrastructure" engagement with China seems to be more beneficial than avoidance. With modest investment in a data reception site and minimal training on data interpretation, even low-tech nations can start to receive real-time meteorological data and imagery to assist with weather prediction, disaster monitoring, etc. Given the currently flagging world economy, it does not make economic sense for each country in Asia to build its own space agency from scratch or its own satellites independently, or construct a TT&C ground segment for satellite maintenance. Nor could the limited geosynchronous orbital slots accommodate multiple satellites for each country. Thus, both for limitations on financial resources and because of constraints on physical "room in space," space *cooperation* in Asia seems to be the better road to pursue.

Despite the potential benefits of cooperation, however, there appears to be jockeying for a leading role in the direction of space in Asia apart from China. India, which has enjoyed recent successes in its *Chandrayaan-1* lunar orbiter program, continues to research and develop its own space program without Chinese involvement. But, in an interview with Press Trust of India, Indian Space Research Organization (ISRO) Chairman Madhavan Nair disagreed with any idea of a "space race" between China and India, stating:

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[253] Speech text at: http://www.reachingcriticalwill.org/political/cd/speeches09/1session/20January_Egypt.pdf (accessed February 16, 2009).

> Our priorities have been in providing the societal services, based on the space assets. There, we have been concentrating on Earth observation and communication areas. Launch vehicles which are appropriate for these missions have been developed. That's why we have developed technologies and systems required for national development.[254]

India has also enjoyed benefits from the United Nations Economic and Social Commission for Asia and the Pacific's (UNESCAP) establishment of a Center for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), headquartered at the Indian Institute of Remote Sensing in Dehradun, India.[255] This gives India a measure of regional clout in space, especially since there are 15 signatory nations currently participating in the program.[256] This is nearly double the size of the Chinese-led APSCO, with three nations (Indonesia, Mongolia, and Thailand) having signed both the Chinese and Indian space conventions.

India is also eyeing the growing demand for commercial space launches. *Jane's Defence Weekly* analyst Rahul Bedi says, "the success of India's space program represents a technological evolution of the whole space programme in India".[257] He also notes, "India is very competitive in launching satellites and it further cements that reputation".[258] Since its inception, the ISRO has earned approximately 2.5 billion dollars from its commercial launches and is poised to continue its success not only in launches but also in satellite manufacturing.[259] ISRO is already getting preparing to launch several payloads from France and Russia in 2009 and 2010, which would constitute a direct challenge to China.[260]

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[254] Unattributed, "India Not Engaged in Space Race With China," *SpaceDaily.com*, October 13, 2008. See http://www.isro.org/ for more information on India's space program and current initiatives in space.

[255] CSSTEAP, For more detailed information, see their website at: http://www.cssteap.org/

[256] The CSSTEAP signatory nations are: DPR Korea, India, Indonesia, Kazakhstan, Kyrgyzstan, Malaysia, Mongolia, Myanmar, Nauru, Nepal, Philippines, Republic of Korea, Sri Lanka, Thailand, and Uzbekistan.

[257] Unattributed, "India Eyes Larger Slice of Satellite Launch Sector," *SpaceDaily.com*, October 23, 2008.

[258] Ibid.

[259] Ibid.

[260] Unattributed, "India Poised to be Major Player in Satellite Manufacturing," *SpaceDaily.com*, October 30, 2008.

One recent event that might dampen India's rise in the arena of commercial space is the recent malfunction of one of its satellites that it had sold to Europe's Eutelsat. Although the satellite was part of a joint venture between the European Astrium and ISRO's Antrix, the problem "can almost certainly be traced to the Antrix-provided platform".[261] Similarly to the recent Chinese loss of *NIGCOMSAT-1*, only time will tell if there is any negative backlash from this satellite failure for India.

In addition to India, Japan is also another Asian nation that may have concerns about China's growing space prowess. Since Japan is not officially associated with either APSCO or CSSTEAP, it created its own Asian-focused space organization in 1993, the Asian-Pacific Space Agency Forum (APRSAF).[262] One key distinction between APRSAF and APSCO or the CSSTEAP is that there are no requirements to sign a convention in order to participate. Interested nations are free to attend annual conferences as they deem necessary. According to the APRSAF website, its official mission statement is to:

> Discuss current space related issues and possible cooperation among countries mainly from the Asia-Pacific region. APRSAF intends to ensure wider participation of space agencies, government officials, regional and international organizations and institutions responsible for applying space technology, as well as space agencies from outside the region and private sectors as observers.[263]

One recent APRSAF-led initiative that is gaining soft power momentum is the SENTINEL Asia program, which is designed to provide advance warning for the disproportionate number of natural disasters that plague the Asia-Pacific region. This Japanese-led effort is an excellent example of bringing space-derived information into a usable format that can have dramatic, life-saving applications for all Asian nations. Since it draws on "satellite derived products and imagery from all available Earth observing

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[261] K.Y. Jayaraman, "ISRO-Built Satellite Fails After Five Weeks," *SpaceDaily*.com, February 2, 2009. Antrix serves as the commercial arm of ISRO, similar to the China Great Wall Industry Corporation serving as China's commercial space arm.

[262] Asia-Pacific Regional Space Agency Forum, for more detailed information, see their website at: http://www.aprsaf.org/

[263] See website for Asia-Pacific Regional Space Agency Forum, http://www.aprsaf.org/ , under "About APRSAF."

geostationary, or low-earth orbiting satellites, including meteorological satellites that provide routine data to the region," it can be a powerful tool for alerting nations of impending floods or other natural disasters that are going to affect their region.[264] Since it is an idea of Japanese origin, it can also be a powerful reminder that Japan also wants to exert a measure of influence in the region using space-based assets.

Table 4, below, lists the Asian countries that either have signed or simply are participating members in the four main Asia-focused space organizations. SCOSA membership is defined by ASEAN membership, so this is likely a fixed group. APSCO and CSSTEAP are not defined by outside organizations, so the number of nations may increase or decrease. APRSAF, while the largest in pure numbers, also has the loosest structure. Without a binding agreement from other countries, Japan relies solely on the goodwill of other nations to be willing to support APRSAF objectives. Note that the ASEAN nations of Indonesia and Thailand are the only two that are full-fledged members of all four groups.

[264] SENTINEL Asia website: http://dmss.tksc.jaxa.jp/sentinel/ (accessed February 16, 2009). According to the website, users can "also 'trigger' dedicated satellite-data acquisitions through their participating and cooperating space agencies during major disasters in their countries."

	APSCO (9)	APRSAF	CSSTEAP (15)	SCOSA (10)
China	X	X		
Iran	X			
Mongolia	X	X	X	
Peru	X			
Bangladesh	X	X		
Pakistan	X	X*		
Turkey	X			
Japan		X		
India		X	X	
S. Korea		X	X	
Nepal		X	X	
Sri Lanka		X	X	
Kazakhstan			X	
Kyrgyzstan			X	
Nauru			X	
N. Korea			X	
Uzbekistan			X	
Bhutan		X		
Brunei		X		X
Cambodia		X		X
Indonesia	X	X	X	X
Laos		X		X
Malaysia		X	X	X
Myanmar		X	X	X
Philippines		X	X	X
Thailand	X	X	X	X
Singapore		X		X
Vietnam		X		X

Table 4. Asian Space Organizations: Member Nations[265]

Due to long-standing political reasons, the four aforementioned space organizations may still remain autonomous in some respects; yet they have already displayed a willingness to work together on several projects of mutual benefit. However, they may still present a soft power challenge to China in the space arena. Beijing will

265 Data derived from each organization's website: http://www.apmcsta.org/CommonWeb/foreword.aspx, http://www.aprsaf.org/text/members01.html, http://www.cssteap.org/links.html, http://scosa.lapan.go.id/membership.htm. (all accessed February 16, 2009). Note: Numbers in parentheses indicates current total of member nations. Since APRSAF participation does not require written acknowledgment or ratifying a convention, no number is given. I also intentionally left off *non-Asian* nations that were listed on the APRSAF site (e.g. U.S., Canada, etc). *Note: Pakistan is a participating nation in APRSAF, but not in the Joint Project Team (JPT), and thus does not have access to SENTINEL Asia data.

likely see enduring competition occurring in the *commercial* space sector, especially with regard to telecommunications satellites and services and, more importantly, reliable space lift. India and Japan both possess indigenous launch capabilities, with North and South Korea planning to join them as early as 2009.

G. CHINA AND THE UNITED STATES: RIVAL, COMPETITOR, OR PARTNER?

If Asia, in general, is cautiously accommodating China's rise as a space power with a watchful eye, what stance should Washington take? U.S.-Chinese space cooperation started on September 9, 1988, when the Reagan administration approved the first-ever export licenses allowing Chinese rockets to launch U.S.-built satellites.[266] China and the United States later joined efforts in space in 1992 when the China Telecommunications & Broadcast Satellite Corporation purchased the orbiting *Spacenet-1*.[267] This relationship grew to the point where China was allowed to launch U.S.-built satellites on its rockets, until the Space Systems/Loral "scandal" broke out in 1996, resulting in years of political aftershocks and stringent satellite export restrictions following the release of the Cox Commission Report's investigation in 1999. China's ASAT "scientific experiment" in January 2007 still lingers in the minds of many policy makers in Washington. Given this once positive and now more negative relationship of space relations, how should Washington view China and its space program: rival, competitor, or possible cooperative partner?

1. China as a Military Space Rival

Viewing the Chinese space program as hostile and Beijing a future rival in space seems to be the predominant line of thinking amongst U.S. politicians and many think tanks. The Chinese ASAT test still rings loudly in their ears, tainting each judgment that

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[266] Shirley Kan, *China: Possible Missile Technology Transfers Under U.S. Satellite Export Policy—Actions and Chronology*, Congressional Research Service Report 98-485F (October 6, 2003): 45. This is very detailed and comprehensive overview of U.S.-Chinese space cooperation and resulting Congressional actions from 1988-2003.

[267] Chris Bulloch, "China's Satcoms: Relying on the West," *Interavia* (April 1998): 44. China renamed the satellite *Chinasat-5* and moved it to the 115.5E slot.

is made on China's aspirations in space The 1997 Loral scandal in which missile technology was allegedly transferred to China against standing U.S. satellite export policy is another black mark against any mention Chinese space cooperation. More vitriolic statements were issued during the March 2006 House Appropriations Committee subcommittee hearing on "Science, the Departments of State, Justice, and Commerce, and Related Agencies" when Rep. Tom DeLay quipped, "We have a space race [with China] going on right now and the American people are totally unaware of this".[268] Frank Wolf, representative from Virginia and subcommittee chairman, added, "If China beats us there [to the Moon], we will have lost the space program. They are basically, fundamentally in competition with us".[269] This is further evidenced in Senator Kyl's January 29, 2007 speech at the Heritage Foundation in which he claimed that China's rhetoric and insistence on the Prevention of an Arms Race in Outer Space (PAROS) was merely a ruse to prevent "further progress by the United States in space while allowing it to covertly catch up".[270] Despite repeated remarks by Chinese Premier Wen Jiabao that the test was not directed at anyone nor did it change China's position on the peaceful use of space, many remain skeptical of the test's true intent. While this may have been an attempt to drum up the China threat in order to secure more funding for NASA's lunar programs, it may also reflect a more general trend of regarding any Chinese effort in space with the utmost suspicion.

Johnson-Freese's address to the April 2007 conference "Collective Security in Space: Asian Perspectives on Acceptable Approaches" explained the more pessimistic outlook in greater detail. She cited the three main commissions that color U.S. space policy, namely the "Rumsfeld," "Cox," and "Rumsfeld Space" Commissions as

[268] Jeff Foust, "China, Competition, and Cooperation," *The SpaceReview.com*, April 10, 2006.

[269] Ibid.

[270] Jeffrey Logan, *China's Space Program*, CRS RS22777 (May 21, 2008), 2. See also Joan Johnson-Freese, *Space as a Strategic Asset*, chapter 2 on "The Conundrum of Dual-Use Technology" for an excellent explanation of this issue.

bolstering a purported China "threat" in space.[271] After the 2007 ASAT test, the "U.S. voices of moderation [which had] made some progress [against the 'China threat' camp]…had [been] drowned out".[272] Thus, while there were positive efforts to keep the threat perceptions from spiraling out of control, they were effectively extinguished by the Chinese ASAT demonstration. In her analysis of the 2004 DoD report on Chinese space activities, Johnson-Freese noted that "five out of six Chinese launches were considered militarily relevant breakthroughs, though all but one were *civilian* launches".[273] Given the downward trend in U.S.-China space relations and the strong anti-China bias from the Pentagon, she pessimistically concluded that chances would be grim for any real improvement "in the near-term and even in the next administration".[274]

In addition to the ASAT test and issue of technology transfer are China's track record on human rights and less-than-effective governance of intellectual property rights, which are often cited as moral and economic reasons to keep Beijing isolated. The "crystal clear" message that China continues to receive from the United States is that the "[U.S.] is not interested in cooperative space programs with China".[275] Thus, the prevailing sentiment that China is a space rival and *not* a country that the United States can work with in space seems firmly entrenched in some circles, at least for the time being.

2. China as an Economic Space Competitor

Despite a general worldwide trend of nations' space budgets either remaining static or in decline, China is actively building, buying and launching satellites into space. Although there may not be tremendous growth in actual sales of satellites, there is an

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[271] Moltz and Quam, "Asian Approaches to Space Security." The Rumsfeld Commission is officially the "Commission to Assess the Ballistic Missile Threat to the United States." The Cox Commission is the "Commission on U.S. National Security and Military/Commercial Concerns with the People's Republic of China." The Rumsfeld Space is the "Commission to Assess U.S. National Security Space Management and Organization."

[272] Ibid.

[273] Joan Johnson-Freese and Andrew S. Erickson, "The Emerging China-EU Space Partnership: A Geotechnological Balancer," 14, emphasis added.

[274] Moltz and Quam, "Asian Approaches to Space Security."

[275] Johnson-Freese, "Strategic Communication with China: What Message About Space?" 37.

increase in the demand for satellite applications and services.[276] Relying on U.S. export licenses to regulate purchases abroad of satellite or satellite components to "influence over how other countries participate in the commercial launch services market" may be a strategy that is backfiring.[277] With the recent purchase of a French Alcatel-built satellite, proudly announced as "ITAR-free," as well as Chinese space launches for Brazil, Nigeria, and now Venezuela, the U.S. space industry is going to face more and more competition.[278] This view was recently echoed by Jim Albaugh, president and CEO of Boeing Integrated Defense Systems. In an address to the 2008 National Space Symposium, he stated that "[in space]…like the business world you have to be worried about the threat of that new guy who just opened up a shop down the street…of course, I'm talking about China and India".[279] John Hamre, former deputy secretary of defense, in his introductory comments at an April 3, 2006 Center for Strategic and International Studies event titled "Global Space Agenda: China," also noted, "somehow, our strategy of containment, if its goal is to prevent you [China] from becoming a spacefaring nation, it isn't working".[280]

China's competitive edge in space launch is due to several factors. First, it offers insurance for all launches in case of failure through the China Insurance Company.[281] Second, its lower wage scales allow it to underbid competing offers by "at least 10 to 15 percent".[282] Third, as part of its outreach to developing nations, it allows a "flexible

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[276] Cheng, "China's Space Program: Civilian, Commercial, & Military Aspects," 5.

[277] Carl E. Behrens, *Space Launch Vehicles: Government Activities, Commercial Competition, and Satellite Exports*, Congressional Research Service Report IB93062 (March 20, 2006), 9.

[278] Ibid., viii. ITAR stands for "International Traffic in Arms Regulations" legislation initially enacted to prevent export of strong cryptography and other sensitive military technology outside the U.S., but was modified to include space and satellite technology following the February 1996 failed Chinese launch of the U.S. Intelsat satellite and subsequent indictment of Loral Space Systems of allegedly transferring sensitive technology to Chinese which could also be used to advance their military space capability.

[279] Jim Albaugh, "Reaffirming U.S. Leadership in Space," *Space News*, May 26, 2008, 19.

[280] Jeff Foust, "China, Competition, and Cooperation," *The SpaceReview.com*, April 10, 2006.

[281] John Rhea, "Need for More International Cooperation," in Wayne C. Thompson & Steven W. Guerrier, ed., *Space: National Programs and International Cooperation*, (Boulder, CO: Westview Press, 1989), 112.

[282] Patrick M. Mayerchak, "Asia in Space: The Programs of China, Japan, and Indonesia," in Wayne C. Thompson & Steven W. Guerrier, ed., *Space: National Programs and International Cooperation*, (Boulder, CO: Westview Press, 1989), 93.

payment method" as part of the package.[283] Taking these factors as a whole, the launch portion can save prospective customers "$50 million per rocket" over the average higher-priced U.S. and European alternatives.[284] The French-based Thales Aleniaspace has already taken advantage of this and had China launch six of its satellites since 2006.[285]

From this perspective, unless Washington starts modifying its space policy (see recommendations in Chapter V), other nations, including China, will continue to eat away at our lead in space. This becomes all the more critical with the decommissioning of the shuttle and our inability to get manned missions to the ISS without paying for Russian flights. Looking to private space enterprises such as Space X, which finally had a successful launch on its fourth Falcon-1 launch, may be a short-term solution. But especially when it comes to manned missions, launcher reliability is paramount. The Russian Soyuz and Chinese Shenzhou are both man-rated space vehicles that have a strong history of success thus far, and may be the only options for the U.S. to continue to send astronauts into space.

3. China as a Space Partner

If the United States truly wants to engage China in a positive and productive manner regarding space, this perspective argues that Washington needs to see China as a potential partner and not just as "rival" or "competitor." As Nicolas Peter notes, "…few if any countries in the world today can stand alone in space activities, demonstrating therefore the importance of cooperation".[286] Although Washington continues to snub Beijing's request to serve as a partner on the *ISS*, there may be some actual merit to allowing China to participate in the program. One obvious benefit would be China's ability to participate financially and allow for some cost-sharing. With its large foreign reserves and sovereign wealth fund, China is in a better position than other *ISS* participants (e.g., Brazil, Italy) to help offset some of the continual development and

[283] Mayerchak, "Asia in Space: The Programs of China, Japan, and Indonesia."

[284] Andy Pasztor, "China's Rocket Service Makes Inroads, Irks U.S.,"A13.

[285] Ibid. Also see Joan Johnson-Freese, *Space as a Strategic Asset*, Chapter 6 on "The Politicization of the U.S. Aerospace Industry" for more on why U.S. companies are becoming less competitive.

[286] Peter, "The Changing Geopolitics of Space Activities," 108.

sustainment costs. Another potential benefit in Chinese collaboration would be greater insight and transparency into China's own space program and technical capabilities. Richard Fisher, vice president of the International Assessment and Strategy Center, offered a slightly puzzling, pessimistic argument in favor of denying Chinese participation in the *ISS*, as follows:

> When we look to our own potential future cooperation, dialogue, space dialogue with China, we have to keep this [potential for military dual-use purposes] in mind. That when we invite—if we were to invite—a Chinese astronaut onto the space shuttle, that the *information technology* that that single individual might pick up *could be turned into a potential Chinese military space platform.*[287]

There is scant evidence, however, that a man orbiting in space would truly add any significant military advantage, especially concerning information technology. Johnson-Freese dryly noted that neither the Americans nor Soviets could find any particular advantage to having a manned military presence in space and that "there seems little basis for such a fear [that Chinese ingenuity would find value in a military-man-in-space that eluded the U.S. military]".[288]

On a more optimistic note, space cooperation between NASA and the CNSA, its Chinese counterpart, through increased contact and exchanges of information, could help overcome mutual mistrust and ambiguity. Over the long-term, it could potentially give way to strengthened confidence and assurance of each others' intentions and concerns about space, reducing ambiguity and increasing transparency across the board. Even during the height of the Cold War, America held a joint space docking exercise with the Soviet Union in 1975 which "achieved important technical and political breakthroughs".[289] If the United States could work with its bitter communist rival during the dark days of the Cold War, according to the "space partner" perspective, Washington could safely find a place for Sino-U.S. space cooperation in the 21st century.

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[287] Johnson-Freese, "Strategic Communication…," 46. Italics added for emphasis.

[288] Johnson-Freese, "Strategic Communication…," 47. For a more conservative perspective, see: Larry Wortzel, "The Rules of Engagement: The Russia Model," *adAstra*, Spring 2005.

[289] Jeffrey Logan, *China's Space Program: Options for U.S.-China Cooperation*, CRS RS22777 (May 21, 2008), 6.

Working in a more direct fashion with the Chinese, it could be argued, may also help keep their space program directed at peaceful objectives and dampen any secret ambitions to militarize outer space. Even some Chinese scholars would agree on this point, including Wu Chunsi from Fudan University's Center for American Studies. He suggests that Washington's active engagement China in space could help create a clean break between the civilian and military programs and that "the commercial and civilian elements of China's space program will see their capabilities grow along with a sense of *independence from the military*".[290] Furthermore, Wu argues, "if China follows a path of isolation, exclusion will only deepen its suspicion and resentment, and the commercial and civilian sectors…would be forced to seek help from the government, or even the military".[291] Thus, instead of acting as a "space hyper-power," a U.S. invitation to the Chinese to become a space partner could arguably soften its image as a global hegemon, and also increase U.S. soft power and credibility with the Chinese.[292]

H. CONCLUSION

China has a flexible approach to space projects and international cooperation, which is clearly a key component of its foreign policy. With the CBERS joint project with Brazil, it was a "two-way input of money and technology," whereas the *VENESAT-1* project with Venezuela was a "simple exchange of cash for products, services, and technology." Logan notes that this fluid approach to brokering space-related projects internationally reflects the Chinese "'win-win' approach to deal making".[293] As of 2001, China had "space-related technical and economic cooperation with over 70 countries," and that number has probably grown since then.[294] With Russian backing, China is also

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[290] Chunsi Wu, "Development Goals of China's Space Program," *China Security*, World Security Institute, Vol. 2, No. 2 (Summer 2006): 110. Emphasis added.

[291] Wu, "Development Goals of China's Space Program," 110.

[292] Term of the United States as "space hyper-power" from: Dean Cheng, "China's Space Program: Civilian, Commercial, & Military Aspects," 3.

[293] Logan, "Venezuela's Space Escort."

[294] Colonel David J. Thompson & Lieutenant Colonel William R. Morris, *China in Space: Civilian and Military Developments*, Maxwell Paper No. 24 (Maxwell AFB, Ala.: Air War College, August 2001): *iii*.

trying to shape the rules of the road for future space conduct through U.N. space organizations and fora. Thus, China has cleverly adapted a strategy of using space-related projects, programs, and agreements as a soft power tool of international relations. John Logsdon, former director of George Washington University's Space Policy Institute, comments, "It's no accident that these [Brazil, Venezuela, and Nigeria] are resource-rich countries. China is using its space capabilities as part of its broader diplomatic efforts".[295] Thus, China is seeking out those nations that it can enter into mutually beneficial relations with, trading and sharing space technology for natural resources that it does not enjoy in abundance.

Other nations in Asia, namely India and Japan (but also North and South Korea and even Iran) also desire to have successful space programs that can bring international prestige and soft power influence in the region. While it appears that healthy competition will peacefully co-exist with cooperation in space, it is an area that demands faithful attention and monitoring to ensure it does not go down a more militaristic and destructive path. With a firmer grasp of China's space program from an international context, the final chapter returns to the United States to examine current U.S. space policy and to offer recommendations for a new approach aimed at addressing the challenges posed by China's rising soft power in space while better serving U.S. interests.

[295] Drew, "Space Inspires Passion and Practicality in China."

V. CONCLUSION

As mentioned at the outset of this thesis, the number of nations that recognize the advantages of space applications and are investing resources to join the space-faring elite is only on the increase. The explosion of downstream services provided by precision navigation and timing (PNT), the growth of direct-to-home telecommunications broadcasting, as well the positive impacts of remote sensing, weather forecasting, and monitoring for natural disasters continue to drive more interest into peaceful uses of outer space. Having an indigenous space capability also increases political prestige and "soft power" and satisfies techno-nationalism.296 China, like many other nations, is not simply standing idly by on the sidelines. It is actively promoting itself as a provider of these services to others, especially technologically weaker nations.

With the rise of China's presence in both space and space-related commercial services, and their growth of space-derived soft power internationally, American interests, political, economic, and otherwise, are sure to be impacted. In a recent Air and Space Power Journal, Trevor Brown notes:

> The problem for the United States is that other nations believe it seeks to monopolize space in order to further its hegemonic dominance...[;] Poor U.S. diplomacy on the issue of space weaponization contributes to increased geopolitical backlashes of the sort leading to the recent decline in U.S. soft power…which, in turn, has restrained overall U.S. national power despite any gains in hard power.[297]

Focusing on the general decline of U.S. soft power and global influence, he adds, "Due to U.S. losses of soft power, the international community now views with suspicion any legitimate concerns that the United States may have about protecting critical assets in space".[298] Looking at current U.S. space policy and strategy, what choices does

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[296] Joan Johnson-Freese, *Space as a Strategic Asset*, 11.

[297] Trevor Brown, "Soft Power and Space Weaponization," *Air and Space Power Journal*, Vol. XXIII, No. 1 (Maxwell AFB, AL: Air University Press, Spring 2009), 67.

[298] Ibid.

Washington make to encourage or restrain China's rise? What can America do differently to rebuild its own soft power? This final section examines that issue and offers recommendations for U.S. space policy.

A. CONSIDERATIONS FOR FUTURE U.S. SPACE POLICY

What follows is a list of considerations and recommendations for U.S. policy on space. It is my sincere hope that consideration and implementation of these suggestions will help restore confidence in U.S. intentions in space as well as promote U.S. space soft power worldwide.[299]

There are a number of areas that could be considered "low-hanging fruit" that are well within our means to start rebuilding positive American influence and soft power and engendering amicable feelings with our existing partners in space.

1. Unilateral Measures

Normally, the term "American unilateralism" connotes a sinister notion, especially for foreign audiences. However, there are areas in the context of space where unilateral measures may be extremely positive and productive. Washington should pursue a stated policy of no first-use of space weapons or, perhaps more directly, a policy of no first-deployment of space-based weapons. Ever since the United States walked away from the ABM Treaty in June 2002, placed missile interceptors at Fort Greeley, Alaska, and started negotiating with Poland and Czechoslovakia about potential sites for future missile defense sites, many countries have begun to view us as an aggressor. Moscow has reacted by threatening to develop even more capable nuclear warheads.[300] China has also reacted strongly by reiterating its stance that National Missile Defense (NMD) "does not

[299] My sincere thanks both to my fellow space professional colleagues in the Space Policy course and to Prof. Moltz who taught it, where many of these ideas were initially discussed. See also: Jeffrey Logan, *China's Space Program: Options for U.S.-China Cooperation*, 5-6.

[300] BBC News has a nice, concise summary of the U.S. missile defense plans in Europe and Russian responses at: http://news.bbc.co.uk/2/hi/europe/6720153.stm (accessed February 16, 2009).

contribute to global stability…and violates the ABM Treaty".[301] Although these are ground-based defensive systems, they also show American unwillingness to abandon any notion of placing similar weapons in space. By showing a willingness to support a joint resolution on "no space weapons" with Russia, and perhaps one that also involved China, Washington would be clearly demonstrating resolve that it is serious about keeping space peaceful for future generations.

The new Obama administration may indeed be willing to take a lead with regards to cooperative space policy. According to the official White House website, "The Obama-Biden Administration will restore American leadership on space issues, *seeking a worldwide ban on weapons that interfere with military and commercial satellites*".[302] While that sounds good initially, that phrase is immediately followed with more language on "assess[ing] possible threats to U.S. space assets and the best options…for countering them".[303] Nonetheless, this still seems to be a step in the right direction and hopefully will be actually carried out in the near-term.

While any U.S.-led movement towards a ban on space weapons would be met with widespread international support, Washington also should issue a clearly stated moratorium on ASAT activities. The February 2008 U.S. shootdown of a malfunctioning satellite did not engender much goodwill. Although numerous statements were made that it was not in retaliation for the Chinese ASAT test, it did not appear that many people believed that the on-board hydrazine constituted a severe enough risk to humanity to justify even low-altitude satellite destruction. By promulgating a clearly-worded unilateral resolution or joint declaration with Russia and China to neither place nor use space weapons, coupled with a self-imposed ban, or at least a moratorium, on all ASAT testing, Washington would thereby broadcast a strong signal of intent to remain non-

[301] Chinese Ambassador Sha Zukang, text of speech, "Can BMD Really Enhance Security?", delivered to Second US-China Conference on Arms Control, Disarmament, and Non-Proliferation, April 28, 1999, text online in English and Chinese at: http://www.nti.org/db/china/engdocs/shabmd.htm (accessed February 16, 2009).

[302] Text from http://www.whitehouse.gov/agenda/defense/ (accessed February 16, 2009). emphasis mine.

[303] Ibid.

aggressive in space and maintain it as a sanctuary for the peaceful use of all mankind.[304] Bottom line, these efforts could help counter China's own hawkish defense establishment policymakers who may be seeking to balance or hedge against any attempt of U.S. space dominance and shape a new direction for China's own space program.[305]

2. Debris Mitigation

One oddly positive result from the largely negative Chinese ASAT test was a new focus on space debris. This event served as a catalyst that galvanized more support and serious efforts to address this issue. More people are now aware that an "F-BOM" (Fratricide By Orbital Mechanics)[306] can be nearly as dangerous than an "H-bomb" in space. The recent collision of a U.S.-built Iridium communications satellite and an old Russian Cosmos relay satellite added more fuel to these concerns.[307]

In light of this new awareness of and concern about space debris, the U.S. should continue to proactively lead and guide full implementation of the Inter-Agency Debris Coordinating Committee (IADC) Debris Mitigation Guidelines to ensure they do not remain a passive, non-legally binding "voluntary" commitment as they are currently, but a true international standard for all future space launches and operations, including those from China.[308]

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[304] See Mike Moore, *Twilight War: The Folly of U.S. Space Dominance* (Oakland, CA: Independent Institute, 2008), 213. Also see Chapter 12, "The Road Not Taken," for additional space policy recommendations.

[305] See also James A. Lewis, "China as a Military Space Competitor," *Perspectives on Space Security* (Washington, D.C.: Space Policy Institute, December 2005) available at: http://www.csis.org/media/csis/pubs/040801_china_space_competitor.pdf (accessed February 28, 2009). For more articles on the Chinese ASAT program not being a threat to the United States (and other related issues), also see: http://www.spacedebate.org/argument/1157/ (accessed February 28, 2009).

[306] My humorous play on "H-bomb" to illustrate the danger of space debris and how it can often damage much more than the intended "target" satellite. Since things in orbit tend to stay in orbit, ASATs are inherently risky for any space-faring nation with far-reaching consequences that can last decades.

[307] See Bill Hardwood, "U.S. and Russian Satellites Collide," *CBSNews.com*, February 11, 2009.

[308] See "Status of Activity of the Inter-Agency Space Debris Coordination Committee," IADC Document No. IADC 08-01, February 2008, http://www.iadc-online.org/index.cgi?item=docs_pub (accessed December 18, 2008). The recent collision of two satellites in space further heightens the need to address this sooner rather than later. See also op-ed article: James Clay Moltz, "Space Jam," *NewYorkTimes.com*, February 18, 2009.

3. Rules of the Road, or a "Space Code of Conduct"

To date, there is no real internationally recognized legal framework on how a nation should conduct itself in space. Given the recent U.S. trend to vote against U.N. resolutions (e.g., PAROS), perhaps a non-binding agreement that had a limited scope of very general and basic norms might be a good place to start. Michael Krepon, in an address to the U.N. NGO Committee on Disarmament, Peace and Security, offered some interesting priorities for establishing a "code of conduct":

- Prohibiting harmful interference with space objects;
- Sharing space surveillance data (space situational awareness, or SSA);
- Abiding by the debris mitigation guidelines;
- Devising and implementing a traffic management system for space; and
- Providing accurate and timely launch notice and registration.[309]

Keeping the language simple and in a "rules of the road" format would allow for countries, including America, to sign on without much political risk. As time went along, the hope is that this could start to create a norm, or expected pattern of behavior, and eventually end up in a binding, codified treaty. If America took the lead in drafting and supporting such a "space code of conduct," it *could* serve as a positive message that would erase some of the stigma that currently taints other nations' views of our own space ambitions and, in the long run, could have a positive impact on keeping space a safer place.[310] It might also steal some of the thunder from Beijing and its efforts to curtail U.S. influence through the U.N. and help engender goodwill for Washington.

4. Discard Inflammatory Policy Language

A neutral observer who casually reviews both the official U.S. National Space Policy as well as prominent statements made by leading U.S. officials would easily arrive

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[309] Michael Krepon, "A Code of Conduct for Outer Space," paper presented at discussion held at United Nations Headquarters by the NGO Committee on Disarmament, Peace and Security, in cooperation with the UN Office for Disarmament Affairs, New York, NY, April 12, 2007. SSA is all the more important given the recent collision of a U.S. *Iridium* and Russian *Cosmos* satellite.

[310] See also James R. Blaker, "Avoiding Another Cold War: The Case for Collaboration with China," *American Security Project Perspectives*, November 6, 2008, 8-9.

at the conclusion that America is intent on an aggressive, hegemonic approach to space security. Since the Rumsfeld Commission, one concept that received a lot of press was the idea of a "space Pearl Harbor".[311] Whether this was intended to refer to a surprise attack against the United States designed to cripple our ability to wage war or to destroy our entire satellite constellation, or both, is unclear. What is clear is the misimpression it left on both uninformed citizens and members of Congress: our space assets are at risk, a rogue nation can "blind" us, and the U.S. military would be utterly helpless to fight. With one ASAT test under its belt, China appeared to fill the role of that rogue nation. In light of a U.S. response of intervention in a Taiwan Strait scenario, many war planners assume China will try to attack U.S. space assets.

While the U.S. military is indeed dependent in many ways on space assets, the notion of a "space Pearl Harbor," at least regarding attacking satellites, is overstated. Many of the military satellite communications (MILSATCOM) "birds" and Defense Support Program (DSP) early-warning satellites are out at Geosynchronous (GEO) orbit, approx. 35,000 km (22,300 miles) away. The Global Positioning System (GPS) is in Medium Earth Orbit (MEO), which is approx. 22,000 km (12,000 miles) away. Both the Chinese and American ASAT events occurred in Low Earth Orbit (LEO), roughly between 160 – 2000 km (100 – 1,240 miles). While America does operate sensitive reconnaissance satellites at LEO that are indeed vulnerable, the technology, both in tracking something *beyond* LEO and trying to "hit" it with a seeker-equipped killer satellite, as well as the required size of the launch vehicle due to the large amount of fuel to get something to MEO or GEO orbits, is not something a rogue nation would be able to easily access. Although it may seem rash to dismiss the "space Pearl Harbor" concept as "much ado about nothing," it is clear by applying simple orbital mechanics and space physics that it is nearly impossible to destroy all U.S. space assets without a tremendous number of large, multi-stage boosters and highly accurate, large kinetic-kill vehicles, and a lot of dead time where America does nothing in response. Having a capability to "kill a satellite" at LEO does not in any way portend any ability to do the same at MEO or GEO,

[311] See Jean-Michel Stoullig, "Rumsfeld Commission Warns Against 'Space Pearl Harbor'," *SpaceDaily.com*, January 11, 2001.

which are 10-20 times further away, and several orders of magnitude more difficult to track, identify, and destroy.[312] Thus, the idea of a China "space threat" wiping out U.S. space resources seems less plausible and more unrealistic than previously imagined.

Similarly, looking at the 2006 version of U.S. National Space Policy, some of the language used in the "Principles" is ambiguous, borderline hostile, and disconcerting:

> The United States considers space capabilities -- including the ground and space segments and supporting links -- vital to its national interests. Consistent with this policy, the United States will: preserve its rights, capabilities, and freedom of action in space; **dissuade or deter** others from either impeding those rights or developing capabilities intended to do so; take those actions necessary to protect its space capabilities; respond to interference; and **deny**, if necessary, adversaries the **use of space** capabilities hostile to U.S. national interests;
>
> The United States will **oppose the development of new legal regimes** or other restrictions that seek to prohibit or limit U.S. access to or use of space. Proposed arms control agreements or restrictions **must not impair the rights of the United States** to **conduct research, development, testing, and operations or other activities in space** for U.S. national interests.[313]

How exactly will Washington "deny" other people using space? If one buys the argument that a rogue nation will attack one of our satellites, does that mean a nuclear retaliatory strike? And why is the United States the only country with a "right" to conduct activities in space? With China looking at its own GPS-like *Beidou* constellation, *Yaogan* remote-sensing satellites, *Shentong* and *Fenghuo* military communication satellites, does Beijing also have to right to "deny" the use of space if someone tries to interfere with its constellation? If not, Washington is assuming special privileges only for itself. This unilateral approach smacks of a schoolyard bully who insists on getting his own way without having to answer to anyone else, and cuts dangerously deep into America's soft power. Is this really the approach that Washington—the world's leading democracy—

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[312] Although I disagree with some portions of the article, see Geoffrey Forden, "Viewpoint: China and Space War," *Astropolitics*, Vol. 6, Number 2 (May-August 2008):138-153, for analysis of what China would have to do to attack U.S. space assets.

[313] *U.S. National Space Policy*, August 31, 2006. Bolded text added for emphasis.

wants to take? Does this not make the previously stated principles of "peaceful purposes" mere fluff and leave us seeming to be hypocritical? I think there are more countries than just the United States that also believe "freedom of action in space is important" and also wish to derive "economic prosperity and national security" from space.[314] How could Washington use such innate desires to promote its security in space?

My simple recommendation is to drop the emotionally-charged rhetoric of "space dominance," "space superiority" and "space control." It is extremely divisive and unnecessary language that drives people away from our side, and presumes that nations will forever willingly accept an inferior posture and subject themselves to whatever Washington decides. Some people advocate an "in your face from space" attitude, even to the point of stating in no uncertain terms that "the United States is the morally superior choice to **seize** and **control** space"[315] and "…deploying a space-based BMD would…*guarantee domination of space*".[316] Washington sincerely risks greater isolation and resistance if it thinks it can "seize and control" anything with no regard to world opinion in this manner, and may actually provide stimulus to Chinese hard-liners who may want to justify a more aggressive approach to space security vis-à-vis America.

5. Support PAROS & TCBM

Beyond changing the way we signal our intentions in space through policy and doctrine, continually being the only nation voting ***against*** the United Nations Resolution for the Prevention of an Arms Race in Space (PAROS) and the Transparency and Confidence Building Measures in Outer Space Activities (TCBM) sends a clear message

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[314] *U.S. National Space Policy*, August 31, 2006. Bolded text added for emphasis.. See item 1, "Background."

[315] Everett Carl Dolman, "Space Power and US Hegemony: Maintaining a Liberal World Order in the 21st Century," in John M. Logsdon and Gordon Adams, eds., *Space Weapons: Are They Needed?* (Washington, DC: Space Policy Institute, George Washington University, October 2003). Bolded emphasis mine.

[316] Everett Carl Dohlman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002), 165. Emphasis mine.

that Washington is completely unwilling to abide by world consensus. American obstinance also potentially signals intentions of one day placing weapons in space by refusing to remove that option from the table. The language of the document states:

> Recognizing that prevention of an arms race in outer space would avert a grave danger for international peace and security, call upon all States, in particular those with major space capabilities, to contribute actively to the goal of the peaceful use of outer space, and of the prevention of an arms race in outer space, and to refrain from actions contrary to that goal and to the relevant existing treaties in the interest of maintaining international peace and security and promoting international cooperation.[317]

Christina Rocca, U.S. Ambassador to the Conference on Disarmament, and Under Secretary of State for Arms Control and International Security Robert Joseph offer this standard reply to why Washington won't support it: "There is no arms race in space and therefore no problem for arms control to solve".[318] However, the interpretation of that carefully worded message is, "Why limit ourselves when it won't prevent other countries from developing space weapons technology?" As space policy expert Clay Moltz observed, " [the 2006 Policy] had walked to the threshold of weaponization but had failed to cross it overtly,"[319] leaving an ambiguous loophole to pursue space weapons if national security required it. If the United States is truly serious about the peaceful use of space for all nations, it should obligate itself, through voting for international resolutions, to cease and desist from developing space weapons. If Washington continues to vote against PAROS, it is possibly risking U.S. isolation in space due to Chinese soft power skills and space diplomacy, which currently track with world opinion.

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317 United Nations 63rd General Assembly, GA/10792, Press Release, UN Department of Public Information, December 2, 2008. The TCBM in Space Activities document (A/C.1/63/L.44) was not yet available online when I checked.

318 See "U.S. to China: No Arms Race in Space." *Newsmax.com*, February 13, 2007, and Robert Joseph, "Remarks on the President's National Space Policy," *Spaceref.com*, December 14, 2006, http://www.spaceref.com/news/viewsr.html?pid=22773 (accessed December 18, 2008).

319 Moltz, *The Politics of Space Security*, 296.

6. Radical ITAR Reform

Finally, as many others do, I recommend a wholesale review and revision of the U.S. export control process, namely the International Traffic in Arms Regulations (ITAR).[320] The National Research Council's Committees on Science, Security and Prosperity and on Scientific Communication and National Security recently issued a brilliant report on the sad impact of U.S. export controls and how they negatively affect American national and economic security. Although export controls were originally intended to safeguard military technology and American supremacy, the unfortunate reality is that times have changed dramatically, and *not* in our favor. Some of the report's findings include:

- The current system of export controls now harms our national and homeland security;
- The system of export controls is fundamentally broken and cannot be fixed by incremental changes below the Presidential-level; and
- A new system of export controls can be more agile and effective, recognizing that, under current global conditions, risks to national security can be mitigated but not eliminated.[321]

Over the past decade or so, the Bush administration and Congress, which "remained reluctant to loosen these [ITAR] restrictions," had the "net effect…to strengthen relations between other satellite producers (such as Russia and the United Kingdom) and a growing list of clients in East Asia, South Asia, and the Middle East".[322]

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[320] For more insights on ITAR-generated obstacles to U.S. space cooperation and competiveness, see "ITAR and the American Way." Spacewar.com, January 28, 2009; Andy Pasztor, "China's Rocket Service Makes Inroads, Irks U.S.," Wall Street Journal (October 5, 2007), A13; Craig Covault, "Building Great Wall: China is Offering the Sale of New Satellite Components to Europe and Asia to Compete Against U.S. Companies," Aviation Week & Space Technology, Vol. 158, No. 25 (June 23, 2003): 37; Johnson-Freese and Erickson, "The Emerging China-EU Space Partnership: A Geotechnological Balancer," 21; Vincent G. Sabathier, "Europe and China," adAstra (Spring 2005) ; Theresa Hitchens & David Chen, "Forging a Sino-US 'Grand Bargain' in Space," Space Policy, Volume 2 (2008), 3-4; "The Ongoing Erosion of the US Space Industrial Base," SpaceDaily.com, January 21, 2009; "Earthbound," Economist.com, August 21, 2008; and "Washington, We Have a Problem," Economist.com, August 21, 2008.

[321] National Research Council Committees on Science, Security and Prosperity & Committee on Scientific Communication and National Security. Beyond Fortress America: National Security Controls on Science and Technology in a Globalized World. National Academies Press, Washington, D.C., 2009, 3-4. Findings pulled from Summary of "Prepublication Copy" available at: http://www.nap.edu/nap-cgi/report.cgi?record_id=12567&type=pdfxsum (accessed February 16, 2009).

[322] Moltz, *The Politics of Space Security*, 286.

This also includes France and China, which have teamed together to produce "small, communication satellites that don't include U.S. parts and therefore exempt from a complex web of U.S. technology-export controls [ITAR]. They are as much as 40 percent cheaper to assemble, test and launch than rival American models".[323] Even Europe, with its long military alliance and historical ties to the United States, is not reacting favorably to U.S. ITAR controls. Vincent Sabathier, former French space attaché, notes, "Very little cooperation regarding space-based security applications goes on between Europe and the United States. Meanwhile, ITAR itself has created barriers to prevent such cooperation".[324] In addition to the dramatic rise of "ITAR-free" space commerce, a report by the Center for Strategic and International Studies noted that "Not only have these requirements [ITAR] harmed our domestic technological and manufacturing base, but they have had a drastic negative effect on both the hard and soft power utilization of space".[325]

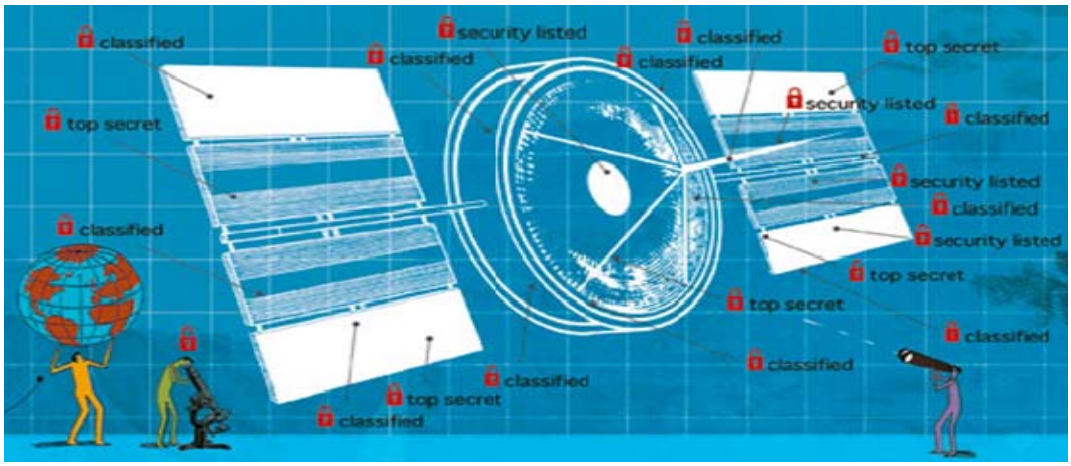

Figure 14. Cartoon Depicting ITAR Restrictions on Satellite Technology[326]

[323] Pasztor, "China's Rocket Service Makes Inroads, Irks U.S.,"A13.

[324] Sabathier, "Europe and China."

[325] Vincent Sabathier & G. Ryan Faith, *Smart Power Through Space* (February 20, 2008), cited in Theresa Hitchens & David Chen, "Forging a Sino-US 'Grand Bargain' in Space," *Space Policy*, Volume 2 (2008), 3-4.

[326] Image from: http://www.economist.com/displaystory.cfm?story_id=11965352, illustration by Frazer Hudson.

Nobody recommends scrapping export controls altogether. But facing diminishing foreign demand for U.S.-built space technology and the growing loss of space technology and human capital, there needs to be radical changes. The "Beyond Fortress America" report recommends several solutions, as follows:

- The President should restructure the export control process within the federal government to prevent harm to national security and technology base and help promote U.S. economic competitiveness;
- A new coordinating center that would fall under the auspices of the National Security Advisor should be established; and
- There should be an economic competitiveness "exemption" that eliminates exports controls on dual-use technologies where they, or their functional equivalents, are available without restriction in open markets outside the United States.[327]

Changes of this magnitude would probably involve an uphill battle, potentially triggering turfs wars among State, Commerce, Defense, and the Congress, as well as fighting the dreaded inertia of bureaucratic path dependency and red tape. Though not an impossible effort, it will take considerable fortitude and bold leadership to overturn more than a decade of U.S. over-reaction to the Chinese threat and Draconian export controls regarding the space industry. Failure to make substantive changes in this area may bring about more "ITAR-free" satellites and space technology marketed not only by the Chinese, but also India, Japan, as well as allies in Europe, as well as cause more irreversible the already hemorrhaging U.S. space industry.

B. SUMMARY

Where do we go from here? Looking at the bottom line, space is no longer the Cold War race between the Americans and the Soviets. As Nicolas Peter notes, "major space-faring nations are now using space as a political tool to reach non-traditional partners in order to build trusting relationships across political borders, illustrating that foreign policy and space are now increasingly overlapping...[;]greater international

[327] National Research Council, 4-8. The summary goes into great detail how these changes should be enacted.

cooperation is the way forward for major space activities".[328] And China certainly is making its mark in the space world, and is not going to leave the space arena anytime soon. Johnson-Freese comments that "They [the Chinese] want to play a leadership role for developing countries that want to get into space. It's just a win-win for them…they are making political connections, it helps them with oil deals and they bring in hard currency to feed back into their own program to make them even more commercially competitive".[329] The sooner Asia and the United States cautiously accommodate a more powerful, space-capable China, the more they will able to leverage and perhaps even shape its rise, weaning it away from a military race in space, and perhaps ensuring there is truly peaceful development and benefit from space for all nations.

America has shown the rest of the world far too much edgy "hard power" diplomacy, including in the space realm. In doing so, it has isolated itself and thereby harmed its own security. Especially with regard to China, the United States is in danger of mischaracterizing the motivations and rationales behind China's space program and, as a result, pursuing counterproductive policies that could actually create incentives for other countries to side with China against American interests in space. We have already seen a drop in U.S. dominance in commercial space, and the rise of ITAR-free programs as a result of our insecurities about technology transfer. The Chinese ASAT test is usually seen as a military test purely designed as an asymmetric capability to attack America's overdependence on space assets, normally in the context of a Sino-U.S. wartime scenario (i.e., over Taiwan).[330] But as China expands its number of military and civilians satellites and thereby incurring the same space-borne liabilities as the U.S., why is it not also vulnerable to a space attack? Bottom line, as Johnson-Freese argues, "other

[328] Peter, "The Changing Geopolitics of Space Activities," 106.

[329] Yardley, "Snubbed by U.S., China Finds New Space Partners."

[330] Baker Spring, "Satellite Shootdown Was a Necessary Operation," *Heritage Foundation Webmemo #1823* (February 22, 2008), http://www.heritage.org/research/nationalsecurity/wm1823.cfm (accessed December 18, 2008).

countries are clearly interested in working with China on space, regardless of the American stance. Therefore, the United States can either be involved and retain some measure of control through leadership, or watch from the sidelines".[331]

It is time for America to shift permanently away from hegemonic ambitions in space, dismantle the idea of space-based weapons and space control, and instead turn towards promoting space cooperation through peaceful projects that can truly serve mankind and preserve the heritage of space as a sanctuary.[332] We no longer have a monopoly on space technology, and our lead is precariously slipping away in commercial space. If Washington avoids inflammatory rhetoric and demonstrates a sincere willingness to usher in a new era of space cooperation, taking care to build in adequate verification and compliance mechanisms, the rest of the world will follow our lead. For the sake of our own interests and long-term security, sitting on the sidelines is *not* an option.

[331] Joan Johnson-Freese, "Space *Wei Qi*: The Launch of *Shenzhou* ," *Naval War College Review*, Vol. LVII, No. 2, Newport, RI: Naval War College (Spring 2004), 121-145.

[332] See Lieutenant Colonel Bruce M. DeBlois, "Space Sanctuary," *Airpower Journal*, Vol. XII, No.4, Maxwell AFB, Alabama: Air University (Winter 1998), available online at: http://www.airpower.maxwell.af.mil/airchronicles/apj/apj98/win98/deblois.html (accessed February 28, 2009).

APPENDIX: BRIEF CHRONOLOGY OF THE CHINESE SPACE PROGRAM

1955	U.S. deported Qian Xuesen, gifted rocket scientist and Chinese foreign national who helped establish the Jet Propulsion Laboratory and other elements of U.S. space program, back to China; eventually becomes "father of modern Chinese space program."
1956	China and Russia exchanged nuclear and rocket technology.
1958	Base for spaceflights built at Jiuquan (Shuangchengzi) in Gobi desert; China receives two Soviet R-2 missiles.
1960	(September) Launched one of the Soviet R-2 missiles using domestically-produced propellant.
	(November 5) Launched *Dongfeng-1*, Chinese variant of R-2.
1966	China began work on *Shuguang 1* ("Dawn 1") two-man capsule, human spaceflight program; similar to NASA *Gemini* program.
1968	Qian Xuesen established Space Flight Medical Research Center to prepare for manned spaceflight.
1969	(November 16) Launched first *Changzheng-1* ("Long March") domestically designed and built three-stage booster.
1970	(April 24) Launched *Dongfanghong* ("The East is Red"); 1st satellite launch; 390-lb. "ball" broadcasted patriotic song, "The East is Red"; 15-day mission.
1971	(March 3) Launched *Shijian-1* telecommunications satellite.
1975	(November 26) Launched 1st photo-reconnaissance satellite (film-recoverable; launched 14 successful missions from 1975-1992; 10-meter resolution in later models).
1978	Announced plans for *Qian* [Xuesen, "father" of China's space program] Spaceplane and Skylab-type space station; both postponed in 1980 due to pressing economic concerns.
1980	Became member of United Nations Committee On Peaceful Use of Outer Space (UNCOPUOS).

1981 (September) Launched three satellites into orbit from single launch vehicle.

1982 (August) China announced entry into commercial satellite launch market at UNISPACE Conference in Geneva.

1984 Became only the 3rd nation to use cryogenic (liquid oxygen/hydrogen) for upper stage (1st is the U.S., 2nd is European Space Agency, Japan is 4th).

Declines invitation from U.S. President Reagan to fly aboard space shuttle.

1985 China entered commercial space launch market; between 1985-2000 launch 27 foreign-made satellites.

1986 Joined LANDSAT project; bought international ground station for access to 15-60 meter resolution (via LANDSAT 5/7; refreshed every 8 days).

1988 (September 9) Reagan administration approved export licenses permitting use of Chinese space launch vehicles for U.S. companies.

1990 (April 7) Launched *Asiasat* (former Western Union *Westar 6* built by Hughes); 1st American satellite sent to orbit via non-Western rocket.

(July 16) Launched Pakistan *Badr-A* satellite.

1992 Started "Project 921": manned-space flight program under Qi Faren (Qian Xuesen retires).

(February) China, Pakistan, and Thailand signed Memorandum of Understanding establishing Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA).

(August 14) Launched *Aussat* (Optus-B1, built by Hughes) after failed attempt on March 22; second U.S.-built satellite launched by China.

(October 6) Launched Swedish *Freja* satellite.

1993 Ministry of Aerospace Industry (MAS) corporatized into China Aerospace Corporation (CASC).

1994 (July 21) Launched *Apstar-1* (U.S.-built by Hughes).

(August 28) Launched Australian *Optus-B3* (built by Hughes).

1995 (January 26) Failed launch of *Apstar-2* (built by Hughes), exploded after liftoff; Hughes worked with China Great Wall Industry Corporation (CGWIC) to determine cause.

Signed agreement with Russia to transfer space technology.

1996 Chinese astronauts started training at Russian cosmonaut training center.

(February 15) Failed launch of *Intelsat-708* (built by Loral) killing six and injuring 57 per official Chinese reporting; began series of investigations that would lead to allegations of missile technology transfer by Loral to China.

1997 (May) Sent delegation to International Organization for Standardization (ISO); discussed creation of international standards for space.

1998 (July 18) Launched French Aerospatiale-built *Sinosat-1*.

1999 China Aerospace Corporation (CASC) split into Chinese Aerospace Science and Technology Corporation (CASC; *Zhongguo Hangtian Keji Jituan Gongsi*) and China Aerospace Science and Industry Corporation (CASIC; *Zhongguo Hangtian Kegong Jituan Gongsi*).

(October 14) Launched China-Brazil Earth Resource Satellite (CBERS; also called *Ziyuan-1* in Chinese); 20-meter resolution, 1st-ever direct downlink of imagery for remote sensing applications.

(November 20) Successfully launched and recovered *Shenzhou-1* to test manned flight capsule.

2000 (September 1) Launched second imaging satellite, *Ziyuan-2*; high-resolution, electro-optical imager; direct downlink to ground segment.

(October) Launched 1st of *Beidou* navigation satellites.

2001 (July) Chinese National Space Administration agreed to partner with European Space Agency on *Cluster/DoubleStar* satellites & data sharing joint venture to study Earth's magnetic environment.

2002 (October 27) Launched second *Ziyuan-2* imagery satellite; reported by U.S. intelligence community as *Jianbing-3* military photo-reconnaissance satellite.

2003 (May 24) Launched 3rd *Beidou* navigation & positioning satellite; completed constellation for all-weather navigation and positioning data.

2003 (September) European Space Agency (ESA) and Chinese Ministry of Science and Technology establish joint "China-Europe Global Navigation Satellite System Technology Training and Cooperation Center" at Beijing University.

(October 13) Launched *Shenzhou-5*; 1st-ever human space launch for China and the third country overall (Russia and U.S. are 1st and 2nd respectively); PLA Lt. Col. Yang Liwei is China's first "taikonaut."

(November) Closed Kiribati Telemetry Tracking & Control (TT&C) due to Kiribati switching recognition to Taiwan (December 29) Launched *Doublestar* satellite (joint project with ESA).

2004 Signed Framework Agreement with Argentina on "Technology Cooperation in the Peaceful Use of Outer Space."

2005 (October 17) Launched *Shenzhou-6*; 2nd manned-space launch with two astronauts on board (Fei Junlong and Nie Haisheng), 5-day mission with various experiments on human spaceflight.

(October 27) Launched *Hangtian Qinghua-1* and *Beijing-1* (disaster monitoring constellation); two microsatellites co-developed with United Kingdom's Surry Satellite Technology Ltd.

(October 28) China, Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Peru, and Thailand signed Convention to establish Asia-Pacific Space Cooperation Organization (APSCO), headquartered in Beijing.

2006 (June 1) Turkey signed APSCO Convention, becoming its ninth member.

2007 (January 11) Destroyed *FengYun-1C* defunct weather satellite with kinetic-kill vehicle (KKV), generating thousands of space debris in LEO.

(May 14) Launched *NIGCOMSAT-1*; Nigeria's 1st communications satellite.

(October 24) Launched *Chang-E 1*, 1st lunar probe (4th country to do so, behind Russia, U.S., and Japan).

2008 (April 25) Launched *Tian Lian 1* ("Sky Link"), China's first Tracking and Data Relay satellite (similar to U.S. TDRS), allows for over 50% communication coverage of *Shenzhou* missions.

2008 (September 25) Launched *Shenzhou-7*; 3rd manned-space launch with three astronauts on board (Zhai Zhigang, Liu Boming and Jing Haipeng); Zhai Zhigang performed 20-minute first-ever spacewalk/EVA (necessary step towards eventually building a space station) in Chinese-designed "Feitian" spacesuit.

(October 29) Launched *VENESAT-1* ("Simon Bolivar"), Venezuela's 1st satellite, to provide communications to both Venezuela and Uruguay; based on the *Dongfanghong-4* satellite bus.

(November 13) *NIGCOMSAT-1*, launched by the China Great Wall Industry Corporation, fails due to battery exhaustion (likely caused by malfunction in the solar array).

(December 15) Launched *Yaogan-5* ("Remote Sensing") under extremely low outside temperature (minus 29 degrees Celsius); 5th in a series of satellites used for "land resources surveys, environmental surveillance and protection, urban planning, crop yield estimates, disaster prevention and reduction, and space science experiments"; 114th successful Long March launch.

(December 23) Launched *Fengyun-2E* meteorological satellite; 11th of 2008 setting new record for number of successful launches in one year (also surpassed U.S. who had 10 launches); 115th successful launch from Long March booster.

2009 (January 11) Completed in-orbit delivery and handover of TT&C for *VENESAT-1* to Venezuelan National Communications Company (CANTV).

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