

THE CATHOLIC UNIVERSITY OF AMERICA

Competition Among States:
Case Studies in the Political Role of Remote Sensing Capabilities

A DISSERTATION

Submitted to the Faculty of the

Department of Politics

School of Arts and Sciences

Of The Catholic University of America

In Partial Fulfillment of the Requirements

For the Degree

Doctor of Philosophy

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Audrey Ann Ammons

Washington, DC

2010

Competition Among States:
Case Studies in the Political Role of Remote Sensing Capabilities

Audrey Ann Ammons, Ph.D.

Director: Wallace J. Thies, Ph.D.

International politics is a competitive realm. One of the most powerful modern advantages in this competitive world is the ownership of independent and autonomous remote sensing satellites. Few have this venue for competition and those that do belong to a very exclusive groups of states.

Kenneth Waltz, author of *Theory of International Politics*, theorized that states emulate the innovations, strategies and practices of those countries with the greatest capability and ingenuity. As Waltz explains, states will emulate the leader in an anarchic realm to attain the same capabilities that helped the hegemon attain or maintain its status. Waltz referred to this as a tendency toward sameness of the competitors.

Modern-day states that pursue global preeminence often exhibit exceptional risk-taking and significant technological innovation. They also challenge the recognized hegemon in an area of expertise and leadership. Realists would say that these states are emulating the behavior of the states they view as successful in order to maintain or improve their position in the world order. Realists also point out that strategic interests lead states to try to gain or at least neutralize those areas that, if controlled by an adversary, could menace them. Realist writers suggest that states will

be reluctant to cede control of an important new technology to another state, even a friendly one, lest they find themselves permanently disadvantaged in an on-going contest for wealth, influence and even preeminence.

The purpose of this research is to investigate if remote sensing capabilities are a venue of competition among modern states and one that they view as a potential path to global preeminence. Why do some states expend scarce resources to develop and maintain an indigenous remote sensing capability when it appears that they can acquire much of the end product from other sources at a reasonable cost? If this is true, it should be possible to confirm that states acquire end-to-end remote sensing capabilities as a means to maintain or improve their position in the world order. These states are willing to devote significant resources in order to control this technology because they believe successful states have used remote sensing technology as a means to acquire and maintain their preeminent position. States that own and operate remote sensing capabilities must take considerable risks and apply technological innovation to succeed. Whether the technology is an historical example such as a sixteenth century ship or its modern equivalent—a twenty-first century satellite—the potential rewards are the same: military advantage, commercial markets, and global recognition.

This dissertation by Audrey Ann Ammons fulfills the dissertation requirement for the doctoral degree in philosophy, approved by Wallace J. Thies, Ph.D., as Director, and by James P. O’Leary, Ph.D., and Maryann Cusimano Love, Ph.D., as Readers.

Dr. Wallace J. Thies, Ph.D., Director

Dr. James P. O’Leary, Ph.D., Reader

Dr. Maryann Cusimano Love, Ph.D., Reader

DEDICATION

To my husband—

William L. Richards, III

who physically departed this earth as I began the dissertation process,
yet remained with me spiritually while I completed this journey.

I will always love you.

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ACKNOWLEDGEMENTS

In memory of my parents, Carrie and Parker Ammons, who encouraged me and told me I could accomplish anything. Thank you, with much love.

I want to thank my family for their love and support: my amazing sister, Susie (Carrie Susan Ammons Grant) who has been my best friend since the day she was born; my brother-in-law, Randall C. Grant, who is indeed my brother; and Parker Hudson Grant, my nephew by blood and my son by heart.

Thanks to special friends Jane and Bob Walsh, and Barbara Rauch whose prayers and friendship supported me through the troubling times that almost derailed the completion of this degree.

I want to express my sincere gratitude to Professor Wallace Thies, my Dissertation Director, who did not give up on me; for without his guidance and support this achievement would not have been possible.

I want to thank the National Geospatial-Intelligence Agency for the financial support and full-time training opportunity. I extend heartfelt thanks to my management and colleagues for their encouragement and moral support. Their generous flexibility in work schedules, their professional comments, and attentive support made this process possible and certainly more bearable.

And finally, thanks to my beautiful Birman, Zawadi. She has supervised every computer keystroke, hissed at the printer whenever it jammed, slept on piles of books just to be near me, purred ferociously during every celebration of little successes, and soothed every late night tear.

DISCLAIMER

The views and opinions expressed in this dissertation are those of the author and do not reflect the official policy or position of the National Geospatial-Intelligence Agency, Department of Defense, or the United States Government.

Chapter I

Introduction

BACKGROUND AND STATEMENT OF THE PROBLEM

International politics is a competitive realm. One of the most powerful modern advantages in this competitive world is the ownership of independent and autonomous remote sensing satellites. Few have access to this venue for competition and those that do belong to a very exclusive group of states. What drives these states to expend scarce resources to develop and maintain an indigenous remote sensing capability when it appears that they can acquire much of the end product from other sources at a reasonable cost?

Kenneth Waltz, author of *Theory of International Politics*, theorized that states emulate the innovations, strategies and practices of those countries with the greatest capability and ingenuity. As Waltz explains, states will emulate the leader in an anarchic realm to attain the same capabilities that helped the leader attain or maintain its status. Waltz referred to this as a tendency toward sameness of the competitors. This research investigates whether Waltz's theory provides an explanation why some states choose to invest in an indigenous remote sensing capability.¹

The purpose of this research is to investigate if remote sensing capabilities are a venue of competition among modern states and one that they view as a potential path to global preeminence. If this is true, then we would expect to find states acquiring end-to-end remote sensing capabilities as a means to maintain or improve their position in the world order. We should also find that these states are willing to devote significant

¹ Kenneth Waltz, *Theory of International Politics* (New York: McGraw-Hill, Inc., 1979), 127-128.

resources in order to control this technology because they believe other successful states have used remote sensing technology as a means to acquire and maintain their preeminent position. States that own and operate remote sensing capabilities must take considerable risks and apply technological innovation to succeed.

States that pursue global preeminence often exhibit exceptional risk-taking and significant technological innovation. They also challenge the recognized leader in an area of expertise and leadership. Within contemporary political science, so-called Realist thinkers would say that these states are emulating the behavior of the states they view as successful in order to maintain or improve their position in the world order. Realists also point out that strategic interests lead states to try to gain or at least neutralize those areas that, if controlled by an adversary, could menace them.² Realist writers suggest that states will be reluctant to cede control of an important new technology to another state, even a friendly one, lest they find themselves permanently disadvantaged in an on-going contest for wealth, influence and even preeminence.

Yet realism, especially the defensive variant associated with scholars like Charles Glaser, also counsels states to be careful how they expend resources, in order to have those resources available when needed. Glaser suggests that states acquire military capabilities and resources up to but not above a level at which their deterrent capabilities are enhanced. Glaser also suggests that cooperative policies can be an important type of self-help and can reduce the need for excessive acquisition of military capabilities.³

² Robert Jervis, *System Effects: Complexity in Political and Social Life*, (Princeton New Jersey: Princeton University Press, 1997), 22.

³ Charles L. Glaser, "Realists as Optimists: Cooperation as Self-Help," in *Theories of War and Peace*. Michael E. Brown et al., eds. (Cambridge, Massachusetts: The MIT Press, 1998), 102-111.

A good example of this internal conflict within realist ranks is the politics of remote sensing capabilities. No state wants to be left behind, but on the other hand, why should states expend scarce resources acquiring the launch vehicles, satellites, and infrastructure needed to support a remote sensing program when much of the end product (photos, etc.) is already available on the internet for free, or can be purchased at a modest cost from commercial vendors.

John Lewis Gaddis noted that the “reconnaissance revolution” is a development that may rival the “nuclear revolution” in importance. The irony is the very technology that can deliver nuclear weapons anywhere on the face of the earth is also the technology that can help to significantly lower the possibility of a surprise attack. This knowledge about an adversary’s military capabilities may supplement the self-regulating characteristics of deterrence.⁴ These attributes make this capability very attractive for states, but beyond the economic and technical reach of most states.

Remote sensing technology provides states with the ability to evaluate others’ capabilities to a degree that is totally unprecedented in the history of relations between states. The states that employ this technology can assess others’ military and—to some degree—economic capabilities. It also has the effect of lessening the deception possible by a closed society in concealing its capabilities. This technology could be said to have the potential to stabilize the international system. Gaddis concluded that the tacit agreement between the Soviet Union and the United States to use reconnaissance

⁴ John Lewis Gaddis, “The Long Peace: Elements of Stability in the Postwar International System,” *International Security* 10, no. 4 (Spring, 1986): 123. <http://libraries.cua.edu> (accessed July 1, 2009).

satellites and other surveillance techniques to monitor compliance was an essential component of the arms control progress achieved by the two states. He also concluded that it would continue to be a critical element of future arms control efforts.⁵

Gaddis said that nations go to war if they assess that they have the power to prevail, but he also points out that their calculations are often wrong. There are two main reasons that their calculations are inaccurate. They fail to anticipate the costs and the nature of the war or they misjudge the intentions and the capabilities of their adversary. Remote sensing technology cannot improve a state's ability to discern the intentions of another state; however, it can significantly improve a state's ability to evaluate another's capabilities. One could argue that this technology could make a state more aggressive if it perceives that it could prevail over an adversary. On the other hand, states may avoid conflict if they perceive that their adversary is of no real military threat or that relative parity exists between them, and war would not be worth the costs.⁶

This raises the question of whether this technology actually makes a state more secure or if it increases the perception, both internally and externally, that it is more secure. Perhaps it is a little of both. States will always seek more information about their adversaries and any technology that will increase the quantity and quality of that information is valuable because of its real or perceived contribution to the state's security. The result is that the behavior of adversaries, and even allies, can be affected by the existence of this technology and the knowledge that the observing state may have an edge in the quest for information. If the additional information results in better decision-

⁵ Ibid., 124-125.

⁶ Ibid., 123-125.

making by the state that uses the technology, as well as by those observed, then the potential exists for greater security.

Most states that own remote sensing technology profess to employ this technology for peaceful purposes. It is difficult to argue that activities such as resource management and disaster management are anything other than positive pursuits. However, it would be naïve to assume that a state concerned about its security—and all states are concerned about security—would not employ every available means to protect itself. This is particularly true if these means are defensive rather than offensive and can be accomplished with some measure of privacy. However, we must assume all states that own remote sensing technology gather imagery intelligence of other states' military capabilities. The only real restrictions are those that are technically or self-imposed.

RESEARCH METHODOLOGY

The research method includes a survey and assessment of relevant literature, and incorporates six case studies. The approach relies on empirical evidence to investigate whether these six states employ remote sensing capabilities as a venue for competition because they believe that the United States' remote sensing capabilities have contributed to its hegemonic position in the anarchic international realm. If so, there should be indicators in three areas. First, laws and policies that support national objectives should address these states' remote sensing capabilities. This identifies which national objectives are served by the states' remote sensing capabilities. Second, support for these states' remote sensing programs should show a long-term commitment to maintain the

capabilities regardless of potential economic returns. This confirms the state has a serious, long-term commitment to maintaining a remote sensing program and indicates that potential economic benefits are not the most important justification for the state's remote sensing program. Finally, official statements should indicate that these states view their remote sensing capabilities as an important component of their national security. The United States clearly uses its remote sensing capabilities as a critical component of its national security strategy. If these states are indeed emulating the hegemon and competing with one another for great power status then it is reasonable to assume that they will employ remote sensing capabilities in a manner similar to that of the hegemon.

The literature surveyed includes primary source material such as official government announcements, testimony to national government bodies, national regulations and policies, United States (U.S.) government analyses, and United Nations (UN) information (e.g., space law, space agreements, etc.). It will also include secondary source material such as previous scholarly and commercial work on the illustrative cases and on the general topic. Other secondary source material includes data from the international press and non-governmental organizations.

Six cases for illustrative and comparative purposes were selected from the states that own and operate remote sensing satellites. The six states are France, Japan, India, Brazil, China, and Russia—each a regional power. Why were these specific states selected for this investigation? The proposal question identifies the most significant population limiter, which are those states with an indigenous remote sensing capability. Though the

number of states with indigenous remote sensing capabilities is extremely limited further refinement was necessary to identify a manageable research population. Additional inquiry revealed that the population of states with indigenous remote sensing capabilities contained two subgroups with a significant overlap: states with launch capability and the leading states in space and space-related activity. This refinement process resulted in a population including the United States and the six case states. The only state that was not selected and appeared in both subgroups was Israel. Israel's space program is somewhat narrowly focused making India, its closest contender, a better case because of its broader civil capabilities.⁷

The cases are grouped into three pairs allowing for comparison both within the pairs as well as across the pairs. The three pairings group the two states that currently have similar concerns, goals and status. In addition to the comparisons within and across the pairs, it is also necessary to acknowledge that each of these states compare themselves with the United States, the only superpower. The United States' preeminence in every domain of power, with the reach and capabilities to promote its interests in virtually every part of the world, make it the ultimate comparison for all states.⁸ For the purposes of this investigation, the characteristic these states aspire to emulate is the United States' preeminence in remote sensing technology.

⁷ National Aeronautics and Space Administration, U.S. Centennial of Flight Commission, "International Space Agencies." http://www.centennialofflight.gov/SPACEFLIGHT/space_agencies/SP45.htm (accessed July 27, 2009). Also: "Futron's 2009 Space Competitiveness Index: A Comparative Analysis of How Countries Invest In and Benefit from Space Industry," MilsatMagazine.com, September 2009. http://www.milsatmagazine.com/cgi-bin/display_article.cgi?number=875113067 (accessed December 15, 2009).

France and Japan, the first pair, are U.S. allies, and both are concerned about possible decline relative to recent arrivals like India and China. One would expect this pair to use their mature remote sensing programs to help maintain their current positions in the international system. In order to do this, they may need to use their remote sensing assets in different ways than their current programs allow. France is the United States' oldest ally and participates in many cooperative efforts, but it also engages in economic competition and sometimes differs politically with the United States.⁹ France has publicly stated that its Satellite Pour l'Observation de la Terre (SPOT), as is common with other French high-technology programs, is a strategic tool for sovereignty and therefore is supported regardless of its real or supposed commercial value.¹⁰ Japan, whose security is tied to the United States, is fundamental to regional stability in East Asia and seeks increasingly closer ties to the multilateral global institutions that made its post World War II prosperity possible.¹¹ When this research began Japan's remote sensing program was at a crossroads, but since that time Japan has enacted a Law of Space that enhances national security, supports Japanese industry, and promotes research and development.

⁸ Samuel P. Huntington, "The Lonely Superpower," *Foreign Affairs* 78, issue 2 (March/April 1999). http://homepages.stmartin.edu/Fac_Staff/rlangill/PLS%20300/The%20Lonely%20Superpower.html (accessed September 26, 2007).

⁹ Ngaire Woods, *Explaining International Relations Since 1945* (New York: Oxford University Press, 1996), 140-141 & 149.

¹⁰ Isabelle Sourbes-Verger and Xavier Pasco, "The French Pioneering Approach to Global Transparency," *Commercial Observation Satellites: At the Leading Edge of Global Transparency*, eds. John C. Baker, Kevin O'Connell and Ray A. Williamson (Washington, DC: Rand and the American Society of Photogrammetry and Remote Sensing, 2001), 187.

¹¹ Charles W. Kegley, Jr., *World Politics: Trend and Transformation* (Belmont, CA: Cengage Learning, 2009), 122-123.

France and Japan are mature states, politically and economically. They have been widely viewed as major powers for over a century. However, maintaining their positions is becoming more difficult as new international arrivals gain capability and prominence. Their remote sensing programs are also mature, and both governments continue to maintain their space programs in spite of financial challenges. In these well-educated, technical, modern societies public support for the space programs is the norm. In 2008, France and Japan made remarkably similar decisions. The French President announced the release of a White Paper on Defense and the Japanese Prime Minister announced the enactment of a Basic Law on Space. Both documents outlined national security concerns and the critical role of national space assets in the defense of the country. Also, both strategies authorized the use of space for military activities to support national security objectives. Implementation of these new strategies was accompanied by organizational changes in both governments. France created a Defense and National Security Council composed of the President, Prime Minister, and Ministers of Foreign Affairs, Interior, Defense, Economy and Budget; Japan created the Space Strategic Headquarters in the Cabinet Level Office to facilitate institutional arrangements.

France and Japan are different in many ways. France does not fear military action by its closest neighbors, while Japan sits in the middle of a region that requires its leadership to be ever wary of other states' actions. However, in 2008 France's and Japan's decisions, rationale, and execution of national security strategy regarding space were very similar. France and Japan are not so much concerned about the militarization of space because that has already happened, but they are concerned about the

weaponization of space. The rapidly increasing technical capabilities of new arrivals on the international scene are also reason for concern. In an anarchic system, France and Japan must prepare to protect themselves and the best way to do that is to emulate the global hegemon namely, the United States. It is also important to note that in both cases, the person holding the highest office made the announcement regarding a revised space program and the announcement itself was very straightforward. National defense and security is the issue; there was no attempt to disguise the intent in a more “acceptable” way.

Both of these states benefit from their relationship with the United States. They may challenge or disagree with the hegemon on those issues that are particularly important to them, but overall they cooperate with the U.S. They choose to emulate the hegemon’s preeminence in this area of expertise because they recognize this as a way to neutralize threats from an adversary.

Brazil and India, the second pair, are in the upper ranks of the regional powers and are now pressing hard for admission into the ranks of the great powers.¹² One would expect this pair to aggressively employ their remote sensing assets to minimize their vulnerabilities as they improve their international standing. Brazil has a strong state structure capable of promoting economic development and effective at bargaining with foreign capitals. Brazil has also defined its own international policy that though friendly with the United States maintains its distance from American foreign policy on some

¹² Barry Buzan, “The Security Dynamics of a 1 + 4 World,” *Globalization, Security, and the Nation State, Paradigms in Transition*, eds. Ersel Aydinli and James N. Rosenau (Albany, New York: State University of New York Press, 2005), 189.

important issues.¹³ Brazil's remote sensing satellites are used for environmental monitoring and urban planning, and are seriously being considered for military purposes.¹⁴ Recently, a Brazilian Defense Ministry spokesman characterized Brazil's current military buildup as a defensive measure to deter nations that in the future may want Brazil's vast resources. He said Brazil's defensive measures include better surveillance, weapons as well as the means to deploy them and restarting Brazil's unmanned space program, on hold since 2003, is an integral part of the plan. India is a regional power that shares its region with two other nuclear-armed states, Pakistan and China. It also has the potential to be a major ally to the United States as well as a fellow democratic nation particularly since the United States is concerned about nuclear proliferation and terrorism in this region.¹⁵ India is an important remote sensing state and says that its remote sensing program is for the socio-economic benefit of the country consistent with security concerns.¹⁶

Brazil and India are important powers in their parts of the world, but they are no longer satisfied with remaining "below the radar;" and they both look to the United States for the blueprint on how to gain international status. In both cases, they are preoccupied with recognition as a modern state—in this case India more so than Brazil. Of course, India's image is a bit more tarnished because of the crushing poverty of its lower social classes. India frequently defends its expenditures on modern technology, especially

¹³ Woods, 169.

¹⁴ James Martin Center for Nonproliferation Studies, "Brazil" and "Brazil: Military Programs." <http://cns.miis.edu/research/space/brazil> (accessed December 12, 2008).

¹⁵ Buzan, 194-195.

¹⁶ Indian Space Research Organization (ISRO), "Organization." <http://www.isro.org/rep2008/citizens.htm#> (accessed January 13, 2009).

military-related technology, when challenged about its inability to care for its large poverty-stricken population. In its defense, India only has to point to its neighbors, Pakistan and China, to justify its acquisition of high-tech military capabilities. Brazil, on the other hand, has no real threats on its borders. What it does have is an immense territory with fragile, valuable resources to protect. The only practical way to do this is with high-tech capabilities, particularly remote sensing assets. The area where these different perspectives show most clearly is in the approach to data dissemination that these two states take. India is very concerned about dissemination control and even takes issue with commercial companies like Google Earth, while Brazil has made not only its remote sensing images available free on the internet, but it has also made the associated software available. It will be interesting to see if Brazil continues its current liberal data dissemination approach as the nation increases the “defensive” application of its remote sensing assets to counter what it perceives as a growing vulnerability to foreign challengers for its vast resources.

Both Brazil and India are committed to retaining their remote sensing assets and, in the face of financial challenges, have made organizational changes and reprioritized their space program plans in order to maintain these assets. In some ways, India has farther to go than Brazil because India has the additional challenge of capacity building in a country where literacy is hampered by the lack of compulsory education and a caste system that stifles the potential of the “best and brightest” if they are from the wrong social group. The official statements about their remote sensing assets can be found on their government websites, usually the national space center websites, and both states

claim that these assets are essential to their modernization and the welfare of their citizens. Both states tend to downplay the military capabilities of these dual-use assets, but it is clear that the military is not only involved but holds significant decision-making responsibilities. Both states have national remote sensing policies that they are strengthening, but they currently have no specific remote sensing legislation.

These states choose to emulate the hegemon because they hope to improve their status and be widely recognized as major powers in the international realm. Both Brazil and India have benefited from cooperating with the United States. Both have also had periods of political conflict with the U.S., usually about military issues. Brazil's military administrations and India's nuclear program are just two examples of the significant issues of disagreement. However, neither of these countries exhibits a desire to challenge the United States for preeminence or expects to achieve parity with the United States on multiple fronts. However, both are working diligently to attain the highest level of remote sensing expertise possible, India primarily for security, and Brazil primarily for resource management.

China and Russia, the third pair, are potential competitors for preeminence. This pair can be expected to use their remote sensing assets to improve their current standing in the world order and reclaim some of their historical prestige. China, the third largest economy in the world, is Brazil's partner in remote sensing.¹⁷ China has implemented an

¹⁷ James Martin Center for Nonproliferation Studies, "China: Military Programs." <http://cns.miis.edu/research/space/china/mil.htm> (accessed January 19, 2009) and Central Intelligence Agency, "The World Fact Book," <https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html> (accessed March 9, 2010). [Note: In 2009, China became the second-largest economy in the world after the U.S. on purchasing power basis when measured on a purchasing power parity (PPP) basis that adjusts for price differences.]

aggressive military modernization program while insisting that it seeks peaceful relations with all great powers. However, it has condemned the United States for pursuing “hegemonic domination of the world” while the U.S. has supported integration of China into the global economic system. The two countries cooperate on many levels though relations are sometimes complicated by events in Taiwan and Hong Kong.¹⁸ Russia has weathered numerous challenges during its post-Soviet years and has taken important steps to be recognized as a great power once again. And as in the past American dominance, power and policy remain the most important challenge.¹⁹ Russia has a long heritage in earth observation and a broad variety of sensing platforms and instruments.²⁰

China and Russia are both undergoing complex transitions politically, socially, and economically. Both hope to be great powers and they recognize that it was the capitalistic United States that became the hegemon not them. They have abandoned their communist plans and socialistic ways in exchange for as much of the western hegemon’s strategy as they can tolerate. Both China and Russia recognize that they must rise to the technical level of the United States if they are to challenge the United States.

The government of China publicly uses the United States space program as its standard for modernity. Their ambitious space program, announced in the White Paper of 2006, duplicates as much of the United States space program as is possible.²¹ China even established a space agency modeled on the National Aeronautics and Space Administration (NASA) and has begun the process of developing space legislation while,

¹⁸ Kegley, 119–121.

¹⁹ Ibid., 123–124.

²⁰ George J. Tahu, “*Russian Remote Sensing Programs and Policies*,” in Baker, 165.

²¹ Chinese Government’s Official Web Portal, “White Paper Full Text: China’s Space Activities in 2006,” Information Office of China’s State Council, October, 12, 2006.

in the interim, relying on basic laws covering science and technology, and national policy on space and remote sensing.

Russia is the original space faring nation and has held on tightly to its space program in spite of major financial challenges. It refused to lose the assets that helped to make its predecessor a great power in a bi-polar world. However during the tumultuous period following the breakup of the Soviet Union, Russia has not been able to maintain its space assets as they were during the Soviet era. Russia recognizes that in order to challenge the United States that must change. Russia already had the government structure to support a space program, but it needed an infusion of capital, so the establishment of a company that could provide images and services for a fee helped to offset some costs of maintaining the assets. The president and prime minister frequently refer to the space program or specific components of it. There is broad federal legislation that covers remote sensing and legislation on space activities.

Both of these states, in their previous incarnations, had hopes of being the sole leader of the world. Both have benefited from cooperation with the United States in recent years, but they have also challenged the U.S. on many issues. Today, China is the only one of the two that has a realistic expectation of successfully challenging the United States on multiple fronts. China is emulating the hegemon with the goal of eventually succeeding, though it recognizes that the journey may be lengthy. China views the United States' space program as the standard for modernity so its pursuit of remote sensing expertise is a logical goal. Russia, on the other hand, is emulating the hegemon in hopes of maintaining its current status. Though Russia would like to regain parity with

the United States its internal problems make that unlikely on most fronts, but its own expertise in space can be enhanced by following the U.S. lead.

India and China publicly and proudly hold up their space programs as evidence of development and modernization. Both are investing heavily in science and technology as their entry into the international leaders' arena; and specifically view investments in space programs as the elite portion of scientific achievements possible by an international leader.

In all six cases, states are committed to continuing space programs. Long range plans include continuing development and increased use of space assets. Most of these states are maintaining or increasing space related budgets over the long-term. Brazil and Russia face budgetary constraints that do not allow for budgetary increases and, in some areas, decreases are actually necessary. However, these decreases or maintenance at current levels are implemented in such a way as to protect quality of operations and mitigate risk. All of the states seek to capitalize on opportunities for revenue from their space assets, but they do not do so at the risk of their security or the risk of losing technical preeminence relative to another state.

Remote sensing satellites are used to support a variety of efforts benefiting humankind. However, this research is focused on the use of these assets in less altruistic ways, which also serve to highlight the anarchic nature of the international environment. There is no question that the United States is the hegemon in the current unipolar world. States that aspire to retain or gain great power status look to the United States as an example. These states cannot, and do not want to, emulate every facet of the United

States assets or behavior, so they must choose how they will emulate the hegemon. Throughout history, technological advances have helped to make powerful states more powerful and have been coveted by less powerful states. Space based assets are considered the pinnacle of technological and scientific achievement, and the United States is the leader in this area of expertise. Therefore it is not surprising that states desiring to maintain their great power status or to achieve great power status will look to the United States for the blueprint on how to develop and operate a space program. Remote sensing is a logical entry point into the “space club.” Remote sensing provides states with dual-use capabilities and the opportunity to research and develop more specialized space-based capabilities. Specifically it allows states to observe their adversaries and adjust their own military capabilities to counter these adversaries. This capability significantly reduces the adversaries’ ability to limit information about their military forces and in turn may reduce the observing states vulnerability. Ultimately, aspiring states want the same sophisticated imagery intelligence capabilities that the United States owns.

BACKGROUND INFORMATION ON REMOTE SENSING

Humankind's foray into space was not born out of beneficent research. It was a bonus achievement resulting from weapons development and the first remote sensing satellite, specifically a photoreconnaissance model, was developed to monitor an enemy's capabilities. The Union of Soviet Socialist Republics (USSR) was the first space-faring country. It was the first country to launch and orbit an artificial satellite, Sputnik (October 4, 1957); launch and orbit a live passenger, the dog Laika (November 3, 1957); and launch and orbit a human, the cosmonaut Yuri Gagarin (April 12, 1961). This legacy did not start with a desire to pursue scientific research that would help the Soviet Union manage its natural resources, benefit humankind, or any of the other laudable reasons given today by states when they begin a space program. The Soviet space program was an "off-shoot" of its attempts to develop an intercontinental-range ballistic missile that could carry a nuclear warhead. The R-7 launch vehicle used to accomplish all of these 'firsts' in space was in fact an ICBM. It was designed, developed, and tested as an ICBM. Launching satellites and living passengers into space was a side-benefit. The first successful test of the R-7 was on August 21, 1957 when the missile carried a dummy warhead 3,500 miles and a second successful test occurred on September 7, 1957. Soviet official statements following the test described the R-7 as a "super long-distance intercontinental multistage ballistic rocket." It appeared that the Soviet Union was quickly achieving nuclear superiority.²²

²² Gaddis, 124–125. Also: The Central Intelligence Agency, "The Dawn of the Space Age." <https://www.cia.gov/news-information/featured-story-archive/2007-featured-story-archive/the-dawn-of-the-space-age.html> (accessed July 27, 2009).

In March 1957, a National Intelligence Estimate (NIE) warned that the Soviet guided missile program was extensive with high priority government support and sufficient resources to develop advanced types of guided missile systems in all categories. When the Soviets demonstrated their expertise and the aggressive pace of their program with two successful R-7 ICBM tests plus two successful space launches in 1957, the United States was both intrigued and spurred to action. During this same time the United States was pursuing its own ICBM program, but the American efforts were a spectacular failure. By late 1957, a Special National Intelligence Estimate was published that predicted the USSR could have as many as 100 operational ICBMs within three years. In contrast, the United States had not deployed a single missile. Determination to balance the Soviet nuclear threat set the United States on an accelerated pace toward a successful missile program.²³

The United States mobilized its development effort and also began to fly U-2 high altitude reconnaissance flights to find Soviet ICBM complexes. On August 10, 1960 the United States launched CORONA, the first photoreconnaissance satellite, specifically to monitor Soviet ICBM developments and soon perfected its own ICBM. The Arms Race and the Space Race were on and they were forever linked.²⁴

The launch of Sputnik in 1957 caught the imagination of the world. It is fair to say that every country wanted to be space-capable at that moment. Since 1957, dozens of countries have started their own space programs using government-sponsored space agencies. However like every other technological business, the business of space has an

²³ Ibid.

²⁴ Ibid.

end-to-end process and only those who master the entire cycle can independently take advantage of all it has to offer. Posen refers to space as one of the “commons” and he points out that the United States command of space allows it to get considerably more use out of space than others, it can credibly threaten to deny other states full use of space and other states would lose a military contest if they tried to deny this area to the United States. Command of space allows the United States to study its adversaries and then tailor U.S. capabilities to fight those adversaries.²⁵

One of the most difficult components to master in the space business is launch capability. This is where the space pack is divided, because there are far fewer countries or international agencies that have developed the capability to launch their own satellites and even fewer that have the proficiency to launch their own spacecraft. Successful launch capabilities are evidence of a very mature and advanced space industry. The countries and international organizations that have achieved this status are Russia, the United States, France, China, Japan, the United Kingdom, the European Space Agency (ESA), India, and Israel; and Brazil is close to having a launch capability. In 1971 and 1975, the United Kingdom and France (respectively) gave up their indigenous launch capacity and dedicated their launch expertise to their activities in the ESA. However, even within the group of launch capable states they are not all equal. The United States excels at research and development, systems integration, management of large-scale industrial projects, the development of new technologies and tactics and the most highly

²⁵ Barry R. Posen, “Command of the Commons: The Military Foundation of U.S. Hegemony,” *International Security* 28, no. 1 (Summer 2003), 7–8, & 43. <http://libraries.cua.edu> (accessed July 1, 2009). Also: The Central Intelligence Agency. “The Dawn of the Space Age.”

skilled and highly trained personnel in the world that are essential to attain and maintain command of the “space common.”²⁶

Remote sensing, like other dual use technologies, is not used solely for security purposes. Ann Florini and Yahya Dehqanzada considered the security as well as humanitarian and environmental uses for remote sensing technology. They concluded that both government and nonstate actors need this technology to deal with global problems. Remote sensing satellites are used to monitor the land surface, the oceans, and the atmosphere. In layman’s terms remote sensing satellites “take pictures” and have become routine and essential tools. Their unique characteristics make them particularly suited to a number of applications. First of all, remote sensing satellites cover the whole globe making them important for the study of large-scale phenomena as well as cost effective for monitoring remote and dangerous areas. Second, remote sensing satellites repeatedly view the same area over long periods of time making it possible to detect changes and identify trends whether natural or manmade. Third, remote sensing satellites can rapidly provide data and information before, during, and after events. Fourth, all data collected by a particular sensor on a particular satellite is collected in the same way which means it is consistent and subtle changes are easier to detect. Fifth, remote sensing satellites and their associated global positioning systems have a high degree of accuracy which means the observer knows precisely where the viewed area is located. Last, and perhaps surprisingly, is that when remote sensing satellites are used for a large number of

²⁶ Posen, 10. Also: National Aeronautics and Space Administration, U.S. Centennial of Flight Commission, “International Space Agencies.”

activities over an extended period of time, the benefits it provides can actually offset some of the costs of launching and operating the satellite. All five of these features apply to remote sensing satellites that can be used either for security or non-security purposes.²⁷

The United Nations has been instrumental in providing member states with space-related guidance, education, and venues for cooperation. For example, Finnemore claims that the United Nations' conducted a campaign, beginning in the early 1960s, to teach states they should fulfill their role as a modern state with regard to science missions. As one of the first steps, the UN encouraged states to adopt a preferred form for establishing science bureaucracy within their borders. Interestingly, the notion that the state has an obligation regarding science policy and the form promoted by the UN has their origins in the United States and Great Britain. This form has two key features: the policy making body cannot be a research organization and the science policy body must have access to the highest levels of government. This form has become the global norm and it is resident, with some modifications, in the cases for this research.²⁸

Specifically with regard to space activities, the United Nations provides states and organizations with a number of venues for cooperation in the peaceful uses of outer space. The United Nations Office for Outer Space Affairs (UNOOSA) is the office

²⁷ Ann M. Florini and Yahya A. Dehqanzada, "No More Secrets? Policy Implications of Commercial Remote Sensing Satellites," Washington, D.C: Carnegie Endowment for International Peace, 1999. <http://www.ceip.org/files/Publications/NoMoreSecrets.asp?from=pubtitle> (accessed January 26, 2003). Also: UN Office for Outer Space Affairs (OOSA), "Space Solutions for the World's Problems, November 2006." <http://www.uncosa.unvienna.org/uncosa/en/index.html> (accessed March 15, 2009).

²⁸ Martha Finnemore, "International Organizations as Teachers of Norms: The United Nations Educational, Scientific, and Cultural Organization and Science Policy," *International Organization* 47, no. 4 (Autumn, 1993), 566, 569–570, & 586–586.

responsible for promoting international cooperation.²⁹ UNOOSA follows legal, scientific and technical developments relating to space activities, technology and applications in order to provide technical information and advice to member states, international organizations and other United Nations offices.³⁰

The United Nations is also involved in two space related activities that are more “hands-on” and these are the registration of objects and the assignment of geostationary orbits. The United Nations’ Convention on Registration of Objects Launched into Outer Space was enacted in 1976 and a register of launchings was created that contains information from member states and intergovernmental organizations that are parties to the Convention. As of March 2010, fifty-four states have ratified the Convention, twenty-five have signed it and two international intergovernmental organizations (the European Space Agency and the European Organization for the Exploration of Meteorological Satellites) have declared their acceptance of the rights and obligations of the Convention. Of the states studied here, France and Russia are signatories and the other states have ratified the Convention. The Committee requests that member states conducting space launches provide the UN with the following information: the name of the launching State; an appropriate designator of the space object or its registration number; data and territory or location of launch; basic orbital parameters; and general function of the space object.³¹

²⁹ United Nations, “Outer Space—resources in the United Nations system,” United Nations, <http://www.un.org/issues/m-ospace.html> (accessed March 15, 2009).

³⁰ United Nations, “United Nations Office for Outer Space Affairs,” <http://www.oosa.unvienna.org/oosa/en/OOSA/index.html> (accessed March 15, 2009).

³¹ UN Office for Outer Space Affairs, “Convention on Registration of Objects Launched into Outer Space.” <http://www.oosa.unvienna.org/oosa/en/SORRegister/index.html> (accessed March 15, 2009) and

There are two factors that determine the orbit a satellite will occupy. The first factor is technical and determines the type of orbit the satellite must occupy. The second factor is the state's desire, which is only limited by whether or not the desired location is currently occupied and whether or not the satellite needs a geostationary orbit, which is the one type of orbit allocated by a UN agency. The capability and the objective of the sensor(s) they carry determine the type of orbit the satellite must occupy. Weather and communications satellites typically occupy geostationary orbits at high altitudes (approximately 22,300 miles above the earth).³² A geostationary orbit allows the satellite to collect information continuously over specific areas by always keeping the satellite in the same position with respect to the rotating Earth.³³ Geostationary orbits are in the equatorial plane, which is a narrow ring above the equator and because of the required two degrees of separation between satellites to avoid radio interference there are only 180 slots available. Multiple satellites may occupy the same slot if they use different frequencies; however these slots are still limited.³⁴ The International

United Nations. "Status: Chapter XXIV, Outer Space, 1. Convention on registration of objects launched into outer space," http://treaties.un.org/Pages/ViewDetails.aspx?src=Treaty&mtdsp_no=XXIV-1&chapter=24&lang=en (accessed March 10, 2010). [Since 1962 and prior to the Convention, the UN Secretariat maintained a registry of launchings in accordance with General Assembly resolution 1721 B (XVI).] [Basic orbital parameters include nodal period (the time between two successive northbound crossings of the equator—usually in minutes); inclination (inclination of the orbit—polar orbit is 90 degrees and equatorial orbit is 0 degrees); apogee (highest altitude above the Earth's surface—in kilometers); and perigee (lowest altitude above the Earth's surface—in kilometers).] [In June 1997, the Secretary-General received communication regarding Hong Kong. China notified the UN that upon resuming sovereignty over Hong Kong the Convention would also apply to the Hong Kong Special Administrative Region.]

³² Canada Centre for Remote Sensing, "Tutorial: Fundamentals of Remote Sensing Satellites and Sensors, Satellite Characteristics: Orbits and Swaths."

http://www.ccrs.nrcan.gc.ca/resource/tutor/fundam/chaper2/02_e.php (accessed March 13, 2009).

³³ National Aeronautics and Space Administration, "Satellite Orbits." <http://asd-www.larc.nasa.gov/SCOOL/orbits.html> (accessed March 13, 2009).

³⁴ Cecil Adams, "Satellite Dishing: Is there anyone keeping track of crashes in space?" Washington City Paper, Dec 25–31, 2008 <http://www.washingtoncitypaper.com/printerpage.php?id=36628> (accessed March 13, 2009).

Telecommunications Union (ITU), a UN agency, is mandated by its Constitution, which has treaty status, to allocate spectrum and register frequency assignments, orbital positions and other parameters for satellites, making the ITU the arbitrator for allocating these slots.³⁵ Most remote sensing satellites operate in near-polar orbits, which may also be sun-synchronous and they generally operate at lower altitudes than satellites in geostationary orbits.³⁶ Inclined orbits fall between geostationary and polar orbits, and orbit selection is generally determined so as to observe the region on earth that is of the most interest. However, there is no international regulation on low-earth orbits (usually less than 1,200 miles above the earth) so the decisions about where to place a satellite are up to the individual space agencies of each state.³⁷

In this document, there are a number of concepts and terms related to remote sensing and space technologies that can be interpreted different ways. Appendix A contains descriptions that explain how these concepts and terms are used in this research.

HISTORY OF REMOTE SENSING POLICY

According to Professor Joanne Gabrynowicz, Director of the National Center for Remote Sensing, Air and Space Law, there have been three eras of remote sensing law and policy with possibly a fourth era emerging. The first era was from 1972 to 1983, the second was from 1984 to 1992, and the third from 1992 to circa 2004.³⁸ Of note is the

³⁵ International Telecommunication Union, “About ITU: Radiocommunication Sector.” and “About ITU: Legal Framework.” <http://www.itu.int/net/about/index.aspx> (accessed March 15, 2009).

³⁶ Canada Centre for Remote Sensing.

³⁷ Adams.

³⁸ Joanne Irene Gabrynowicz, *The Land Remote Sensing Laws and Policies of National Governments: A Global Survey*. Prepared for U.S. Department of Commerce/National Oceanic and Atmospheric Administration’s Satellite and Information Service Commercial Remote Sensing Licensing Program

fact that by 1972, or the beginning of the first era, the United States and the Soviet Union were monitoring each other's territory using reconnaissance satellites. The use of these satellites and a tacit bargain to refrain from interference, referred to as "national technical means" in Article XII, was codified in the Strategic Arms Limitations Treaty I.

The first era began with the launch of the United States' Earth Resources Satellite 1, later renamed Landsat, which was government owned. Landsat was designed as a space-based moderate-resolution satellite to provide remote sensing data for use in agriculture, geology, forestry, regional planning, education, mapping and global change research. Landsat data also proved to be extremely useful for emergency response and disaster relief. Worldwide users included government, commercial, industrial, civilian, military and educational communities.³⁹ At this time, the United States national policy was the only policy and there was no formal law. The policy was one of nondiscriminatory access so all data was available to anyone requesting it. The only stipulation was that the recipient must also make the data available on a nondiscriminatory basis. This policy was based on the Cold War foreign policy approach of influencing allies and nonaligned states by demonstrating technological superiority and encouraging them to use the data.⁴⁰

During this first era, the United States, in particular, did everything possible to develop a customer base for remote sensing data. Images and data tapes were provided free of cost to scientists worldwide and other users could purchase data at the cost of

(University of Mississippi School of Law, Mississippi: The National Center for Remote Sensing, Air, and Space Law, 2007), 5–6.

³⁹ United States Geological Survey, "Project Descriptions: Landsat and Landsat Data Continuity (LDCM) Projects," http://landsat.usgs.gov/about_project_descriptions.php (accessed January 15, 2010).

⁴⁰ Ibid.

reproduction. Governments, including those without remote sensing capabilities were encouraged to join the Landsat team by establishing data receiving ground stations within their borders. Of course, at this time Landsat was owned by the United States government so giving away data and allowing other governments to “free-ride” did not negatively affect commercial interests.⁴¹

The second era began with the attempted commercialization of the United States Landsat system, the advent of the French Satellite Probatoire d’Observation de la Terre known as SPOT 1, and India’s Indian Remote Sensing Satellite, the IRS-1A. In 1984, the United States passed The Land Remote Sensing Commercialization Act, its first Federal remote sensing statute. At this time, policies in both the United States and France were driven by the desire to commercialize remote sensing. India also made remote sensing data commercially available on the international level, while stressing socio-economic development at the national level. A government-private team operated the United States satellites, but governments were the sole operators of the French and Indian satellites. However, all three states employed the nondiscriminatory access policy in some form and in the United States, it was incorporated into the Federal remote sensing statute. All three states funded their satellites through substantial subsidies that in effect created a quasi-private environment. The intended user community was the commercial market, but, in fact, governments continued to be the largest users of remotely sensed data.⁴²

⁴¹ M.J. Peterson, “Diverging Orbits: Situation Definitions in Creation of Regimes for Broadcast and Remote Sensing Satellites,” *American Political Science Review* 98, no. 2 (May 2004), 282-283.

⁴² Gabrynowicz, 6.

Also during this second era, more countries were interested in acquiring and using remote sensing data. In fact, some Third World countries had become proficient enough with remote sensing data to offer analytical training courses for nationals of neighboring countries. NASA's Landsat Station Operators Group offered users a forum for active dialogue and its participants included ground station owners as well as Landsat system designers and administrators. The users' community had grown rapidly and in addition to forums such as these, the community was also served by a number of professional journals that linked users around the world.⁴³

The third era began with the United States' second Federal remote sensing statute—the Land Remote Sensing Policy Act of 1992. This Act returned the Landsat system to the public sector, amended the law as it applied to private systems, and declassified high-resolution satellite technology making it available for commercial and environmental applications. During this era a number of states entered the remote sensing arena with space-based systems and the operators were both private and government entities. Each state's policies and laws were driven by commercial and environmental policies, and all states continued to claim they practiced some form of nondiscriminatory access to their data. The United States once again incorporated these practices into its amended remote sensing statute and the policy was included in a number of multilateral and bilateral agreements. The primary data users continued to be government entities that used the data for national security and environmental purposes.⁴⁴

⁴³ Peterson, 286.

⁴⁴ Gabrynowicz, 6.

A new era began to emerge around 2004, when a number of events occurred that collectively caused—and are still causing—shifts in the remote sensing legal and policy landscape. These events included the conclusion of the *Landsat Data Continuity Mission* competitive process in the United States; activation of the *Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters*; growing interest in remote sensing satellite constellations; small satellite technology; and developing nations launching and operating remote sensing satellites or planning to do so. These events and others continued to focus on expanding the user base while operating within growing national security restrictions.⁴⁵

Another important aspect about the current era are the legal rights of the civilian companies that own remote sensing satellites and supply much of the data available today. Unlike the early days of remote sensing when governments were trying to develop interest in remote sensing and gave away data for free or for the cost of reproduction, these companies do not give away data. Even though their partners include governments, these companies do not have free-riders and their data is covered by licensing agreements.

⁴⁵ Ibid., 6-7.

POLITICAL ROLE OF REMOTE SENSING CAPABILITIES

Florini and Dehqanzada in *No More Secrets? Policy Implications of Commercial Remote Sensing Satellites* introduce their topic with a statement about the appeal, benefits and costs of remote sensing.

Ever since the earliest satellites and astronauts started taking pictures of the Earth from space nearly four decades ago, those images have inspired excitement, introspection, and, often, fear. Like all information, satellite imagery is in itself neutral. But satellite imagery is a particularly powerful sort of information, showing both comprehensive vistas and surprising detail. Its benefits can be immense—but so can its costs. The same images that remind us that we all share a fragile planet also enable those who have the images to more accurately aim their weapons at adversaries near and far.⁴⁶

This research focuses on “those who have the images” or more accurately not just those who possess the images but those who own the capability to take the images. Specifically, this research focuses on six members of that exclusive group. Why do they choose to own their own remote sensing satellites? Waltz’s *Theory of International Politics* provides an explanation. Each of these states is a regional power in its own right and all of them look to the United States, the only superpower and the acknowledged hegemon, for the standards for which they should strive if they, too, hope to be a great power. The United States is clearly the leader in space activities, including remote sensing technology.

Are these six states exhibiting a “tendency toward sameness” with respect to remote sensing capabilities because they believe the United States’ advantage in this area contributes to its Superpower status? Political Realists would answer yes. Realists

⁴⁶ Florini and Dehqanzada, “No More Secrets?”

thinkers would say that these six states are emulating capabilities that they believe helped the United States achieve its current status. Most states, as well as the United Nations, consider remote sensing satellites to be routine and essential tools. However, most states cannot afford to own their own satellites. They must rely on other sources for the images that these essential tools can provide.

States can obtain great quantities of imagery and imagery products from a variety of sources and those products can be used to accomplish many missions. States can acquire no-cost data from public databases and the utility of the acquired information will depend on the data itself, and the state's ability to interpret it and convert it into a usable product. Commercial vendors can quickly and discreetly fill most requests with minimally processed images or valued-added products based on the customers' specific requirements. Data from these sources can be used for many missions such as resource management and disaster preparedness on the civil side, and general support information on the military side. It is true that states, including the United States, purchase large quantities of imagery and imagery products from commercial vendors to support civil and military missions. Some states have opened their historical archives to other states as well as the public, while other archives are only available to predetermined groups based on commercial licensing agreements. Some states also have agreements with each other to share information, including imagery and imagery products. States that share imagery with each other do so carefully and though the state receiving information cannot control the frequency, currency, or accuracy of the product, it still comes without the burden of supporting an indigenous capability.

So the puzzle is why do some states expend scarce resources to develop and maintain an indigenous remote sensing capability when it appears that they can acquire much of the end product from other sources at a reasonable cost? There are technical and political reasons for this type of investment. States that own advanced weapons and space systems have imagery needs that exceed those of most states. Imagery and imagery products from public databases and commercial vendors are not suitable to meet all of the technical requirements necessary to support advanced weapon and space systems. The best way to meet the very specific and oftentimes unique imagery information and product requirements of those systems may be an indigenous remote sensing capability. For example, the type and accuracy of geospatial information required to create geospatial products and data bases that support intercontinental-range ballistic missile (ICBM) targeting is very different than that required to create a military map for a beach landing.

In addition, indigenous remote sensing capabilities can acquire imagery on demand and minimize the risk of mission or technical information being compromised. Indigenous remote sensing capabilities also provide their owners with complete control constrained only by technical limitations and the rules they choose to follow when collecting information. The United States, France, Russia, China, and India are countries that can justify their indigenous remote sensing capability based on technical needs. It can be characterized as part of the cost of doing business when one owns other advanced technologies that require precise, specific, and unique geospatial information. However,

this does not mean that these states have only technical reasons for such investments; the political advantages may run a very close second.

Other countries have less obvious technical reasons for investing scarce resources in developing and maintaining an indigenous remote sensing capability. For these countries, it appears that most of their imaging needs could be met by externally available sources and it is far less clear why they believe the expenditures are worth the benefits. For these countries, such as Japan and Brazil, political reasons seem to be the driving force. They appear to be searching for both security and prestige. These countries want to maintain, in the case of Japan, and acquire, in the case of Brazil, an important global position. They are following policies of prestige and trying to solidify international recognition as major powers. Both countries want to show the rest of the world—especially the primary global actors—that they deserve respect and should be consulted on global issues. Internally, it is important for any government to convince the citizenry that the government is providing for their security as well as protecting the nation's global image. The internal perception can mean the difference in incumbents being re-elected or losing to the opposition. A way to do that is to acquire the same type of capabilities that the great powers own. If the capability can be leveraged to recover some of the investment costs, then it is more acceptable from an economic perspective. Of course, Brazil has deliberately incorporated a commercial aspect into its decision-making about its indigenous capability. Some of Brazil's reasoning is indeed economic, however it is equally important that the commercial aspects of its remote sensing business provide good cover for the potential military side of the capability. Japan, whose security

situation is far more precarious than Brazil's, is less concerned with recovering its investment or pretending to operate only a civil space program.

Much of the previous political science research about remote sensing capabilities has focused on the globalization aspects as well as the dual-use nature of the technology. Remote sensing has not been explored as an area of competition among states in the same way that the manned space program and arms races have been explored as venues of competition. However, there is value in moving the study of remote sensing beyond current boundaries because it is an essential component of most states' resource management tools and for many an essential component of their security capabilities. Though it is still an exclusive club, the number of space faring states continues to grow and most of them are not looking outward into the stars, but earthward. By studying states that currently own and operate remote sensing satellites, we may learn more about how they view the international environment and their place in it as compared to other states.

Also, it is not enough to study just the weapon systems that states own. We must also look at the expertise with which those assets are used. Without question, the U.S. has overwhelming nuclear superiority, the world's dominant air force, the only truly blue-water navy, and a unique capability to project power around the globe. The United States not only leads the world in the size of its military capabilities, it also leads the world in exploiting the military application of advanced communications and information technology. It has demonstrated an unrivaled ability to coordinate and process information that allows the U.S. to control the battle space with extraordinary precision,

oftentimes from great distances. This qualitative edge has contributed to the United States preeminence in all components of national power.⁴⁷ The importance of information technology expertise, such as remote sensing, is a key component of the United States' qualitative edge. The importance of this qualitative advantage has not gone unnoticed by states hoping to improve their own position in the world order. Qualitative expertise is not limited solely by size or other capabilities; it can enhance the capabilities one already possesses.

Though there is general agreement that the current international environment is unipolar, there is disagreement about whether the current unipolar system is an example of a recurring geopolitical movement or a unique historical moment, and whether unipolarity encourages states to cooperate (bandwagon) or compete (balance) with the hegemon. The current international system emerged after the collapse of the Soviet Union when the bipolar system gave way to a unipolar system. Some of the disagreements about the uniqueness of this unipolar system focus on the United States capabilities, and whether or not the current situation is so unique that other states believe it is futile to try to compete, and particularly to attempt to catch up, with the United States.

States cannot totally balance against the United States or bandwagon with it. Either approach would carry excessive risks and would deny opportunities to benefit from cooperative efforts with the hegemon. However, balancing is not limited to the traditional notion of hard balancing. Christopher Layne would classify the acquisition of

⁴⁷ Stephen G. Brooks and William C. Wohlforth, "American Primacy in Perspective," *Foreign Affairs* 81, no. 4 (July/August 2002), 21-22.

remote sensing capabilities as “leash-slipping.” Leash-slipping is one of several forms of soft balancing that does not directly counter an existential hegemon threat. States that use a leash-slipping strategy are not concerned that the hegemon will attack them. Instead, they want to conduct an independent foreign policy so they begin by building up their military capabilities. By maximizing their abilities and acquiring the capability to act independently of the hegemon in the realm of security, these states slip the leash of the hegemon and gain the leverage needed to compel the hegemon to respect their foreign policy interests. This soft form of balancing is insurance against a hegemon that might use its power in a threatening way sometime in the future. Leash-slipping is also a strategy employed by states when they are concerned about the adverse effects of another rising state’s gains on its own general position, both political and economic, in the international arena. Layne concludes that if leash-slipping is successful it will lead to the creation of new poles of power in the international system, restore multipolarity and end the United States hegemony.⁴⁸

William Wohlforth agrees that eventually some great powers will have the capability to counter the United States alone or in a traditional great power alliance. However, for some time, it is more likely that second-tier states will find it too costly to form counterbalancing alliances than it is for the U.S. to sustain the current system of alliances reinforcing its own dominance. Wohlforth also believes that unipolarity is ultimately a distribution of capabilities among the world’s great powers that minimize

⁴⁸ Christopher Layne, “The Unipolar Illusion Revisited: The Coming End of the United States’ Unipolar Moment,” *International Security* 31, no. 2 (Fall 2006), 7–9, & 29–30. <http://libraries.cua.edu> (accessed July 1, 2009).

two major problems. These problems are security and prestige competition that confronted the great powers of the past.⁴⁹

If the acquisition of remote sensing capabilities by the rising powers is indeed leash-slipping, then are we seeing evidence of competition? Are some of these states building their remote sensing capabilities in preparation for a time when they can challenge the United States? Are other states, who have no illusions of overtaking the hegemon ensuring that they maintain an important position in the new world order to come? Though Wohlforth predicts the United States hegemony will eventually end, he also points out that rising states will need to do far more than coordinating policies in traditional alliances. To balance the hegemon rising states must translate their aggregate economic and technological potential into the concrete capabilities necessary to be a pole. This means establishing and maintaining a defense industry and power projection capabilities that can play in the same league as the United States.⁵⁰

What about the “problem” of prestige noted by Wohlforth? Year after year, U.S. government officials in testimony to Congress and public speeches point out that other states maintain or seek the ability to launch an ICBM, not just for its long-range weapons delivery capability but also for the prestige associated with this category of weapon system. Interestingly, for states that want to conceal their development of an ICBM capability it is possible to claim that instead they are developing a satellite launching capability. Satellites and their launch vehicles, like ICBMs, garner prestige for their

⁴⁹ William C. Wohlforth, “The Stability of a Unipolar World,” *International Security* 24, no. 1 (Summer 1999), 31–32, & 40. <http://libraries.cua.edu> (accessed July 1, 2009).

⁵⁰ *Ibid.*, 30.

owners but are usually less controversial and objectionable to other states. Emerging long-range powers use this cover story to hide development of their missile launch capabilities. Neither the hegemon nor other monitoring capable states have been able to predict the exact nature of first-test missile launches by these so-called rogue states. This is because emerging long-range powers are not relying on the robust test programs used by the United States, Russia, China, and Western European states to ensure a missile's accuracy and reliability. However, for these states the prestige of owning a long-range missile launch capability exceeds the need to verify its capabilities. The fact that these launch vehicles probably lack accuracy and reliability and cannot be deployed in large numbers does not diminish the possibility that they can politically threaten the United States and its allies.⁵¹

States may also recognize that as the possibility for the return of multipolarity increases, cooperation among the rising powers may become more difficult making self-help more important. Previously, Layne concluded that cooperation will become more difficult as multipolarity emerges. This claim is related to the Realist concept that international cooperation between states is hindered by their concerns over relative gains. Relative gain describes states' actions only with respect to power balances and does not account for other factors such as economics. It also assumes that the environment is zero-

⁵¹ Ibid. Also: Central Intelligence Agency. "The Ballistic Missile Threat to the United States," Statement for the Record to the Senate Subcommittee on International Security, Proliferation, and Federal Services on The Ballistic Missile Threat to the United States by Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, February 9, 2000. https://www.cia.gov/news-information/speeches-testimony/2000/nio_speedh_020900.html (accessed August 24, 2009).

sum, meaning wealth—of any type—is finite and the only way for a state to gain is to take wealth from another state.⁵²

On the other hand, the liberal emphasis on absolute gains says that states' will evaluate the total effect of a potential action by assessing all factors including power, economics, and cultural effects. This theory is associated with a non-zero-sum game, which assumes that comparative advantage will allow all participating states to expand their wealth. Brooks and Wohlforth suggest that while other states use balancing rhetoric against the U.S. hegemon as a rallying point for stimulating cooperation with other states— particularly those states in their own region of the world, they are unwilling to foreclose on their own promising bilateral arrangements the United States.⁵³

THEORY OF INTERNATIONAL POLITICS

Kenneth Waltz in *Theory of International Politics* provides a theory that explains certain outcomes within the realm of international politics. His theory can explain the behavior of modern-day regional powers with regard to ownership of remote sensing capabilities.

Waltz's approach, based on systems theory, conceives of international politics as a domain distinct from the economic, social and other international domains. It starts with a simple concept: a system is composed of a structure and of interacting units; and the structure is the system-wide component that makes it possible to think of the system

⁵² Christopher Layne, "The Unipolar Illusion: Why New Great Powers Will Rise," *The Perils of Anarchy: Contemporary Realism and International Security*, eds. Michael E. Brown, Sean M. Lynn-Jones, and Steven E. Miller (Cambridge, Massachusetts: The MIT Press, 1995), 166–167.

⁵³ Brooks and Wohlforth, 29.

as a whole.⁵⁴ Specifically, the structure of the international political system is defined by an organizing principle, which is anarchy. Waltz refers to international politics as “politics in the absence of government.” In Waltz’s theory, the organizing principle does not vary, because there is no central control, and since at this time there is no international controller on the horizon, the international realm will remain one of anarchy.⁵⁵

The second defining principle of Waltz’s theory is the distribution of capabilities among the units of the structure. Waltz cautions that although capabilities are attributes of units the distribution of capabilities across units is not; it is a system-wide concept.⁵⁶ In an interview at the Institute of International Studies, UC Berkeley in 2003, Waltz engaged in a discussion of the second defining principle of his theory. He explained how in the international political system, the more capable units shape the realm and pose the problems that the other units have to contend with, and it is here where the variation (or variables) in the system are located. During this interview, Waltz provided a modern, real-world example of how changes in the distribution of power among the units required the units to adjust to a change in the system. He described how in modern history until World War II there had always been five or so great powers competing with one another. World War II resulted in a world with only two great powers; the previous great powers were reduced to major powers. The types of problems each state faced were different in the pre- and post- World War II worlds and the difference in their own positions in those

⁵⁴ Waltz. *Theory of International Politics*, 79.

⁵⁵ Ibid, 88–89, & 93.

⁵⁶ Ibid, 97–98.

different worlds affected their behavior. Waltz pointed out that in the international political realm, which is a self-help system where units cannot count on help from anyone else, these formerly great powers no longer provide their own security, but become consumers of security provided by others. Also in the post-World War II world, the United States assumed new responsibilities that it never dreamed of assuming, including providing security for major parts of the world. The structure of the international political system changed dramatically between pre- and post- World War II, and the units of the systems accommodated themselves to the new structure.⁵⁷

The defining principles of Waltz's theory of international politics and the tendency toward sameness of the competitors provide a starting point for this inquiry. Modern-day states that pursue global preeminence will challenge the recognized hegemon in an area of expertise and leadership. Realists would say that these states are emulating the behavior of the state they view as successful in order to maintain or improve their position in the world order. Realist writers also suggest that states will be reluctant to cede control of an important new technology to another state, even a friendly one, lest they find themselves permanently disadvantaged in an on-going contest for wealth, influence and preeminence.

One might question why only Waltz's theory was applied to this inquiry and other theories were not investigated. Critics of this approach might say that other theories could provide a different explanation, such as commercial, economic, or profit benefits for the pursuit of remote sensing capabilities by these case states. In the earliest stages of

⁵⁷ "Theory and International Politics: Conversation with Kenneth N. Waltz," February 10, 2003. <http://globetrotter.berkeley.edu/people3/Waltz/waltz-con0.html> (accessed November 23, 2008).

this investigation, it became clear that remote sensing capabilities are not self-supporting. It is true that commercialization can offer opportunities to recoup some costs, but for the foreseeable future remote sensing capabilities will not be self-supporting and require the support of governments. Therefore it is highly unlikely that states would pursue remote sensing capabilities for economic reasons. With that in mind and the reality that not every theory can be investigated, this research focused on Waltz's theory.

Waltz continues to stand by his theory and resist the idea that realism has outlived its usefulness. He maintains that the state remains the principal actor in the international realm, anarchy still prevails, power balances are important, and self-help is the conservative approach for states. He acknowledges that changes in weaponry and changes of polarity had system wide ramifications, but they did not transform the system. He concludes that if the system had been transformed, then international politics would not be international politics anymore and the past could no longer serve as a guide to the future. He concludes that the system was not transformed, but the structure of international politics was remade and for a time we will live with unipolarity. The structural change that occurred with the end of the Cold War and the disappearance of the Soviet Union affects the behavior of states and the outcomes their interactions produce. He notes that transformation will occur when the system is populated by states that no longer have to help themselves, and each would work to maximize collective gains without fear about how they might fare compared to each other.⁵⁸

⁵⁸ Kenneth N. Waltz *Realism and International Politics* (New York, New York: Routledge, 2008), 197 & 222-223.

CRITICISM OF THE THEORY OF INTERNATIONAL POLITICS

Most scholars generally agree that Kenneth Waltz's *Theory of International Politics* is a seminal work that has contributed greatly to the understanding of international relations. However, some of them also criticize his theory. In general, they appreciate the simplicity of Waltz's theory, but for them it lacks elements that they believe are essential.

For example, John Gerard Ruggie concludes that Waltz's theory cannot account for major changes in world politics because Waltz did not fully develop his concept of structure. Ruggie believes that Waltz overlooks dynamic density or how changes in interdependence affect the relationship between an international system's structure and the degree of order observed within it. In addition, he differs with Waltz on the importance of structural change because for Ruggie it is only a unit-level process. In conclusion, Ruggie believes Waltz's definition of international political structure is perhaps too spare.⁵⁹

Robert O. Keohane, on the other hand, does agree with Waltz about system-level theory as a starting point for a theory about international relations. However, he believes that there are problems with Waltz's theory such as an inconsistency between his theory of the balance of power and his assumption that states seek to maximize power. He also sees difficulties with Waltz's ambiguous concept of power and the fact that the contexts within which power is exercised are not sufficiently specified. As a result, Keohane believes that Waltz's theory does not explain change well and that a revised theory that

⁵⁹ Robert O. Keohane, "Realism, Neorealism and the Study of World Politics," *Neorealism and its Critics*. (New York: Columbia University Press, 1986), 16–25.

includes elements of the international system ignored by Waltz would have greater explanatory power. Most importantly, Keohane believes that Waltz fails to test his theory by the criteria he establishes.⁶⁰

Robert W. Cox faults Waltz with assuming that a form of thought derived from a particular phase of history is universally valid. Cox on the other hand sees conflict as a possible source of structural change rather than as a recurrent consequence of a continuing structure. Cox identifies himself with historical materialism and Waltz with positivism—a research program that does not sufficiently account for human ideas and practices and one that searches for general laws at the expense of recognizing the connections between people’s ideas and the material world with the resulting transformations from one structure to another. As a result, Cox does not see Waltz’s theory as a critical theory of the state but rather as a problem-solving international structural theory of international politics.⁶¹

Though Waltz’s critics pose valuable arguments, the elegance of his theory makes it particularly useful for this research. This researcher agrees with those who find great explanatory power in Waltz’s simple theory and used this research opportunity to test his it. Other explanations such as economic benefits have proven to be less satisfactory. At one time, particularly in the United States, there was hope that the market for remote sensing products and services would be robust enough to support the remote sensing industry. Remote sensing data and products, as well as launch vehicles and services, are in demand but the space industry in general cannot survive without the direct or indirect

⁶⁰ Ibid.

⁶¹ Ibid.

financial support of governments. This reality has resulted in some governments abandoning space program plans or putting existing programs on hold for economic reasons. However, these six states did not abandon their plans and despite some serious challenges have avoided major reductions in their programs. Waltz's theory provides a plausible explanation why a state would invest precious resources in an indigenous capability when the end product can be acquired for a reasonable cost or by free-riding.

Robert G. Gilpin summarized the strength of this approach when in response to these same critics he noted that realism emphasizes power as the final arbiter of all things political and that in our own time the state represents the group that is the essence of social reality.⁶²

THE THEORY OF INTERNATIONAL POLITICS AND REMOTE SENSING CASE STUDIES

States have to make choices regarding which assets to acquire with their limited resources. States that own remote sensing capabilities place high value on these assets, otherwise they would not use precious resources to acquire, operate and maintain them. By studying how and at what level these assets are controlled within their government, how they are supported politically and financially, and what the government publicly says about the assets we can gain insight into governments' reasons for investing in these assets.

⁶² Ibid., 21.

The six case studies are organized in a specific manner. First there is background information about the country. Similar, though not identical, types of background information are supplied about each country for context. For example, type of government, geographic description; gross domestic product (GDP); population; literacy and life expectancy rates; international relations and membership in organizations; and relations with the United States are common information types included about the cases. The background information may also include information that highlights specific strengths, vulnerabilities or relevant situations.

The second portion contains remote sensing specific information that focuses on three areas: evidence of long-term commitments, policies and laws, and official statements. These are the invariables—the indicators that these states, using the United States as the standard, view remote sensing ownership as necessary if they are to improve their position in the world order. Evidence of long-term commitments includes budget support, remote sensing organizations at significant levels in the government, and related activities such as capacity building via investment in space-related academics. Evidence in policies and laws includes remote sensing or space activity specific policies or laws. In the absence of dedicated legislation there should be evidence that in practice, general policies and laws do support remote sensing activities. Finally, there should be official statements that confirm remote sensing is important to the country and supports security or other national objectives.

Chapter II

Case Studies: The French Republic and Japan

INTRODUCTION TO THE REPUBLIC OF FRANCE AND JAPAN

France and Japan are modern, technologically advanced democracies. Space-based technology enhances the daily lives of their citizenry and is so commonplace that most do not even think about the source of the images or signals that fill their lives. However, the leadership of these two countries looks well beyond the conveniences of space-based technologies to how indigenous space-based assets can help them maintain their place in the world order.

Both France and Japan emerged from World War II with the desire to improve their position in the world. France was a damaged, weary Ally that had suffered the indignity of occupation at the hands of Hitler's Germany. Japan was a nation that lost the war, lost the god-like status of its Emperor, lost its freedom in the post-war occupation, and gained the unenviable position of being the only country on the planet to have suffered the ravages of nuclear weapons. Before World War II, France had been a member of the modern European community and was expected to recover from the wounds of the War. In contrast, few would have predicted the relatively rapid recovery that occurred in Japan and the amazing transition that has brought this nation to the prominence it holds today.

Neither France nor Japan realistically sees itself as usurping the position of the United States in the global world order. The two countries are distantly positioned to one another and would not consider the other a primary challenger. However, both of these would-be global leaders are now seeing their own positions in the world order challenged

by rising regional powers and former empires. Brazil and India are regional powers that intend to become global leaders in the near term and hope to command the same type of respect that France and Japan have enjoyed. China and Russia, important ancient empires and former socialist icons, are now trying to make their way into the modern, capitalist community on their own terms. Their sights are more likely set squarely on the United States, but their rise in the world order will have consequences for both France and Japan.

France and Japan depend on space-based technology for many of the modern conveniences to which they are accustomed and for a certain amount of prestige that they enjoy around the world because of their space programs. However, both are acutely aware of how dependent they are on space-based technology for some of their security. Both of these countries suffered the hardships of war within their borders during recent memory. In today's world, the threat to security comes not just from traditional threats in the form of other countries, but also from non-traditional sources such as terrorists. France and Japan have recently reevaluated their security positions and decided to acknowledge, even elevate, the use of space-based assets within their security programs.

Prior to 1975, France was one of the few space-faring countries that had an advanced space program, including a launch capability. Yet France decided to become less independent in its space pursuits and join the ESA. In 1975, France tied its future in space, success or failure, to the European Space Agency. France brought more to the table than any other member-state of the ESA. It is arguable that without France the ESA would not have achieved its current level of success in scientific and commercial endeavors. For some time, the French leadership was content with the scientific and

commercial success that ESA has enjoyed in space activities. However, the current leadership believes that this is not enough. The Sarkozy Administration believes that if the ESA does not embrace a more political agenda then the ESA and all of its member-states, including France, will fall behind other space-faring states. That outcome is unacceptable to France so the country is launching an aggressive campaign to persuade the other member states that ESA should take on a political approach.

France hopes to persuade the European Union (EU) to change its approach to space activities. France would like EU politicians and not bureaucrats to decide on priorities for the European Space Agency. France believes that if the EU does not change its approach to space, then it will not be able to keep up with China, Japan, and India.¹

France's President, Nicolas Sarkozy, admires many things about the United States including its space capabilities. A senior French official involved in space policy spoke with the British Broadcasting Corporation (BBC) about the French suggestion that the European Space Agency should operate more like the United States' NASA by giving it a politically-led direction. The French believe that space policy is a key area for reform in the EU. The official noted that the United States, Russia, China, and Japan all have a political motivation for their space activities. He stated that so far Europe has only had a scientific motivation and is in danger of becoming redundant in the global space community if it does not develop a clear political agenda.²

¹ BBC News. "France Plans Revolution in Space." <http://newsvote.bbc.co.uk/1/hi/science/nature/7482232.html> (accessed July 27, 2009).

² Ibid.

Reports indicate that ESA intends to expand these achievements with more ambitious projects like the manned exploration of Mars in which Europe can play an “indispensable” part. The French official agreed that this was exactly the kind of issue where a political agenda would benefit ESA’s decision-making process. He commented that the question of what mission to pursue next, i.e., the Moon or Mars, are political questions not scientific ones. He acknowledged that they could be made into questions of science, but they are really political questions, which ESA cannot answer because it lacks a political element. He went on to say that such an approach would fundamentally change the aims of ESA and that would require all member states to agree.³

The ESA’s European space policy implementation manager countered that comparisons with NASA are unfair because NASA has built a reputation on the programs it has delivered. Those programs are possible in part because NASA spends seven or eight times as much as ESA does in a year resulting in an impact that is seven or eight times greater than what ESA could achieve in a year. He noted that for ESA to accomplish similar goals, its profile and investment would need to be similar. There is serious opposition from some member countries because a political approach is not what they want from the ESA that they know and with which they are comfortable.⁴

The ESA’s mission is to shape the development of Europe’s space capability in scientific and industrial areas. Funding is invested in each member state’s space industry in an amount roughly equivalent to the amount of money the member state pays into ESA. The agency has had great success in space including developing a launch site in

³ Ibid.

⁴ Ibid.

French Guiana, creating a major commercial satellite business, training an astronaut corps, contributing the Columbus laboratory to the International Space Station, and development of the Galileo global navigation system.⁵

Though critics acknowledge ESA's accomplishments, they say it belongs to another time when European space activities were a bridge between the United States and the Soviet Union during their space race. These same critics believe that ESA should no longer depend on others for services like getting their astronauts into space.⁶

This new French position once again brings France into agreement with the United Kingdom. Previously, the two countries agreed on how business should be encouraged to get involved in space and develop commercial opportunities. It appears they are now in agreement about space exploration and discussions with the British National Space Centre have been well received.⁷

France intends to continue pursuing changes in the ESA to include a more political approach. There is widespread acknowledgement among member countries that EU and ESA interests are increasingly overlapping. This convergence led to the establishment in 2004 of a Space Council where shared concerns can be discussed. There is consensus that some space projects are so fundamental to the economic future of the EU that the direction to implement them must come from the European Commission in Brussels. The Galileo satellite-navigation system is one of these projects and the outcome of this project may have important implications for the French proposals.⁸

⁵ Ibid.

⁶ Ibid.

⁷ Ibid.

⁸ Ibid.

Japan achieved remarkable success during the first twenty-five years of its space program. This was followed by ten years of satellite and launcher failures creating a crisis of confidence accompanied by decreased funding for the country's civil space program. This internal crisis occurred at the same time Japan witnessed China's space program expand to include a manned space program and North Korea increase the emphasis on its ballistic missile and nuclear weapons programs. The United States also began to call for a reinvigorated space exploration initiative that would involve Japan. Japan's response to these space-related activities will determine its place in the global space community.⁹

Japan is also facing some very challenging political issues. Japan must decide how far to walk away from their long-held policy of prohibiting the use of space for military purposes and their 1969 space law that prohibited Japan from participating in any military space activities. In 2008, the Japanese Diet enacted a new law on space that allows Japan to use space militarily for non-aggressive, defensive purposes. Specifically, the 2008 Space Law allows Japan to launch and maintain high-resolution reconnaissance satellites and warning satellites for the early detection of ballistic missile launches. The Law provides for two additions to the Cabinet Office, a space agency and a space development headquarters. This new legislation also unifies policies related to the use of outer space. The decision of how to implement this law will determine how far Japan

⁹ Steve Berner, *Japan's Space Program: A Fork in the Road?* A Technical Report from the National Security Research Division (Arlington, VA: RAND Corporation, 2005), 1 & 33. <http://www.rand.org/> (accessed January 2, 2009).

will test the limits of “defensive” purposes when employing the dual-use technologies permitted by the Basic Law on Space.¹⁰

France and Japan share global responsibilities toward the international community and they have recognized that it is important to strengthen the relationship between themselves. Therefore, Japan and France conduct a political dialogue on many different levels. Japan is able to engage in more active relationships with the entire European continent if it has a strong, active relationship with France, one of Europe’s leading countries. The fact that France supports Japan’s desire for a permanent seat on the UN Security Council is symbolic of France’s global strength. France also understands the political weight that Japan holds in the international community. This new emphasis on political dialog between the two countries has produced several joint communiqués on development assistance, reciprocal investments, cooperation in science and technology, and globalization for the benefit of all.¹¹

¹⁰ Japan Science and Technology Agency. “Basic Law on Space.” <http://sciencelinks.lipi.go.id/content/view/852/260> (accessed January 13, 2009).

¹¹ Ministry of Foreign Affairs of Japan. “Japan-France Relations,” June 2009. <http://www.mofa.go.jp/region/europe/france/index.html> (accessed July 17, 2009).

CASE 1: THE FRENCH REPUBLIC

BACKGROUND INFORMATION ON THE REPUBLIC OF FRANCE

The French Fifth Republic was created by the Constitution of September 1958, which established a parliamentary form of government with the President as chief of state and the prime minister as the head of government. This constitution gives the executive strengthened powers in relation to those of Parliament. Since prehistoric times, France has been a crossroads of trade, travel and invasion that collectively created a circumstance, which may have helped it, become one of the earliest countries to progress from feudalism to the nation-state.¹²

France is the largest west European country occupying 220,668 square miles or an area about four-fifths the size of Texas with a population of just over 64 million who are healthy and well educated. The infant mortality rate is just 3.36 per 1000. The literacy rate of 99% is achieved through a free education system that begins at age two, though the ten years of compulsory education are for ages six through sixteen. The first institution of higher learning, the University of Paris, was founded in 1150 and since then the number of public and private universities and professional schools have substantially increased.¹³

France is a leader in Western Europe because of its size, location, large economy, strong military posture, membership in European organizations, and its energetic diplomacy. Though France reveres its rich history and independence, the leadership is

¹² U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: France," August 2008. <http://www.state.gov/r/pa/ei/bgn/3842.htm> (accessed January 2, 2009).

¹³ Ibid. [Note: The 64 million is a July 2008 estimate that includes population in overseas territories.]

increasingly tying the future of France to the continued development of the European Union. France has generally worked to strengthen the European Union's global economic and political influence as well as its role in common European defense. It views the development of a European Security and Defense Policy (ESDP) with other EU members and Franco-German cooperation as the foundation of efforts to enhance European security. In July through December 2008, the French assumed the rotating EU presidency and during this term France focused on immigration, energy, the environment, and European defense. French military doctrine is based on the concepts of national independence, nuclear deterrence, and military sufficiency; and France continues to place a high priority on arms control and non-proliferation.¹⁴

France continues to play an important role in Africa, especially in its former colonies. Its activities in Africa include aid programs, commercial activities, and military agreements, and its constant presence results in cultural impacts. Though the French military presence is likely to diminish in Africa, France will probably maintain an important role in promoting stability in the region.¹⁵

France plays an important role in other parts of the globe. France supports Quartet (U.S.-EU-Russia-UN) efforts to implement the Middle East roadmap and supports the involvement of all Arab parties and Israel in a comprehensive multilateral peace process. France also has extensive political and commercial relations with Asian countries, including China, Japan and Southeast Asia; and is seeking to broaden its commercial presence in China. A particularly noteworthy achievement in Southeast Asia

¹⁴ Ibid.

¹⁵ Ibid.

was France's success as the architect of the 1991 Paris Accords, which ended the conflict in Cambodia.¹⁶

In addition to its membership in the EU, France is an active member of many regional and global organizations. France is a charter member of the United Nations and a member of most of its specialized and related agencies. France also holds an influential global role as a permanent member of the United Nations Security Council, the Atlantic Alliance, the G-8¹⁷, the Organization for Security and Cooperation in Europe (OSCE), the World Trade Organization (WTO), and la Francophonie among other multilateral institutions. Among Atlantic Alliance members, France is second only to the United States in number of troops deployed abroad.¹⁸

The French Republic is the United States' oldest ally and participates in many cooperative efforts but also engages in economic competition and sometimes differs politically with the United States. France and the U.S. have parallel policies on most political, economic and security issues. Differences have not generally impaired the pattern of close cooperation that characterizes relations between the two countries. France is a close partner with the U.S. in the war on terror and an active participant in the Mutual Legal Assistance Treaty, which supports the exchange of information regarding terrorist activity. Though France works closely with the U.S. in the war on terror, it opposed the use of force in Iraq in 2003 and did not join the U.S.-led coalition. It did however agree

¹⁶ Ibid. [Note: Quartet objectives include the establishment of a Palestinian state, living side-by-side in peace and security with Israel.]

¹⁷ Group of eight economic power nations, currently comprised of Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States.

¹⁸ U.S. Department of State, Bureau of European and Eurasian Affairs. "Background Note: France," August 2008. <http://www.state.gov/r/pa/ei/bgn/3842.htm> (accessed January 2, 2009).

to generous debt relief for Iraq in the Paris Club negotiations and accepted the establishment of a NATO training mission in Iraq. France's expanding commercial presence in China will pose a competitive challenge to U.S. business, particularly in aerospace, high-tech and luxury markets.¹⁹

With a GDP of \$2.5 trillion, France has the sixth-largest economy in the world. It has a large industrial base, substantial agricultural resources, a highly skilled work force and it has also been very successful in developing dynamic telecommunications, aerospace and weapons sectors.²⁰ France has publicly stated that its high-technology programs, including SPOT, are strategic tools for sovereignty, and therefore are supported regardless of their real or supposed commercial value.²¹

THE FRENCH SPACE PROGRAM

In 1961, France established a national space agency, the Centre National d'Etudes Spatiales (CNES) [National Space Studies Center], which is a civilian agency responsible for proposing and implementing French space policy, and overseeing military space policy. The agency is also in charge of the design, development, and production of new technologies, which it does in coordination with French military institutions. By late November 1965 France became the third country to launch a satellite, the Asterix-1, using a Diamant rocket.²²

¹⁹ Ibid.

²⁰ Ibid. [Note: GDP is 2007 estimate.]

²¹ Sourbes-Verger and Pasco, 187.

²² Secure World Foundation, "France."

<http://75.125.200.178/%7Eadmin23/index.php?id=80&page=France> (accessed June 26, 2009).

France is an important member of the European Space Agency (ESA), which has its headquarters in Paris. France has a 58% share of Arianespace, ESA's commercial launch services company, making it the largest national shareholder followed by Germany at 19%. France's equatorial launch site in Kourou, French Guiana has been known as "Europe's Spaceport" since the founding of ESA. It is here in Kourou that ESA in cooperation with Arianespace launches European space missions.²³

The French space program suffered some financial setbacks over an extended period of time, and in 1997 through 2002, the country experienced financial losses that culminated with the test launch failure of the most advanced version of the Ariane launch vehicle, the Ariane-5 ECA in December 2002. In 2003, CNES restructured internally and executed a financial renovation to deal with these financial challenges. As a result, the 2005 French space budget was approximately 1.7 billion euros or approximately \$2.1 billion. The total budget can be separated into several major funding categories. There was 681 million euros for the national space program, 685 million euros for ESA and 370 million euros for CNES. The 2005 total also included 685 million euros for ESA, which is expected to remain constant through 2009, making France the largest contributor to ESA whose budget was 2.9 billion euros in 2005 (approximately \$3.7 billion). In addition, the French Defense Ministry received 600 million euros of separate funding in FY2005 exclusively for its military space program.²⁴

²³ Ibid.

²⁴ Ibid.

FRENCH LAUNCH CAPABILITIES

France is one of only ten countries or international organizations that have achieved the capability to launch their own satellites. However, in 1975, France gave up its indigenous launch capacity and dedicated its launch expertise to ESA activities.

In the early 1960s, France developed and successfully used its Diamant rocket to become the third country to launch a satellite in Earth's orbit. During the early years of its rocket testing, France used a launch site in the French Sahara; but in 1964 France shifted its launch site to French Guiana. In 1968, the Guiana Space Center was declared operational and after the ESA was established in 1975 this space center became "Europe's Spaceport." ESA financed complexes at the Guiana Space Center that support launches of the Ariane family of vehicles to this day. Three of the complexes were constructed specifically to support Ariane-5 launches. Three agencies participate in launches at the Guiana Space Center: Arianespace serves as the commercial launch operator; ESA developed the spaceport infrastructure and contributes financially to its expansion; and CNES functions as the prime contractor and provides financial and directorial management for the Ariane launch vehicles.²⁵

Routine CNES operations are supported by telemetry and tracking ground stations located in Aussaguel, near Toulouse, France; Kourou, French Guiana; Hartebeesthoek, South Africa; and Kiruna, Sweden which is used specifically for the Spot satellite program.²⁶

²⁵ Secure World Foundation. "French Launch Capability."
http://75.125.200.178/%7Eadmin23/index.php?id=104&page=France_Launch (accessed June 26, 2009).

²⁶ Ibid.

France has used the Ariane family of launch vehicles since 1979. The Ariane-4 with its 4,900 kilogram payload capacity was the primary launch vehicle of European commercial launch services between 1988 and 2000; its final flight was in 2003. However, in 2000 the decision was made to retire the Ariane-4 and replace it with the more powerful and less costly Ariane-5 launch vehicle. The Ariane-5, which has a 6,800 kilogram payload capacity that can put satellites in geostationary orbit, is now the primary launch vehicle for ESA members. The Ariane-5 ECA is an improved version with a 10-ton capacity. The “ECA” in its name represents its cryogenic engine. The first qualification launch in December 2002 ended in failure after the main engine nozzle broke due to extremely high temperatures. The second qualification launch of the Ariane-5 ECA in February 2005 was successful. The Ariane-5 ESC-B is planned to have a 12-ton payload capacity. Other versions have specialized capabilities such as the Ariane-5 ES ATV, which is designed to orbit ESA’s Automated Transfer Vehicle that will provide the International Space Station with pressurized cargo, water, air, nitrogen, oxygen and attitude control propellant. This broad range of Ariane launch vehicles allows the ESA to support a variety of space missions.²⁷

²⁷ Ibid.

FRENCH MILITARY SPACE PROGRAM

France's military space program began in 1995 with the launch of a military surveillance satellite and since then the program has focused primarily on advanced remote sensing satellites. Current and planned satellites have advanced capabilities including high resolution, superior image-forming, increased maneuverability and variable orbits, infrared for nighttime surveillance, electronic-intelligence gathering capabilities such as electronic and radar communications intercepts, and telecommunications.²⁸

The military space program in France is focused on advanced remote sensing satellites. It began in 1995 with the launch of the Helios-1A military surveillance satellite. The Helios-1A was a high-resolution satellite that was operational until 2000. However, the Helios-1A lacked an all-weather, radar imaging capability which limited its collection window to daytime and clear weather. The Helios-2 satellites have improved resolution, superior image-forming capabilities, and increased maneuverability due to a variable orbit. The Helios-2A was launched in December 2004 with the Helios-2B following about four years later allowing the two satellites to operate in tandem for the French defense program's Earth observation mission. The Helios-2 satellites still lack an all-weather, radar imaging capability, but they are equipped with infrared capabilities designed for nighttime surveillance.

²⁸ Secure World Foundation, "French Military Space Activities."
http://75.125.200.178/%7Eadmin23/index.php?id=105&page=France_Military (accessed June 26, 2009).

Besides the Helios satellites, France has launched other satellites with military missions. In December 2004, four Essaim electronic-intelligence gathering satellites were launched with the Helios-2A satellites. The Essaim satellites are used to test radar and electronic communications intercept capabilities, which may lead to an operational eavesdropping system by 2014. The Orfeo satellite system is composed of Pleiades, which are small, dual-use, high-resolution satellites that are the optical component and work with four Italian Cosmo/Skymed radar-equipped satellites. The CNES and Defense Procurement Agency signed an agreement for military purposes to place a high-resolution sensor on the Spot-5 satellite to work with the Helios data-gathering satellites. Spot satellites are considered to be a civilian asset, however, in 2003 reports surfaced that perhaps as much as 60% of Spot satellite images are used for defense purposes.²⁹

France also operates a military telecommunications satellite network known as the Syracuse system. The Syracuse-1 and -2 satellites consist of a military communications band that is linked on-board to two French civilian Telecom satellites. The third satellite in the Syracuse network is a dedicated military telecommunications satellite, known as the Syracuse-IIIB.³⁰

France has also sold satellites to foreign governments. In 1998, France sold a Rocsat-2 observation satellite to Taiwan. In 2003, China sought to acquire a Helios-1 type satellite with a capability of less than one-meter resolution. The French military opposed this type of technology transfer because of the future threats it could pose to international security. However, some French politicians favored a proposal to equip

²⁹ Ibid.

³⁰ Ibid.

China with this type of technology in order to counterbalance U.S. capabilities under the doctrine of “multipolarity” formulated by French President Jacques Chirac.³¹ In fact, press commentary in Europe during this time charged that President Chirac’s effort to ease the European Union’s embargo on arms sales was motivated in part by Chirac’s desire to draw China into a strategic multipolar alliance with the EU to balance against American hegemony.³²

As a regional power and leader in the EU, France is acutely aware of the need for Europe to have a coordinated security approach. In July 2008, when France assumed the rotating presidency of the EU, it pursued an agenda that included the European Security and Defense Policy (ESDP). France supports the concept of common defense-related infrastructure projects in communications, intelligence, missile defense and the military use of space. French proposals to establish a space command for its armed forces would be complemented by a European initiative on the military use of space. The French White Paper on defense and national security released in June 2008 with its accompanying plans to double the French space budget to over \$1.5 billion per year supports these concepts.³³ The French White Paper states that France will continue diplomatic efforts in support of the demilitarization of space and does not intend to deploy weapons in outer space. However, the White Paper also discusses plans for a major new effort that will use space applications to enhance national security by

³¹ Ibid.

³² John J. Tkacik, Jr. “Washington Must Head Off European Arms Sales to China,” *Backgrounder*, no. 1739 (March 18, 2004) www.heritage.org/research/asiaandthepacific/bg1739.cfm (accessed March 15, 2009).

³³ Claudia Major, “The French White Paper on Defense and National Security,” *CSS Analyses in Security Policy* 3, issue 46 (2008), Center for Security Studies (CSS) International Relations and Security Network (ISN). <http://www.isn.ethz.ch> (accessed March 18, 2009).

upgrading its signals and electronics intelligence satellite capability and incorporating a new missile warning system composed of both ground- and space-based elements. France also plans to strengthen space surveillance efforts with key European partners.³⁴

FRENCH ARMS CONTROL ACTIVITIES

Since 2002, France has made very few space arms control statements. The statements that it has made usually focus on establishing a way forward for the stalled Conference on Disarmament to address the prevention of an arms race in outer space. In these statements French officials affirm that France's position on the military uses of space are consistent with those of the EU, including the establishment of a subsidiary body in the Conference on Disarmament to deal with the subject of an arms race in space on the basis of a mandate agreed to by all. On a related issue France was initially hostile to the United States' decision to withdraw from the Anti-Ballistic Missile Treaty. However France eventually accepted the United States' withdrawal as long as a U.S national missile defense system would not interfere with France's own nuclear deterrent plans.³⁵

³⁴ Ibid.

³⁵ Ibid.

FRENCH SPECIFIC REMOTE SENSING INFORMATION

In 1970, CNES began an exploratory remote sensing program. The early experiments included flights of specially equipped aircraft, and an evaluation by the Institut Geographique National [National Geographical Institute] (IGN), which provided an assessment of the uses of remote sensing. CNES and IGN created the Groupement pour le Developpement de la Teledetection Aerospatiale [Association for the Development of Remote Sensing] (GDTA) in 1971. The GDTA tested the new airborne infrared technology, but more importantly facilitated the access and interest of French users to Landsat data and in 1975 signed a contract with Telespazio for the use of the first Landsat ground station in Europe, at Fucino, Italy.³⁶

Europe quickly became interested in remote sensing technology. In 1976, ESA created the Earth Observation Program Group which functioned as a consultative body to assess remote sensing development. ESA took the group's recommendation that a remote sensing program be developed. The first step was to develop Earthnet, a European network to receive the remote sensing data that was available at the time, which was Landsat and the U.S. Seasat data. This network continued to expand and improve. Perhaps the most important result was ESA's opportunity to evaluate and use the Seasat data from the synthetic aperture radar that could look through cloud cover which is common weather in Europe. This led to ESA's decision to develop its own remote sensing radar system in 1981 and ERS-1 was launched in 1991. This system, composed of various technologically complex instruments was specifically designed to

³⁶ Sourbes-Verger and Pasco, 188–189.

meet ESA's goals of scientific study of planetary changes and the environment. These goals were not based on commercial viability, but the contribution to global transparency through the pursuit of science.³⁷

The French contribution to the development of this program and other pursuits of the ESA, such as the Ariane effort resulted in France funding 52% of the ESA budget by 1976. However, from 1973 to 1976 CNES's budget shrank and uncertainties about the future of the institution left it in turmoil. The investment in ESA was important to France for political as well as scientific reasons and the major investment in Ariane directly affected the CNES space center in Toulouse. The French halted work on their Diamant launcher in 1975, but they did not want to lose the expertise gained. CNES actively promoted new programs that would allow the center to continue regardless of CNES's future.³⁸

ESA led the scientific and experimental programs and in 1974 the Toulouse space center conducted a technical study for an initial concept of a remote sensing satellite. The Groupe des Ressources Terrestres (GRT) [Terrestrial Resource Group], a working group evaluating potential remote sensing applications, was chaired by a representative of the Bureau de Recherche Geologique et Miniere. The GRT membership included representatives from public organizations interested in cartography, oceanography, geology, agriculture, and land management. The GRT report issued in 1976 at the height of the CNES crisis provided a life line for the troubled agency. The report's recommendations focused on ensuring European autonomy in acquiring remote sensing

³⁷ Ibid., 189.

³⁸ Ibid., 189–190.

data: develop a space platform for earth observation launched by an Ariane rocket; and establish methods and an organization to process and exploit the raw data collected from the satellite.³⁹

Meanwhile, the French team focused on satellite applications, which eventually became the SPOT, earth-observation satellite program, and the Symphonie, telecommunications satellite program. After the GRT report was issued, France officially proposed to the ESA Council that its remote sensing project be carried out under European auspices. However, the ESA was not interested in SPOT. Technical objections to the optical remote sensing system were based on the lack of a radar capability which was very important to cloud-plagued countries. More fundamental objections focused on the fact that the ESA budget was almost entirely consumed by the Spacelab and Ariane projects. France also attempted to engage the United States in a cooperative effort, but this failed as well. Earlier an idea had been considered to coordinate experiments with the multi-spectral scanner and other sensors on Landsat and SPOT. NASA, however, was indecisive about cooperation on the multi-spectral scanner effort and France moved forward without the U.S. joining the project.⁴⁰

Undeterred, CNES evaluated the feasibility of continuing the project as a national effort with the participation of Belgium and Sweden, the only other states that had shown interest during the proposal to the ESA Council. Previously, CNES made presentations on the SPOT project in various European capitals in an effort to interest all of the ESA

³⁹ Ibid., 190.

⁴⁰ Ibid., 190–191, & 203. (Note: SPOT was originally known as the Satellite Probatoire d’Observation de la Terre.)

Council members. However, from the beginning most of the member states were not interested because their space budgets were devoted to Spacelab and Ariane projects, and also the proposed optical sensors were less useful over countries with often-cloudy skies. Technical changes were made and the result was an original design that stressed high-resolution applications for cartographic needs. In 1978, approximately six years after the United States launched the first Landsat earth-resource satellite, France began the SPOT program. Formal agreements were reached with Sweden and Belgium in 1978 and 1979, respectively. As expected, the other ESA members chose not to participate in the SPOT program. The existence of the Landsat program directly influenced the French space community's decision to develop national competence in remote sensing. The French consider space a national strategic asset and therefore appropriate for state intervention. Their approach also sought to make the most of the public's investment in remote sensing without precluding possible commercial spin-offs.⁴¹

The French needed to adopt an original strategy in order to gain a strategic position among the space-faring states. Their program needed to help sustain CNES and promote the French and European space industry. In order to attain these goals, this program needed new strategic objectives. Since 1975 with the establishment of the ESA, France had been a leader in developing Europe's presence in space and relationships with other space-faring states. Though the French did not consider commercialization a prerequisite for a remote sensing program, they brought commercialization to the

⁴¹ Ibid., 187–192. (Note: The final technical design, as compared to Landsat, exhibited originality and contributed to the later commercial success of the project. These features included two high-resolution visible (HRV) instruments, each with a panchromatic resolution of 10 meters, and the 20-meter multispectral performance. The stereoscopic capability was also adjusted which would allow repeat views of areas of particular interest.)

planning process in the very early stages as the most convenient way to achieve a French and European space observation capability.⁴²

By 1981, France had made the formal decision to create Spot Image, SA, the corporate structure, which allows both public and private partners to benefit from the commercialization of SPOT data and products.⁴³ Beginning in 1978, various studies assessed the feasibility of economic benefits from the new SPOT project. However, it was in 1980 with the issue of funding SPOT-2 that economics forced decisions. Commercialization emerged naturally as a solution. Because Landsat existed and ESA was in charge of all scientific programs, the scientific approach was not a solution to the issues of organization and exploitation of the SPOT system. Also, CNES needed to demonstrate that SPOT was self-sustaining and the best way to do this was to emphasize its application prospects. In 1983, Belgium and Sweden agreed to participate in SPOT-2 and they also became partners in Spot Image. Once again, none of the other ESA countries were interested in dedicating resources to become a participant in Spot Image. However, Belgium and Sweden decided that the best way to maximize the industrial cooperation developed in the Ariane project was to partner in Spot Image.⁴⁴

When the French decided to employ commercialization in 1981, their goal was to reinvest the financial gains from the sale of imagery to fund future space segments and

⁴² Ibid., 187–188. (Note: The French approach was contrary to the United States approach which did assume commercialization was a prerequisite for establishing the Earth-Observing Satellite corporation (EOSAT) in 1984.)

⁴³ Note: The convention for capitalization varies depending on whether the reference is to SPOT, the satellites, or Spot Image, the commercial operator of the SPOT satellites. A variation to this is the commercial operator's logo, which capitalizes the entire name, SPOT IMAGE, next to a partial picture of the earth. When SPOT is used to refer to the government project/program, the convention follows that used for the satellites.

⁴⁴ Sourbes-Verger and Pasco, 192–193.

exploitation expenses. It was a commercial strategy backed by government guarantee and based on three guiding principles: imagery would be distributed on a commercial and non-discriminatory basis and pricing would be the same for each customer; a company would be established to organize imagery distribution and manage customer support services; and continuity of service would be guaranteed for at least ten years after the launch of SPOT-1 and SPOT-2 by the launch of SPOT-3 and SPOT-4. Also from the beginning regardless of the financial gain from commercialization there was a government guarantee that continuity of service and improvements would be funded.⁴⁵

The French model of public-private partnership and the successful management of a new market through the ability to assure continuity of service and provide a product with unique characteristics established France as a leader in remote sensing. It also allowed France to achieve a political goal of competing with the United States as an owner of remote sensing capabilities and distributor of data and images. In many ways, SPOT was more successful than Landsat making France the leader in “commercial” imagery and the country that states around the globe relied on for imagery and imagery products. This was a victory for French technology and France’s ability to translate technology into an enterprise; and it gained and helped maintain French relations in many states through agreements for SPOT ground stations.⁴⁶

Several events inadvertently established SPOT as an essential tool worldwide for dealing with international situations. These were the Chernobyl nuclear accident (two

⁴⁵ Ibid., 192–195. (Note: Though one of the founding principles is a fundamentally open data policy, exceptional circumstances may affect distribution; however those circumstances are determined and dealt with on a case-by-case basis.)

⁴⁶ Ibid., 194–195.

months after SPOT-1 launched) in 1986, preparations for Desert Storm in 1991, and the UN Special Commission's multilateral verification inspections that began after the Gulf War. The reliability and long-life of SPOT contrasted with Landsat's problems allowed SPOT to prosper globally and break into the North American market, making the United States the largest national market for SPOT products.⁴⁷

For the French, the notion that "global transparency" might be a stabilizing factor in international relations lent official legitimacy to the policy of commercialization. In fact, in 1978 France proposed that an international satellite-monitoring agency be established under the auspices of the United Nations for the purpose of disarmament verification. Within a few years, the prospects for commercializing remote sensing data faded, but the principle remained unquestioned in France.⁴⁸

The idea that global transparency might yield stability was not universally held even within France. The decision to sell SPOT panchromatic images with a 10-m resolution was the first step toward a closer association of civilian and military capabilities. The rationale for this decision was that its principal target application was cartography. Also, the U.S. had limited Landsat to a 30-m resolution in panchromatic mode for security reasons which gave France an opportunity to penetrate the market. Additionally, there were considerations about future remote sensing needs of the French military that could be satisfied by synergistic capabilities—SPOT and Helios are such

⁴⁷ Ibid. Also United States Geological Survey, "Landsat Update: Volume 1, Issue 2, 2007," http://landsat.usgs.gov/documents/LU_Vol_1_Issue_2.pdf and "Landsat Update: Volume 2, Issue 1, 2008," http://landsat.usgs.gov/about_LU_Vol_2_Issue_1.php (accessed January 15, 2010). (Note: Beginning with the launch of Landsat 5 in March 1984, the Landsat project began to experience a number of problems. These problems or anomalies resulted in data loss. The anomalies were overcome by redundant systems, active corrections by Flight Operations and processing procedures.)

⁴⁸ Ibid., 188.

technologies. Also offering high resolution images demonstrated to disarmament organizations that independent capabilities for verification and armament could be used in the way proposed by France in its proposal for an international satellite monitoring agency. However, the Secretariat General a la Defense Nationale [the General Secretariat for National Defense] (SGDN) was concerned and actively lobbied for encryption of data dealing with sensitive French sites or, at a minimum, that only 20-m resolution data be distributed. The Secretariat General's objections were noted but SPOT 10-m resolution images were approved for distribution making SPOT the first unclassified satellite capable of providing information useful for crisis management.⁴⁹

With SPOT, France opened the door to higher resolutions on civilian satellites and inadvertently led to civilian space technologies being used in applications that were formerly the purview of governments primarily in the form of military technologies. For example, in the late 1980s when the first French military observation satellite, Helios, was in development using high-resolution civilian satellites for disarmament and verification was not considered legitimate. Prior to this there had been an unwritten international consensus among the space-capable states that civilian space systems would not be used for security matters. In 1995, India launched the IRS 1-C satellite, which according to the Indian Space Research Organization had a six-meter resolution. Even among some in France, this was viewed as a serious breach of an international consensus against using civilian systems in security matters. The 1994 U.S. presidential directive

⁴⁹ Ibid., 199–200. (Note: The French proposal was known as the ISMA proposal at the United Nations. The French Ministry for Cooperation, which is responsible for cultural and technical cooperation with other states, supported the idea.)

that opened the market to high-resolution imagery also surprised many around the globe.⁵⁰

In 1994, a U.S. action forced France to refine its approach to be either publically driven or truly commercial. The United States decided to open high-resolution remote sensing activities to private enterprise, which broke a de facto consensus in the remote sensing world. Contrary to practice in the U.S., any French public service has always had the option to earn money from its activities. This action also came at a time when high spatial resolutions of the remote sensing satellites paralleled the performance of the French military satellite series, Helios, which meant that commercializing high-resolution data had security implications for France.⁵¹

However France, particularly the French Foreign Ministry, views its ability to use SPOT as a diplomatic tool as a legitimate aid in enhancing French influence throughout the world. The most direct example of this utility was a decision at a 1990 meeting of the Western European Union (WEU). This meeting was held at the suggestion of France and included discussions about developing a European observation satellite for verification and disarmament. By 1991, the WEU Satellite Centre for satellite imagery processing and interpretation was established in Torrejon, Spain. The Centre was initially limited to exploiting civilian images, but later it acquired the technological capabilities to process Helios imagery as well as Indian, Russian and American civilian sources.⁵²

⁵⁰ Ibid., 200–201.

⁵¹ Ibid., 188.

⁵² Ibid., 201.

A factor that was initially neutral but later raised new challenges was SPOT's worldwide network of ground stations. This network was established at a time when the resolution level was not deemed to be destabilizing, but of course that has since changed. In fact, this large worldwide network contributed to the SPOT program's global success.⁵³

FRENCH SPACE POLICY

In 2008, France took an important step regarding its space program's role in national security. On June 17, 2008, President Nicolas Sarkozy announced the conclusions of the White Paper on Defense and National Security, which outlines France's strategy for the long term and well beyond the tenure of the Sarkozy administration. France has decided to bring together and coordinate public policies in defense, national security, diplomacy and economics. If France continues along this path, it should provide improved coordination between international and national security forces with the objective of addressing emerging threats that have become "vaguer and greater in number" since the collapse of the Soviet Bloc and the attacks on September 11, 2001.⁵⁴

According to the President's statement, the White Paper shall be updated before any new law on military planning or national security is enacted. This new strategy set up a Defense and National Security Council, which has overall responsibility for security issues and brings together the French President, the Prime Minister, the Minister of

⁵³ Ibid., 195–196, & 201.

⁵⁴ French Government Portal, "Defense and Security: Head of State Sets Course," *Latest News*, June 17, 2008. http://www.premier-ministre.gouv.fr/en/information/latest_news_97/defence_security_head_60414.html (accessed January 13, 2009).

Foreign Affairs, and the Ministers of the Interior, Defense, Economy and Budget. The requirement for the White Paper to be updated before any new related laws can be enacted raises the question of what will happen if the Fifth Republic finds itself in cohabitation. When the French President and Prime Minister are from different parties there is naturally an atmosphere of competition which can leave little room for progression and can make France appear to be insecure and indecisive. Experience with periods of cohabitation have shown that while they can create paralysis in the government they also clearly divide the duties of the President who has foreign responsibilities while the Prime Minister is responsible for internal affairs. This new strategy was enacted to improve coordination between international and national security forces and improves France's ability to address emerging threats. However, only a period of cohabitation will prove if these goals are important enough to overcome the inherent competitive tendencies of differing parties with regard to space legislation.⁵⁵

This national security strategy is based around five strategic functions: knowledge and anticipation, prevention, deterrence, protection and intervention. President Sarkozy's announcement specifically mentioned space capabilities with regard to two of these functions. The new knowledge and anticipation function calls for strengthening intelligence activities. Specifically, France intends to double spending on military satellites by 2020. The White Paper also calls for the launch of new programs, particularly in the field of intelligence-anticipation, which is defined as observation, electronic eavesdropping, early warning on land, at sea and in the air and in particular the

⁵⁵ Ibid.

development of surveillance and armed drones, as well as both offensive and defensive cyber-war capabilities. These indigenous programs are intended to limit French reliance on foreign systems to fulfill the objectives of the strategy. In the area of protection of the population, the White Paper calls for reinforcing resilience which requires a change in the means and methods of surveillance used over the national territory including land, sea, air and now space and to develop a faster and wider-ranging response capability for French public authorities. Protection of the population is a priority; therefore, communication and information systems and civil warning systems lie at the center of the crisis management and preparedness system. A new aspect in protection missions added by the White Paper is that operational goals are now assigned jointly to internal security services, civil security services and the armed forces.⁵⁶

The White Paper on Defense and National Security, June 2008, launches an in-depth overhaul of France's security and defense strategy. It is important for its break with tradition in both process and content. The result is a strategy that reflects the willingness of the French government to engage in potentially painful reforms to keep up with strategic challenges. These include a shift of focus from France's historic spheres of influence towards a "strategic arc" of instability that stretches from the Atlantic via the Mediterranean to the Persian Gulf and Horn of Africa and on to south Asia; greater emphasis on intelligence; and the approval for France's reintegration into NATO's integrated military command structure.⁵⁷ In April 2009, at a summit meeting to mark NATO's sixtieth anniversary, co-hosted by France and Germany, French President

⁵⁶ Ibid.

⁵⁷ Major.

Sarkozy formally announced France's return to NATO's integrated command after a forty-three-year absence. This highly anticipated announcement received heated criticism at home, but the President does not legally need Parliamentary approval to proceed and opinion polls show a majority of citizens support him. The NATO Secretary General has warmly welcomed the decision, saying that it will strengthen the Alliance.⁵⁸ At the European level, the rapprochement with NATO offers the opportunity to overcome deadlocks and improve cooperation, which could strengthen France's international role. Critics claim that the return to NATO will threaten French independence and the autonomy that the White Paper espouses to seek.⁵⁹

The White Paper also gives us insight into France's goals in making some of these changes—namely, to improve their technical edge because they believe the threat has changed. France understands how the actual, or even perceived, technical capabilities of the United States have contributed to its status as a country capable of defending its interests and France seems to be emulating the U.S. in this regard. For example, the French plan to reduce the size of their military, focusing on quality not quantity, while enhancing its technical prowess, and cooperating with their European neighbors.

Currently, there is no French legislation specific to remote sensing; therefore general rules of law are regulating civil and military Earth observation activities. Governmental control is imposed on the Spot Image commercial policy, even in the absence of legal text, to ensure protection of national interests and respect of France's

⁵⁸ Teri Schultz, "France is to 'rejoin' NATO, an alliance it never really left. Let me explain..." *The GlobalPost*, March 13, 2009, <http://www.globalpost.com/notebook/diplomany/090312/france-rejoin-nato-alliance-it-never-really-left-let-me-explain> (accessed March 18, 2009).

⁵⁹ Major.

international obligations. Specifically, the Prime Minister has responsibility for imposing limitations to Spot Image when recommended by GIRSPOT, which is the working group comprised of the Deputy Secretary General for National Defense, the Ministry of Foreign Affairs, the Ministry of Defense, the Ministry of Space, Ministry of Research, and the CNES. Directives for limitations are implemented through CNES. The GIRSPOT data control policy works in spite of the absence of reliance on any applicable legislation. Except for the limitations imposed in 1991 during the Gulf War, which prevented Spot Image from providing data of Iraqi territory to Iraq (despite Principle XII of the UN Principles on Remote Sensing), GIRSPOT's activities remain confidential. France applies data control on a non-transparent basis and abides by Articles 30 and 296 of the 2002 version of the Treaty establishing the European Union. Specifically, Article 30 allows restrictions on grounds of public policy or public security and Article 296 states no Member is obliged to supply information it considers contrary to the essential interests of its security. New legislation, portions of which have been adopted, may include the EU Treaty language and apply it to remote sensing data.⁶⁰

⁶⁰ Philippe Achilleas, "French Remote Sensing Law." *Journal of Space Law* 34, no. 1, Spring 2008 (Mississippi: University of Mississippi School of Law), 3, 5-6, & 9. [This article provides the following specific information regarding legislation: (1) The legislative decree of 18 April 1939 on war materials, arms, and munitions is the major legal source applied to military satellites and ground stations as well as their components. France complies with the 1995 EU code of conduct on arms exports. French law requires that both imports and exports of military goods and assimilated goods be approved by a ministerial level license. International transfers of remote sensing data collected by French military satellites and/or ground stations are not controlled. (2) With regard to civilian activities, France does not have general legislation on space operations or specific legislation on remote sensing activities. Collection and distribution of remote sensing data are first regulated by international space law and also protected by general French law. Specifically, they benefit from the freedom of trade and industry proclaimed since the French Revolution (Decree of 2 and 17 March 1791). The Constitutional Council has declared that this freedom has constitutional value. Data collection and distribution are protected by the freedom of information as proclaimed in Article 11 of the French Declaration of the Rights of Man and of the Citizen adopted 26 August 1789, which also constitutional value.]

The overall authority for military space policy falls under the Defense Ministry while the implementation of military space policy in France involves cooperation between CNES and the Delegation generale pour l'armement (DGA) [Defense Procurement Agency], the military agency that manages military space programs. Coordination between CNES and DGA is overseen by the Groupe de coordination espace (GCE) [Space Coordination Group], headed by the Chief Officer of Defense.⁶¹

⁶¹ James Martin Center for Nonproliferation Studies. "France: Military Programs." <http://cns.mils.edu/research/space/france/mil.htm> (accessed January 19, 2009).

CASE 2: JAPAN

BACKGROUND INFORMATION ON JAPAN

Japan is a constitutional monarchy with a parliamentary government operating under the Constitution of May 1947. Legend claims that the Emperor Jimmu, a direct descendant of the sun goddess and ancestor of the present ruling imperial family, founded Japan in 600 B.C. Sovereignty was previously embodied in the emperor, but is now vested in the Japanese people, and the Emperor is defined as the symbol of the state. The government is a parliamentary democracy and executive power is vested in a cabinet composed of a prime minister and ministers of state, all of whom must be civilians.⁶²

Japan is a country of rugged, mountainous islands situated in a volcanic zone along the Pacific depth and occupying an area of 145,902 square miles, which is slightly smaller than California. The population of 127.3 million has a literacy rate of 99%, low infant mortality rate of 2.8/1,000, and a long life expectancy of seventy-nine years for males and eighty-six years for females. High sanitary and health standards result in a life expectancy that exceeds that of the United States. Japan is an urban society that has experienced a phenomenal growth rate during the past 100 years due to scientific, industrial and sociological changes. However, recently growth has slowed because of falling birth rates. Japan's population declined for the first time in 2005, two years earlier than predicted.⁶³

⁶² U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: Japan, September 2008." <http://www.state.gov/r/pa/ei/bgn/4142.htm> (accessed January 2, 2009).

⁶³ Ibid.

Japan, an active member of the United Nations since 1956, has diplomatic relations with nearly all independent nations. Japanese foreign policy aims to promote peace and prosperity for the Japanese people through supporting the United Nations and working closely with the West. All post-World War II Japanese governments have relied on a close relationship with the United States as the foundation of their foreign policy. Specifically, these governments have depended on the Mutual Security Treaty for strategic protection, which has also been important to the peace and stability of the rest of East Asia.⁶⁴

Japan's relations with South and North Korea are complex. Japan's economic and cultural ties with South Korea have grown, but historical differences—including territorial disputes—continue to complicate Japanese and South Korean political relations. There are historical, contentious bilateral issues—especially that of abductions to North Korea of Japanese citizens—that prevent normalization between Japan and North Korea. Japan has been a strong supporter of the United States' efforts to encourage Pyongyang to abide by the nuclear Non-Proliferation Treaty and its agreements with the International Atomic Energy Agency (IAEA). The United States, Japan and South Korea coordinate closely and consult trilaterally on policy toward North Korea. Japan also participates in the Six-Party talks to end North Korea's nuclear arms ambitions.⁶⁵ However, Tokyo refuses to provide assistance called for in the Six-Party Talks agreement (February 13, 2007) until North Korea takes satisfactory steps to resolve the abduction issue. North

⁶⁴ Ibid.

⁶⁵ Six-Party Talks concern North Korea's nuclear program. Participants are China, Japan, North Korea, South Korea, Russia, and the USA.

Korea has announced it will reinvestigate abduction cases after a new Japanese administration is in place.⁶⁶

Japan's relations with Russia are hampered by the inability to resolve their territorial dispute over the Southern Kuriles, islands that make up the Northern Territories, which were seized by the USSR at the end of World War II. This territorial stalemate has prevented conclusion of a peace treaty formally ending the war between Japan and Russia. However, despite the lack of progress in resolving the Northern Territories and other disputes, Japan and Russia continue to develop other aspects of their relationship, including two large, multi-billion dollar oil-natural gas consortium projects on Sakhalin Island.⁶⁷

Japan has pursued a more active foreign policy in recent years in recognition of the responsibility that accompanies its economic strength. For example, Japan has expanded its ties with the Middle East which provides most of its oil. In addition, Japan has been the second-largest assistance donor (behind the United States) to Iraq and Afghanistan. Japan is increasingly active in Africa and Latin America and has extended significant support to development projects in both regions, recently concluding negotiations with Mexico and Chile on Economic Partnership Agreements (EPA). Japan's economic cooperation with its neighbors is also increasing and includes the conclusion of EPAs with Singapore and the Philippines, and ongoing negotiations for EPAs with Thailand and Malaysia. In July 2008, Japan hosted the G-8 Summit and

⁶⁶ Ibid.

⁶⁷ Ibid.

focused on four themes: environment and climate change, development and Africa, the world economy, and political issues including non-proliferation.⁶⁸

Japan has diversified and expanded its ties with other nations while maintaining its relationship with the United States. For example, Japan signed a peace and friendship treaty with China in 1978. Ties between the two countries developed rapidly though disagreements over the demarcation of their maritime boundaries still exist. Of interest to China is Japan's strong and thriving bilateral trade relationship with Taiwan with whom it maintains economic and cultural but not diplomatic relations.⁶⁹

The United States-Japan alliance, which is the cornerstone of United States' security interests in Asia, is also fundamental to regional stability and prosperity. The United States-Japan alliance continues to be based on shared vital interests and values despite changes in the post-Cold War strategic landscape. These interests include stability in the Asia-Pacific region, support for human rights and democratic institutions, the preservation and promotion of political and economic freedoms, and securing prosperity for the Japanese and American people as well as the international community. Japan provides bases as well as financial and material support to the United States' forward-deployed forces, which number about 50,000 in Japan. During the past decade, the United States-Japan alliance has been strengthened and in effect expands Japan's noncombatant role in a regional contingency.⁷⁰

⁶⁸ Ibid.

⁶⁹ Ibid.

⁷⁰ Ibid.

Japan is one of Asia's most successful democracies and its largest economy, and as such contributes irreplaceable political, financial and moral support to United States-Japan diplomatic efforts. Japanese political and financial support has substantially strengthened the United States' position outside of Asia on a variety of global geopolitical problems, including the Persian Gulf, Middle East peace efforts, and the Balkans. Japan is a significant participant in the war on terrorism led by the United States. Japan is an indispensable United States' partner on United Nations reform and it is the second largest contributor to the United Nations budget. Japan broadly supports the United States on nonproliferation and nuclear issues while the United States supports Japan's aspiration to become a permanent member of the United Nations Security Council.⁷¹

The combined economic and technological impact of the United States and Japan has elevated their relationship to one that is global in scope. The bilateral economic relationship between the United States and Japan is based on enormous flows of trade, investment, and finance that matured into a strong and increasingly interdependent relationship. The two countries cooperate on a broad range of global issues. The United States and Japan are also partners in science and technology, collaborating in areas such as international space exploration.⁷²

Japan's industrialized free market economy, the second largest in the world with an estimated GDP for 2007 that was \$4.384 trillion (official exchange rate), making it a major economic power not only in Asia but globally. Japan is a mature industrial

⁷¹ Ibid.

⁷² Ibid.

economy as evidenced by its reservoir of industrial leadership and technicians, well-educated and industrious work force, and intensive promotion of industrial development and foreign trade; and it also has high savings and investment rates. Japan has few natural resources therefore trade is very important because it brings in the foreign exchange needed to purchase raw materials for its economy. The Japanese economy is highly efficient and competitive in areas linked to international trade however productivity in protected areas such as agriculture, distribution, and services is far lower. In the 1960s through the 1980s, Japan achieved one of the highest economic growth rates in the world, then in the early 1990s the Japanese economy slowed dramatically when the “bubble economy” collapsed, marked by plummeting stock and real estate prices.⁷³

THE JAPANESE SPACE PROGRAM

Japan became the fourth country to launch a satellite. This was achieved on February 11, 1970 with the successful launch of Ohsumi aboard a Lambda 4S-5.⁷⁴ In the early years of its space program, Japan concentrated its efforts on launcher development and telecommunications satellites, while remote sensing programs had a much lower priority.⁷⁵ However, it quickly became apparent to this island nation that remote sensing assets consisting of one or more satellites in low earth orbit with modest resolutions would be extremely useful for weather and resource management. This was followed by an interest in space-based assets for security purposes such as missile defense and

⁷³ Ibid.

⁷⁴ Secure World Foundation, “Japanese Military Space Activities.” http://www.secureworldfoundation.org//75.125.200.178/%7Eadmin23/index.php?id=126&page=Japan__Military (accessed June 26, 2009).

⁷⁵ Kazuto Suzuki, “Japanese Remote Sensing Policy at a Crossroads,” in Baker, 205 & 213.

intelligence gathering. Missile defense would require more sophisticated technologies such as infrared sensors and the ability to place a satellite in a geostationary orbit. As the Japanese remote sensing program achieved higher resolutions, remote sensing opened the door to intelligence gathering for military purposes. Since 1970, the Japanese space program has evolved into a world-class effort and moved Japan closer to its goal of catching up with the advanced space-faring states.

In 2008, Japan enacted the Basic Law on Space (Law No. 43 of 2008), which declares that Japan can use space militarily for nonaggressive, defensive purposes and must take necessary measures to promote development and use of outer space that contributes to Japan's national security (Article 14).⁷⁶ This legislation was established in May 2008 and enacted by the Diet in August 2008 with goals to "improve the Japanese people's lives and to build a society in which the people can live safely with a sense of reassurance." Under this law, Japan is allowed to send up and maintain high-resolution reconnaissance satellites and early warning satellites in geo-stationary orbit for the early detection of ballistic missile launches. There are also organizational changes associated with this legislation. First the Strategic Headquarters for Outer Space Development has been established in the Prime Minister's Cabinet (Article 25 to 31); and second, a Cabinet Office responsible for the Headquarters' administration (Article 32) will be established within one year as soon as the necessary measures such as legal provisions are in place. The Basic Law unifies policy related to the use of outer space, which were previously

⁷⁶ Japan Science and Technology Agency. Also: Ministry of Defense Japan, "Space-Related Defense Policies and Future Topics for Consideration, November 2008." http://www.mod.go.jp/e/d_policy/pdf/space2008.pdf (accessed January 15, 2009).

advanced by a number of ministries and agencies. The Basic Space Law is the start of an entire government effort to work cooperatively on the compilation of the space development strategy and the promotion of an integrated policy.⁷⁷

Prior to the Basic Law on Space, Japan enacted other legislation and policies that served to govern and support its space activities. In 1995, the Science and Technology Basic Law, which determined the basic outline of science and technology policy in Japan, came into force to promote scientific and technological creativity. This law is considered crucial for Japan's national prosperity and independence. Unfortunately, the Second Science and Technology Basic Plan (2001-2005) cut the space development budget more than other sectors. This trend was reversed in the Third Science and Technology Basic Plan (2006-2010) and space-related activities are now positioned as one of the nation's four secondary priority areas. In addition, technologies for space transportation systems, and marine-Earth observation and exploration systems are included in the five critical technologies established by the Council for Science and Technology Policy.⁷⁸

In August 2006, Japanese decision makers were considering which policy or policies should be formulated. As of 2007, Japan had no formalized, detailed data policy for each satellite, but instead the guidelines of the Space Activities Commission applied to the Japan Aerospace Exploration Agency (JAXA) and these guidelines still apply. In principle, all remote sensing data is available to the public without regard to a specific

⁷⁷ Prime Minister of Japan and His Cabinet, "Strategic Headquarters for Space Development, Friday, September 12, 2008." http://www.kantei.go.jp/foreign/hukudaphoto/2008/09/12chuu_e.html (accessed January 13, 2009).

⁷⁸ Ichiro Taniguchi, "Industrialization of Space Development and Utilization in Japan," Japan Aerospace Exploration Agency. http://www.jaxa.jp/article/interview/vol31/index_e.html (accessed January 13, 2009). [Note: The secondary priority areas are energy, manufacturing technology, social infrastructure, and "frontier" which include space.]

spatial resolution limit; but in practice, data access is determined on a satellite-by-satellite basis, with decision makers considering who is requesting data and why. Japan's priorities regarding policies include establishing rules for processed data; solving issues pertaining to providing Earth observation data; and encouraging data use. Data can only be used for peaceful purposes and JAXA retains the intellectual property rights.⁷⁹

There are three categories of users. Public data users are those that contribute to promotion of data utilization. Data is available to these users at the cost of reproduction and is available on networks at almost no charge. "Other data users" include commercial users who are offered a low price but not less than prices offered by private companies. National security users have access to classified data that comes from Japan's Information Gathering Satellite (IGS).⁸⁰

Space development activities are part of the Japanese national strategy and prior to the Basic Space Law enacted in 2008 there were over forty years of space-related history. In 1961, the Space Activities Promotion Committee of Nippon Keidanren (Japan Business Federation), composed of representatives from space-related companies, was formed to study the direction of industrial space development and utilization, and make proposals for national policy. In 1969, the Diet in Japan adopted a resolution that outlined the country's development of space for peaceful purposes and established the National Space Development Agency of Japan (NASDA). In September 2003, after some restructuring and consolidation of government entities, NASDA became JAXA. JAXA, the merger of three Japanese space agencies, is an independent administrative public

⁷⁹ Gabrynowicz, 19.

⁸⁰ Ibid.

corporation (a corporate-like entity performing government-like functions) making JAXA personnel contract employees that belong to unions, not civil servants. JAXA has new and different goals from its predecessor NASDA. JAXA is responsible for coordinating Japan's space activities, which are primarily focused on civilian-related projects and its objective is to promote space development and use. In this case promotion includes dissemination of data and results, which, in turn, includes remotely sensed data. JAXA also supports space education through its Space Education Center. Japan has a space budget commensurate with its plans to maintain and improve its space capabilities. For example, Japan's FY2004 budget for space projects was \$2.7 billion.⁸¹

Dr. Ichiro Taniguchi, Chairman of the Space Activities Promotion Committee of Nippon Keidanren, believes that Japan—like the United States, Europe, Russia, China, Korea, and India—should use space development and utilization as a diplomatic tool.⁸² In fact, there appears to be growing interest by the Ministry of Foreign Affairs to use space technology as a diplomatic tool just as the Chinese are doing with their success in human space flight and subsequent use of that success in diplomacy efforts.⁸³

⁸¹ Taniguchi. Also Secure World Foundation, "Japan."
<http://75.125.200.178/%7Eadmin23/index.php?id=86&page=Japan> (accessed June 26, 2009).

⁸² Ibid.

⁸³ Gabrynowicz.

JAPAN'S LAUNCH CAPABILITIES

Japan has the capability to launch, control and monitor its space-related activities. This is consistent with Japan's strategy to acquire and gain expertise in all aspects of a remote sensing capability, including infrastructure, thereby achieving self-reliance with this technology. The H-IIA is launched at the Tanegashima Space Center while scientific satellites and sounding rockets are launched from the Uchinoura Space Center. Satellites are tracked and controlled by the Katsuura, Okinawa, and Masuda Tracking and Communication Stations. The Masuda station also tracks and monitors rockets in flight; and the Ogasawara Downrange Station tracks rockets launched from the Tanegashima Space Center. Japan plans to integrate its telemetry, tracking, and control facilities which they eventually plan to integrate into a single network.⁸⁴

However, in 2003 the Japanese encountered a significant setback in the launch portion of their space program. In March 2003 the H-IIA, Japan's most advanced rocket, was used to launch the first two Information Gathering Satellites (IGS) of the four-satellite constellation. The second pair of satellites and the H-IIA launcher were destroyed when the rocket malfunctioned during the November 2003 launch. Further launches were suspended until February 26, 2005 when Japan successfully launched a weather observation satellite.⁸⁵

The failure of the November 2003 launch appears to have changed Japan's near- and intermediate-term plans regarding its launch capability. Japan previously had plans

⁸⁴ Secure World Foundation, "Japanese Launch Capability."

http://www.secureworldfoundation.org/index.php?id=125&page=Japan_Launch (accessed June 26, 2009).

⁸⁵ Ibid.

to develop an advanced version of the H-IIA with testing scheduled for 2008. A next generation rocket that would be less expensive and more reliable was also planned for development. Both of these efforts would have promoted the country's commercial launch industry. After the H-IIA failure in 2003, Japan shifted its focus to increased safety and reliability for the H-IIA while moving the rocket launch program to the private sector.⁸⁶

JAPAN'S MILITARY SPACE PROGRAM

Japan's space activities have historically centered on civilian-related projects, however Japan has more recently begun to expand its focus into military uses of space. In 1994, Japan seriously began to reconsider its long-held policy of prohibiting the use of space for military purposes. This is in contrast to Japan's 1969 space law that prohibited Japan from participating in any military space activities. The non-governmental Defense Research Center and two government organizations, the Japanese Defense Agency and Japan's Space Activities Commission, concluded that photographic reconnaissance and other non-lethal military space missions are a logical extension of Japan's space and national defense activities.⁸⁷ Security applications in general require more advanced technologies, such as infrared sensors and higher orbits for missile defense; so this meant that Japan—in keeping with its strategy for an indigenous capability—would seek to gain expertise in these technologies.

⁸⁶ Ibid.

⁸⁷ Federation of American Scientists, "Information Gathering Satellites Imagery Intelligence." Space Policy Project, World Space Guide. <http://www.fas.org/spp/guide/japan/military/imint/> (accessed June 26, 2009).

After North Korea's missile test launch in 1998, Japan placed four spy satellites into orbit, but the data-collection technology used in those satellites has since become dated. There is a new plan, approved by a panel led by former Prime Minister Taro Aso that would increase the quality and quantity of satellite imagery from the areas of interest. This plan will also improve the efficiency with which information is transmitted and create a satellite-based early warning system to detect missiles.⁸⁸

Japan has also begun to focus more attention on missile defense. Japan's recent interest in missile defense was also prompted by North Korea's 1998 launch of a Taepodong missile over Japanese territory. Since that event, Japan has devoted significant effort to improving its missile defense capabilities. For example, Japan dedicated \$1 billion of its \$42 billion FY2004 defense budget to missile defense. The Japanese Defense Agency received 118.8 billion yen (approximately \$1.09 billion) for missile defense in 2005. The Japanese Defense Agency also received an additional \$9 million in 2005 for research on future missile defense systems.⁸⁹

Japan has focused much of its missile defense activity on a cooperative research effort with the United States. Since 1999 Japan has spent approximately \$131 million on upgrades to its SM-3 missile defense system as part of this cooperative venture. Japan's missile defense plans include the development of a two-layer shield composed of two U.S.-made systems: the sea-based Aegis Standard Missile-3 (SM-3) and the land-based Patriot PAC-3. This two-layered system is designed primarily to defend against North Korean missiles. The shield will target missiles in both the midcourse and terminal

⁸⁸ Ibid.

⁸⁹ Secure World Foundation, "Japan."

phases of their flights; only the midcourse phase occurs in outer space. Full operational capability for both systems is expected by 2011.⁹⁰

Japan's security is inextricably linked to the United States. As tensions increase in and around the Korean Peninsula the Proliferation Security Initiative, led by the United States and including Japan and South Korea, is facing challenges from North Korea. United Nations sanctions and the Proliferation Security Initiative are meant to intercept and interdict any shipments of weapons of mass destruction or related components, including nuclear materials. Pyongyang stated that any blockade by the United States and its allies would be considered an act of war and would be met with a decisive military response. An increasingly desperate and nuclear-capable North Korea makes Japan's ties to the United States increasingly more important to its domestic security.⁹¹

JAPAN'S ARMS CONTROL ACTIVITIES

Japan has made few official statements about arms control issues since 2002. Japan has insisted that its missile defense system, developed in cooperation with the United States, is purely defensive and it is working to ensure that the presence of this defensive system will not spur an arms race. On December 19, 2003, the Chief Cabinet Secretary stated, "Japan will take all possible measures to ensure national defense and prevention of proliferation of weapons of mass destruction, by ensuring transparency and encouraging international understanding on ballistic missile defense (BMD) and by

⁹⁰ Ibid.

⁹¹ Hui Zhang, "Don't Play Nuclear Chicken with a Desperate Pariah," *Foreign Policy*, June 2009. http://www.foreignpolicy.com/story/cms.php?story_id=5020 (accessed June 26, 2009).

promoting further cooperation with the United States on technology and operation.” Earlier in June 2002, Ambassador Kunido Inoguchi at the Conference on Disarmament publicly agreed with the United State’s call for PAROS discussions rather than formal negotiations.⁹²

SPECIFIC REMOTE SENSING INFORMATION

Japan is an important remote sensing state whose initial interest in developing a domestic remote sensing program was sparked by the success of the Landsat program. In fact, their strategy was modeled after the Landsat program. Japan’s strategy, outlined in the Fundamental Policy of 1978, was to develop remote sensing satellites for scientific and research purposes beginning with marine observation, which required a lower resolution, before advancing to land observation using optical and radar sensors. Japan, an island nation highly dependent on the sea for food and some portion of income, quickly recognized that an indigenous remote sensing capability would give their fishing industry a technological edge. The Japanese also recognized that from this logical starting point, which served their commercial interests, it would be possible to enhance their security in the future.⁹³

It is reasonable to ask why the Japanese did not choose a different strategy, specifically why they did not free ride on the U.S. and use images provided by their security partner or perhaps images they could purchase from SPOT or Landsat. Neo-

⁹² Secure World Foundation, “Japanese Arms Control Activities.” http://www.secureworldfoundation.org//75.125.200.178/%7Eadmin23/index.php?id=127&page=Japan__Arms_Control (accessed June 26, 2009).

⁹³ Suzuki, 205 & 213.

realism, for example, predicts that states will free ride whenever possible rather than spend scarce resources on something they can get for free or a negligible cost. However, depending on U.S. provided images or purchased images could not provide the same level of control and timeliness that these indigenous satellite systems would provide. Free riding would mean that Japanese interests would always be subordinated to the provider's interests, in this case the U.S., and purchased imagery would be less timely than the data indigenous capabilities could supply.⁹⁴

The Japanese government was also determined to catch up with other space advanced countries and not be left behind with respect to international standards of space technology. Therefore, it is logical that their national space strategy focus on developing, or at minimum gain expertise in, space technologies. In addition, Japanese industries, particularly those capable of hardware development, were ready to benefit from and ensure that Japan establish a technological base that would allow Japan to join the club of space advanced countries.⁹⁵

Throughout the 1970s and the 1980s Japan was clearly focused on scientific and technological achievement particularly in earth sciences. During this time they produced the Geostationary Meteorological Satellite (GMS) and the Marine Observation Satellite (MOS). These meteorological and marine satellites had the potential to benefit the Japanese commercial fishing industry and provide some early warning from sea-based natural disasters. The Japanese also gained expertise in some specific space-based technologies during the development of GMS and MOS. GMS, developed with the

⁹⁴ Ibid, 205 & 220.

⁹⁵ Ibid.

Meteorological Agency, to monitor cloud movements offered the opportunity to acquire spin satellite stabilization techniques from the United States. The MOS effort focused on developing visible and near infrared, thermal infrared, and micro-radiation sensors, as well as the three-axis stabilized satellite bus.⁹⁶

Beginning in the mid-1980s, Japanese interests shifted slightly due to concerns about environmental protection and the implications for international cooperation. While recognizing these more ephemeral advantages of remote sensing, they still focused their efforts on developing technologically advanced equipment. Developing expertise in these basic technologies was critical to an indigenous remote sensing program, but it neglected the interests of the other ministries who had by this time recognized the usefulness of remote sensing data.⁹⁷

The first example of a Japanese remote sensing effort that met the demands of both users and developers was the Japanese Earth Resources Satellite (JERS-1). The Ministry of International Trade and Industry (MITI) was particularly concerned about Japan's acute dependence on Middle East energy resources, which had become increasingly visible during the two oil crises in the 1970s. MITI was struggling to develop its own resource supply system and reduce Japan's vulnerability. A bitter conflict ensued among different organizations within the Japanese government each of whom saw this as an opportunity to develop a high-resolution radar satellite. MITI demanded the right to develop the sensors because it wanted to be fully capable of monitoring resource exploration. MITI was eventually given responsibility for the JERS

⁹⁶ Ibid., 213.

⁹⁷ Ibid.

sensors and subsequent radar sensor developments. The internal government conflict did not end peacefully and led to an enduring feud.⁹⁸

ADEOS was the next large remote sensing program and was designed to satisfy many objectives. The original satellite design was not primarily for remote sensing, but the satellite bus was instead developed as a space platform which is a step toward manned space station technology. A space platform was a keystone program in the Fundamental Policy, but at this time it was essential to demonstrate value in the program. NASDA, responsible for domestic technology development programs, needed to justify its program to the Ministry of Finance. The solution was to add environmental monitoring and international cooperation objectives which actually became NASDA's new strategic agenda during the mid-1990s. NASA and the French Centre National d'Etudes Spatiales were invited to participate, thus lending a substantial—as well as symbolic—value to the program. International cooperation was also a key element in future programs, including the Tropical Rainfall Measuring Mission (TRMM), the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), and the ADEOS-2.⁹⁹

Japan's Fundamental Policy of 1996 gave higher priority to remote sensing programs that emphasize user-developer cooperation, particularly in the design. Though the primary focus was still on developing high-resolution sensors, with 2.5m resolution,

⁹⁸ Ibid., 213–214.

⁹⁹ Ibid., 214.

ALOS, was the first of these program to have true user-developer cooperation in the design and capability specifications.¹⁰⁰

The Japanese remote sensing program has exhibited a number of strengths that helped it overcome internal challenges. One of these strengths has been consistency and another has been that even with the infighting and funding difficulties, NASDA and the Science and Technology Agency (STA) succeeded by introducing different policy objectives to secure program funding. Nevertheless, management of the remote sensing program was affected by negative criticism after the ADEOS failure and resulted in changes to the constellation design to address technical weaknesses.¹⁰¹

Japan achieved its technological objective, high-resolution sensor technology, with its IGS program. Coincidentally, NASDA and STA's preeminent role in technological development ended. The Committee for NASDA Evaluation's report in 1998 indicated that the space industry might take over the remote sensing program development for more commercial purposes. In addition, NASDA's role was further reduced as commercialization took over core remote sensing activities because a 1990 agreement with the United States prevents NASDA from developing non-research and development satellites.¹⁰²

The catch-up approach has succeeded with regard to remote sensing technology, but Japanese focus has changed from the narrow technology-biased path to a more expanded approach that includes a political focus on exploiting the technology.

¹⁰⁰ Ibid.

¹⁰¹ Ibid., 214–215.

¹⁰² Ibid., 215.

However, the most dramatic shift came when North Korea launched the Taepodong in 1998. That event had a direct influence on Japan's space policy community to expand their efforts and include military space reconnaissance in Japan's space program.¹⁰³

Japan operates within a construct that makes "security" a bit different from that of other countries, particularly those who possess status as a regional power and global leader. Constitutional constraints and its alliance with the United States prevent Japan from active involvement in international security, which includes using outer space for anything that has military implications. Until the 1980s, developing military space systems to support the Self-Defense Forces was considered unnecessary because they only operated within and immediately around Japanese territory. However, currently naval and air forces operate as far out as 1000 nautical miles from the home islands which has allowed the United States to shift some naval forces to the Indian Ocean. Japan, since its alliance with the United States, has relied on the American intelligence gathering capabilities. However, this almost total reliance on an ally would be questioned when North Korea began testing ICBMs. Even though Japan's military ambitions have been significantly more modest than France's global military pretensions, Japanese concerns about its lack of indigenous monitoring capabilities have increased in proportion to its local adversaries capabilities.¹⁰⁴

In the mid-1990s, the ruling Liberal Democratic Party (LPD), the Ministry of Foreign Affairs (MOFA), and the Japan Defense Agency (JDA) began to consider the possibility of a reconnaissance program in order to increase Japanese military autonomy

¹⁰³ Ibid., 205.

¹⁰⁴ Ibid., 216.

in the post-Cold War era. An autonomous capability, though initially not as advanced as the French capability, would also provide a way to deal with the new U.S.–Japan Security Guidelines and the introduction of theater missile defense. IGS was discussed as early as 1996 during three meetings of the LDP’s Council of Foreign Affairs and Security. By 1998, the notion of IGS became one of the principal features of LDP’s foreign policy. After this policy decision, JDA began development of the Imagery and Mapping Support System with plans for completion in 2000. The Imagery and Mapping Support System would use high-resolution commercial data. Simultaneously, in an effort to begin serious debate about a Japanese reconnaissance satellite, MOFA began to investigate reconnaissance satellites around the world.¹⁰⁵

The Japanese Diet Resolution of 1969 made the process of exploring a Japanese reconnaissance satellite slow and lengthy, but the Taepodong launch in September 1998 made the idea of IGS politically acceptable. The Japanese were shocked and frightened by the North Korean launch. So much so, that the “peaceful use of space” ideal that they had held was no longer realistic. The LDP, JDA and MOFA took advantage of this opportunity and the LDP held seven intense meetings between September 10 and October 15, 1998. On October 29 it was proposed that the government develop two optical satellites and two radar satellites. A Cabinet decision to introduce IGS for consideration was concluded on November 6, which was followed by an envoy of powerful politicians visiting the United States from November 9 to 13 to study actual development and operation of reconnaissance satellites. Within a two-month period, the Government of

¹⁰⁵ Ibid.

Japan had made more progress toward a reconnaissance satellite program than they had in the two years prior. There is no doubt that the Taepodong launch was the catalyst for this rapid decision making progress. However, this seemingly instantaneous decision could not have been reached if the IGS concept had not been seriously discussed, debated, and explored for several years before this frightening event turned what had heretofore been a concept into a plan.¹⁰⁶

The Japanese had a decision and a plan, but it was not quite an executable plan—not yet. Two major factors contributed to what would become a series of problems. First of all, the process to introduce IGS had come from the top of the government which ran counter to the Japanese bottom-up culture. This bottom-up approach allows for ideas to be negotiated and socialized among the relevant ministries before presentation to the authorizing body. Also in this case the “top” composed of LDP, MOFA, and JDA had no experience in space policymaking procedures. The result was confusion and lack of agreement on details, including how the satellite should be procured and how the data should be used, and who was responsible. For example, both JDA and MOFA met with the United States to “explain” the Japanese position on foreign procurement and data distribution; however, their presentations were inconsistent. The LDP in an effort to avoid criticism for not adhering to the Diet Resolution, decided to use IGS for multiple purposes, not just reconnaissance, which created further confusion. In the midst of this chaos, many organizations tried to benefit from the IGS decision, including the Ministry

¹⁰⁶ Ibid.

of Transport, the Public Security Investigation Agency, the Environment Agency, the Ministry of Home Affairs, and the Fire and Disaster Management Agency.¹⁰⁷

The Committee for IGS Promotion, chaired by the Cabinet Secretary-General, assumed control by 1998 and took responsibility for the whole system design and coordination among the ministries. Time was the biggest challenge for the committee. Japan wanted the satellite immediately so they could have frequent and unrestricted access to information about North Korea. It would take at least four years to develop a satellite with domestic technology, so other options were also explored and these included: procuring a satellite from the United States or using allied intelligence information combined with commercial data. After careful consideration and much debate, Japan concluded that the only way to ensure autonomous and concealed operation and data gathering as well as satisfy the demands of Japanese satellite manufacturers was to pursue domestic procurement.¹⁰⁸

Though the United States indicated that it approved of an autonomous Japanese intelligence capability and was willing to cooperate with Japanese authorities, the decision to develop IGS domestically was met with strong opposition from the United States government. In reality, Washington had hoped to sell a complete U.S. system or at minimum a complete satellite. The United States' reaction put the committee in an awkward position. The initial decision was welcomed in Japan because it would give the relevant Japanese ministries an opportunity to acquire expertise in new technologies, specifically a higher resolution sensor and an encrypting signal transmitter, as they

¹⁰⁷ Ibid., 216–217.

¹⁰⁸ Ibid., 217.

develop the four IGS satellites. This decision precluded Japan from purchasing a U.S. made system. However, the committee found a compromise solution that worked for all parties and both countries exchanged a memorandum of understanding in September 1999 stating that Japan would purchase some key technology from the United States that did not exist domestically. Japan would save some money by investing in new technology domestically and the Japanese agencies would benefit from the development experience. Japan would still depend heavily on the United States for crucial technology, but this face-saving approach protected the relationship and ensured future defense and intelligence cooperation between the two governments.¹⁰⁹

The final Japanese decision highlights an important dilemma for states dealing with a hegemon who is not only a close ally, but is also essential to their security. The systemic constraints, specifically the need for a protector, must be weighed against the desire to be independent. Independence in space technologies would satisfy foreign policy interest groups but could result in an unhappy hegemon. That's exactly what happened during Japan's decision-making process regarding its space program. In the end, Japan found a solution that allowed it to retain its protector and also begin to develop its own space capabilities. However, this solution required Japan to remain dependent on the United States to a greater extent than Japan would have liked.

The next challenge was finding a balance between cost and efficiency. NASDA and the other agencies involved in the IGS development effort were already over tasked. The Prime Minister's solution was to use 70 billion yen (\$670 million U.S.) from his

¹⁰⁹ Ibid., 217–218.

special portfolio, which can be allocated without the consent of the Ministry of Finance. At a total of 81 billion yen (\$773 million USD), the IGS budget was unprecedented. Funding for other programs related to remote sensing tripled in 2000 which reduced cost pressures on these programs and allowed NASDA to recruit additional staff.¹¹⁰

IGS was launched in 2003 during what was described as a time of tension on the Korean Peninsula. A few days before the United States Secretary of State had testified to the Foreign Relations Senate Committee about the possibility of a North Korean Nodong ballistic missile launch that could occur with very little warning. North Korea had signed the Japan-Democratic People's Republic of Korea Pyongyang Declaration that restricted North Korea from testing missiles in and after 2003. Japan urged North Korea to refrain from violating this agreement.¹¹¹

At a press conference on March 27, 2003, the Press Secretary of MOFA was reminded that when North Korea launched the Taepodong in 1998, they claimed that it was a satellite launch; and he was asked if in light of that was security for this launch higher than normal and were the Japanese Self-Defense Forces on a higher alert status. Mr. Takashima's response focused on why Japan developed the IGS.

“...the situation surrounding Japan and the Japanese archipelago requires constant close monitoring. Furthermore, the Government of Japan thought that because of the natural characteristics of the Japanese archipelago, a better monitoring system of large-scale disasters, such as earthquakes or eruptions of volcanoes, would be necessary to cope with such situations. Based upon that kind of judgment, we decided to develop and set up a satellite monitoring system. It has no intention of being hostile toward any country. This is simply aimed to increase our own capability to

¹¹⁰ Ibid., 218.

¹¹¹ Ministry of Foreign Affairs of Japan, “Press Conference 27 March 2003: Section II, Questions concerning launch of information-gathering satellite.” <http://www.mofa.go.jp/announce/press/2003/3/0327.html> (accessed June 26, 2009).

ensure better security and better means to cope with that sort of natural disaster. We believe that any criticism from North Korea or any other country is not justified.”¹¹²

After further questioning he did admit that security was tighter, including reducing the advanced notice of the launch from the usual weeks to a few days, but it had nothing to do with North Korea. However, he stated that this was because the satellite system involved some classified information and very advanced technology, therefore extra precautions were taken to prevent any sort of incident such as a terrorist attack. He also stressed that the security status of the Self-Defense Forces throughout Japan had been tightened on March 20 in response to the war in Iraq, and the higher security measures at the IGS launch site in Kagoshima Prefecture were being handled by the police and not the Self-Defense Forces.¹¹³

North Korea’s intentions will continue to be a source of concern for Japan and will likely dictate some of their space-related activities. The new Basic Law on Space allows them more freedom in the future to expand their possible responses to this significant threat.

¹¹² Ibid.

¹¹³ Ibid.

Chapter III

Case Studies:

The Federative Republic of Brazil and India

INTRODUCTION TO THE FEDERATIVE REPUBLIC OF BRAZIL AND THE REPUBLIC OF INDIA

The Federative Republic of Brazil and the Republic of India are regional powers that have every intention of improving their position in the world order. Within their regions of the world, both are considered powers to be reckoned with by their neighbors. Both countries are rapidly increasing their economic and political power, which has implications on a global scale. Their increasing prowess as space faring states and nuclear powers also has implications on a global scale, but these two areas create concerns as well as competition.

Brazil insists that all of its space activities are focused on peaceful uses of outer space. However, there are significant concerns in the global community about Brazil's intentions and the inherent military capability of its space program. Brazilian officials have stated that their space program does not have enemies, only competitors.¹ However, even with the military capabilities that a successful space program can offer, Brazil is not in any immediate danger from a comparably equipped and threatening neighbor.

Brazil's civil space program has been a great help to its government in managing its continent size country, which has limited transportation infrastructure throughout much of its territory. Regardless, Brazil has been criticized for not acting to protect the

¹ Federation of American Scientists, "Brazil is Going Into Space," *Sao Paulo ISTOE*, August 9, 1995. <http://www.fas.org/news/brazil/lat95188.htm> (accessed January 8, 2009).

vast and fragile resources it owns by using the information it has gleaned from its remote sensing satellites. The Amazon, an area that is now understood to be critical for the entire globe, is still being plundered and stressed. However, being “green” has more appeal in the highly advanced countries that have already attained their desired place in the world. Brazil, as well as India, has chosen development first and ecology when it is useful to do so.

India, of course, sits across the border and down the global street from nuclear-capable and threatening neighbors. India’s space program has many peaceful uses and has been essential in its development efforts to bring its country and population into the modern world. However, there is no pretense that their space program is without a military component, though officially the military space capabilities are labeled as “defensive in nature.”

In addition, India realizes that as the only developing country with a space program, its space activities have contributed more to its development than has any other country’s space program. For example, none of the other space-faring countries needed to use their telecommunications satellites to provide television links to isolated villages in an attempt to improve the education level of millions of people in a country burdened by illiteracy. The Indian government is acutely aware that to continue this pace of development the country’s space program, particularly the segment of various civil satellites, is critical to improving the country’s literacy rate. The space program also provides access to some other specialized education, resource management, and medical services particularly to thousands of villages that did not have access to these services

before the space program existed. India is acutely aware that without continued progress toward increased literacy development will suffer making it extremely difficult, if even possible, to achieve great power status or hold on to the status it has achieved.

Brazil and India consider their space programs essential if they are to transition from being a regional power to a great power. Both countries can realistically see France and Japan as countries to catch up with in the world order. They realize that successfully competing with the hegemon is unlikely and they act accordingly. Both states take advantage of cooperative efforts with the United States in order to gain technology or support for their activities. They compete with the United States economically and in scientific endeavors, but they do not seriously challenge the United States in areas that could lead to significant conflict, especially military confrontations.

The relative success of these two regional powers and their great distance from one another make them economic competitors in those areas where they both participate, but it lessens their competitive tendencies regarding one another in areas of politics and security. Brazil and India certainly have mutual interests, however their collaborative efforts have been limited and they have chosen to align themselves with stronger partners whenever possible.

CASE 3: FEDERATIVE REPUBLIC OF BRAZIL

BACKGROUND ON THE FEDERATIVE REPUBLIC OF BRAZIL

The Federative Republic of Brazil is a federal republic based on its 1988 constitution, which grants broad powers to the federal government. The government is composed of legislative, judicial and executive branches. The president is both head of state and head of government. Brazil is the only Portuguese-speaking nation in the Americas, a legacy of Brazil's colonial days, which began when Brazil became a colony of Portugal in 1500. Brazil gained its independence on September 7, 1822.²

Brazil has an estimated 192 million inhabitants, which is the largest population in Latin American and ranks fifth in the world. Brazil's GDP of over \$1.2 trillion (official exchange rate) is the result of a 4.5% growth rate in 2007, aided by a benign environment. The government has implemented strict yet prudent fiscal and monetary policies to improve the national fiscal situation as well as the personal financial situation of the citizens. Urban growth has been rapid and 81% of the total population was living in urban areas by 2005. The growth greatly aided economic development but it also created serious social, security, environment, and political problems for major cities. Brazil's geographic area is vast and at 3,290,000 square miles only slightly smaller than the U.S. The terrain is varied and climate is mostly tropical or semitropical with a

² U.S. Department of State, Bureau of Western Hemisphere Affairs. "Background Note: Brazil, June 2008." <http://www.state.gov/r/pa/ei/bgn/35640.htm> (accessed January 2, 2009).

temperate zone in the south. Its large population has a literacy rate of 86% of the adult population, an infant mortality rate of 26.7 per 1000 and a life expectancy of 72.5 years.³

The Federative Republic of Brazil has traditionally been a leader in the inter-American community playing an important role in collective security efforts and economic cooperation in the Western Hemisphere. Brazil is party to the Inter-American Treaty of Reciprocal Assistance (Rio Treaty) and a member of the Organization of American States (OAS). Recently, Brazil has given high priority to expanding relations with its South American neighbors by becoming a founding member of the Latin American Integration Association (ALADI), and the Union of South American Nations (UNASUL) which were created in June 2004.⁴

To increase its international economic and political profile, the Lula administration is seeking expanded trade ties with developing countries and strengthening Mercosul (Mercosur in Spanish), a customs union between Argentina, Uruguay, Paraguay, and Brazil, with associate members consisting of Chile, Bolivia, Peru, Columbia, and Ecuador, while Venezuela's full membership is pending. Through Mercosul, Brazil has either concluded or is pursuing many trade agreements, including those with the EU and India. China, which has become Brazil's fourth-largest trading partner and a potential source of investment, is an important export market for Brazilian soy, iron ore and steel.⁵

³ Ibid.

⁴ Ibid.

⁵ Ibid.

Brazil has become increasingly involved in international economic and trade policy discussions as its domestic economy has grown and diversified. Specifically, Brazil has been a leader of the G-20 group of nations in the WTO Doha Round talks.⁶ The U.S., Western Europe, and Japan are primary markets for Brazilian exports and sources of foreign lending and investment.⁷

Brazil is a charter member of the United Nations and participates in its specialized agencies. Previously, Brazil contributed troops to UN peacekeeping efforts in the Middle East, the former Belgian Congo, Cyprus, Mozambique, Angola, East Timor, and recently led the peacekeeping force in Haiti. In addition, Brazil has bolstered its commitment to nonproliferation through ratification of the nuclear Non-Proliferation Treaty (NPT), acceding to the Treaty of Tlatelolco, joining the Missile Technology Control Regime (MTCR) and the Nuclear Suppliers Group, and signing a nuclear safeguard agreement with the IAEA. Brazil served as a non-permanent member of the UN Security Council from 2004-2005 and prior to this, it had been member of the UN Security Council eight times. Brazil is now lobbying for a permanent position on the Council.⁸

Since the United States became the first country to recognize Brazil's independence in 1822, the two countries have enjoyed friendly, active relations encompassing a broad political and economic agenda.⁹ However, during the military rule from 1964 to 1985, Brazil's relationship with the United States was troubled by Brazil's

⁶ The G-20 group is a forum for cooperation and consultation on matters pertaining to the international financial system. It is comprised of finance ministers and central bank governors from 20 economies: 19 countries plus the European Union.

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

nationalistic tradition and its rejection of external controls, in spite of the fiercely anti-communist stance of the military government.¹⁰ Continued high-level contacts between the two governments, including reciprocal visits by Presidents Bush and Lula in March 2007, reflect the depth of U.S.-Brazilian engagement and cooperation.¹¹

Brazil has one of the most advanced industrial sectors in Latin America. Brazil's diverse industries, which account for one-third of its GDP, range from automobiles and parts, other machinery and equipment, steel, textiles, shoes, cement, lumber, iron ore, tin, and petrochemicals, to computers, aircraft, and consumer durables. Brazil has a diverse and sophisticated services industry as well, with mail and telecommunications the largest sectors, followed by banking, energy, commerce, and computing. Agriculture is also a major sector of the Brazilian economy and accounts for 25% (including agribusiness) of the economy making it a critical area for economic growth and foreign exchange. Brazil is rich in natural resources, including forests, mineral reserves, oil, and significant water reserves that make Brazil one of the world's leading producers of hydroelectric power. The Brazilian government has an ambitious and ongoing program to reduce dependence on others for strategic needs. Self-reliance in energy has been one of the most successful of these efforts, resulting in a reduction of imported oil from more than 70% of Brazil's oil and derivatives needs in the mid-1980s to net figure nearing zero in 2008.¹²

¹⁰ Hilcea Santos Ferreira and Gilberto Camara, "Current Status and Recent Developments in Brazilian Remote Sensing Law," *Journal of Space Law* 34, no. 1 (Mississippi: University of Mississippi School of Law, 2008), 12.

¹¹ U.S. Department of State, Bureau of Western Hemisphere Affairs.

¹² Ibid.

BRAZIL'S SPACE PROGRAM

The Brazilian space program is led by two primary organizations. The Brazilian Space Agency is a civilian organization responsible for managing Brazil's space policy that works with the National Institute of Space Research (INPE), a civilian organization responsible for satellite development. Brazil's plans for space activities are documented in the "National Program of Space Activities: 2005–2014," which indicate its space activities are to benefit Brazil's society and industry. The planned near-term space activities focus on earth observation, telecommunications, meteorology, and technological and scientific missions.¹³

The Brazilian space program has had some significant setbacks in recent years, particularly in their launch vehicle efforts. In August 2003 during an equipment test, a VLS-1 rocket blew up on the launch pad killing twenty-one people. A government investigation followed and a report released in March 2004 concluded that poor funding and lax management contributed to the accident.¹⁴

Brazil's space agency followed the recommendations of the investigation's report and continued to pursue space activities after the August 2003 accident. This persistence resulted in a successful international mission with a Brazilian astronaut. On March 30, 2006, the first Brazilian astronaut, Lieutenant-Colonel Marcos Pontes, was launched into space from the Baikonur launch facility in Kazakhstan on a Russian Soyuz rocket and performed scientific research on the International Space Station (ISS) for nine days

¹³ Secure World Foundation. "Brazil." <http://75.125.200.178/%7Eadmin23/index.php?id=77&page=Brazil> (accessed June 26, 2009).

¹⁴ Ibid.

before returning to Earth. Brazil has been an active participant in building the ISS since 1997, but this mission was especially important and a great source of national pride for the country. Brazil originally agreed to make parts for the space station in exchange for the opportunity for a Brazilian astronaut to be a member of another ISS member's space crew on a previous flight to the ISS. Unfortunately Brazil was unable to honor its agreement because funding inadequacies crippled its ability to manufacture the specified parts and deliver them on the required schedule. As a result, Brazil forfeited its right to send an astronaut into space. However, Brazil was able to reach a separate astronaut launch agreement with Russia for \$10.5 million that permitted Lieutenant-Colonel Pontes to go into space.¹⁵

In an attempt to follow the funding recommendations of the investigation report, Brazil dedicated the equivalent of approximately \$106 million USD to space activities in 2008. The "National Program of Space Activities: 2005–2014" states that the Brazilian Space Agency will cooperate with foreign space programs in order to share the financial burden of space activities and enhance the technological base and expertise of Brazil's space program. This has led to cooperative space projects with China, Ukraine, Canada, and India; and cooperation with Israel and Argentina has been proposed. One of the most interesting and important agreements has been the cooperative relationship with Germany to develop the Multiple Application Synthetic Aperture Radar, a night-vision radar satellite designed to monitor the Amazon. This project is estimated to cost 100 million euros and Brazil says that it should be built by 2010 and launched by 2013. Brazil also

¹⁵ Ibid.

has a cooperative satellite venture with Russia, known as the Brazilian Geostationary Satellite project. This effort is estimated to cost \$600 million and should result in the production of three telecommunications satellites by 2011. Brazil is also negotiating with the European Union to participate in the Galileo navigation satellite program.¹⁶

The most successful of Brazil's cooperative relationships has been with China. Brazil and China have jointly developed and launched remote-sensing satellites under the China-Brazil Earth Resources Satellite (CBERS) program. This effort has produced remote-sensing satellites for real-time, civilian, and environmental monitoring; and it markets CBERS images to other countries. The first two CBERS satellites carried three cameras: a high-resolution camera, a wide-field imager, and a multispectral infrared scanner. These sensors have resolution capabilities ranging from 20 meters to 260 meters. The third CBERS satellite was launched in September 2007, known as CBERS-2B and has resolution capabilities ranging from 2.5 meters to 20 meters. It started to transmit data in January 2008 using a CCD camera in addition to the wide-field imager and the multispectral infrared scanner like its predecessors. Future satellites will probably carry more sensors and have higher resolutions.¹⁷

¹⁶ Ibid.

¹⁷ Ibid.

BRAZILIAN LAUNCH CAPABILITIES

Brazil's indigenous prototype launch vehicle, the Vehiculo Lancador de Satellite (VLS) rocket, has a record of failed flight tests. This program also has a legacy of tragedy because of the explosion caused by an electrical malfunction during an equipment test in August 2003 that killed twenty-one people. Despite this enormous setback, the Brazilian Space Agency continues to develop the VLS rocket and intends to produce a rocket capable of launching small satellites into geostationary orbits.¹⁸

It was October 2004 before the Alcantara Launch Center resumed operations after the accident, but it did so with the successful launch of a VSB-30 (Brazilian Sounding Vehicle) prototype, which was a sounding rocket developed with the German Space Agency. There was an additional successful launch of the VSB sounding rocket in July 2007, which studied the effects of microgravity on the rocket and more importantly increased the confidence of the Brazilian Space Agency.¹⁹

The ground facilities portion of Brazil's space program infrastructure has some advantageous features. Brazil launches its rockets from the Alcantara Launch Center in northeastern Brazil, 2.3 degrees south of the equator, which is a uniquely-situated location for launch facilities. This location is approximate to the equator, where the Earth's rotation is faster, and reduces the amount of fuel required for launches by about 30%, which increases the potential payload capacity and decreases fuel costs. These attributes make the Alcantara Launch Center an attractive option for countries planning to

¹⁸ Secure World Foundation, "Brazilian Launch Capability."
http://75.125.200.178/%7Eadmin23/index.php?id=95&page=Brazil_Launch (accessed June 26, 2009).

¹⁹ Ibid.

launch rockets and would put Alcantara in direct competition with ESA's French Guyana Space Complex, which also has these same attributes. In fact, Brazil hopes to make this an international rocket launch center and offer international customers an additional alternative. Brazil also has a launch center located near the northeastern city of Natal, the Centro de Lancamento da Barreira do Inferno (Launch Center of the Barrier of Hell), which primarily conducts launches of sounding rockets. The National Institute of Space Research manages Brazil's satellite programs and also maintains the state's Satellite Tracking and Control Center at Sao Jose do Campos and at facilities in Cuiaba and Alcantara.²⁰

The August 2003 VLS launch disaster and the contributing funding problems forced Brazil to prioritize their cooperative arrangements with foreign government space programs, including those that incorporated technology transfers and financial support. In October 2003, Brazil signed an agreement with Ukraine that committed Brazil to upgrade Alcantara to accommodate international launches of Ukraine's Tsiklon-4 (Cyclone-4) rocket. The powerful Tsiklon-4 rocket will launch payloads of 1.8 tons into geostationary transfer orbit and 5.5 tons into lower orbits. The estimated cost of this program is \$180 million dollars, which will be split equally between the two countries. Brazil considers this investment worthwhile to the future of its commercial launch business as well an important component to its CBERS program because Brazil plans to use the Tsiklon-4 rocket to launch satellites for the joint China-Brazil effort. The

²⁰ Ibid.

program suffered some delays, but is still on track to complete the requirements of the agreement.²¹

The Brazilian Space Agency and the Russian Space Agency signed a Memorandum of Understanding (MOU), known as the Southern Cross Program, in November 2004. This MOU commits Brazil to create a new launch-vehicle family capable of carrying larger satellites, as well as a liquid-fueled version of the VLS. For Brazil, this is an opportunity to enter the next phase in the development of the VLS launch vehicle. The Southern Cross Program plans to build five new satellite launchers (Alpha, Beta, Gamma, Delta, and Epsilon) by 2022. The Alpha launcher will be based on the VLS-1 launcher though the solid propellant third and fourth stages will be replaced with a single liquid-fuel stage. Importantly, the subsequent rockets in the VLS family will use liquid-fuel engines that are developed and manufactured in Brazil. The Southern Cross Program MOU also requires that a supporting ground infrastructure at the Alcantara Launch Center, including telemetry and tracking systems, be developed.²²

This cooperative agreement with Russia will help Brazil meet its objectives in the National Space Activities Program (PNAE) for 2005-14 that states Brazil will produce three stages for the VLS launcher program. These stages include: the completion and launch of a VLS-1; the development of an updated version, VLS-1B, that will use liquid propulsion capable of carrying 800 kilograms to low-Earth orbit; and the development of a launcher capable of reaching geostationary orbit carrying 800 kilograms.²³

²¹ Ibid.

²² Ibid.

²³ Ibid.

BRAZIL'S MILITARY SPACE PROGRAM

Brazil is considered one of a group of states that are using space assets for military purposes. In 1994, Brazil established the civilian Brazilian Space Agency to manage the space program and replace the military-connected Brazilian Commission for Space Activities. Establishing a civilian agency was part of Brazil's effort to prove that its space launch program was not being used for military purposes. Though members of the MTCR—including the U.S.—were still suspicious, Brazil was allowed to become a member of the MTCR in 1995. Brazil was allowed to keep its space launch program in spite of the fact that this program had significant potential for military applications. The United States and the other MTCR members agreed to Brazil retaining its launch program because they were most interested in persuading Brazil to halt its missile technology exports and some of its missile programs. However, the military continues to control important aspects of the space program, particularly with respect to rocket development.²⁴

Brazil has released little in the way of official military space doctrine though policymakers have argued in favor of spending on space by highlighting the military advantages of independent space access. Brazil's space activities tend to focus on international security issues such as border control and contraband. There is little that can be classified as Brazilian military space activity. However, the military is known to use the dual-use CBERS products to monitor the Amazon and its large border. The

²⁴ Secure World Foundation, "Brazilian Military Space Activities." http://75.125.200.178/%7Eadmin23/index.php?id=96&page=Brazil_Military (accessed June 26, 2009).

military's communications requirements are also met via a dual use system, the Brasilsat B-2 satellite. It is certainly possible that the military could use the CBERS products to observe other states, however there is no confirmation of such activities.²⁵

BRAZILIAN ARMS CONTROL ACTIVITIES

Since 2002, Brazil has emphasized that its space activities are solely for peaceful purposes. In statements about space arms control, Brazil has indicated support for the negotiation of a treaty banning space weapons. However in contrast to its statements, Brazil declined to participate in the November 2002 International Code of Conduct Against Ballistic Missile Proliferation. The Code of Conduct is a voluntary endeavor designed to restrain countries from developing ballistic missiles that are capable of carrying weapons of mass destruction. Participating states are required to exchange information about ballistic missile and space launch programs, including advance notice of ballistic missile or space vehicle launches. Brazil was the only member of the MTCR that did not participate and it cited concerns about the potential effect on its space program.²⁶

²⁵ "Futron's 2009 Space Competitiveness Index: A Comparative Analysis of How Countries Invest in and Benefit from Space Industry," *MilsatMagazine*, September, 2009. http://www.milsatmagazine.com/cgi-bin/display_article.cgi?number=875113067&method (accessed January 15, 2010).

²⁶ Secure World Foundation, "Brazilian Arms Control Activities." http://75.125.200.178/%7Eadmin23/index.php?id=97&page=Brazil_Arms_Control (accessed June 26, 2009).

REMOTE SENSING SPECIFIC INFORMATION

Brazil is investing heavily in science and technology. Brazil consolidated and expanded the national system for science, technology and innovation, which it considers strategic for the country's sovereign and sustainable development. Compared to its neighbors, Brazil has the most diversified and largest technology and innovation system in Latin America. Brazil has worked diligently during the last fifty years to earn this distinction. It is based on a list of accomplishments including deepwater oil prospecting, aircraft construction, records in the agribusiness export sector, and space and nuclear programs. Brazil considers its national space program an important component of its technology strategy. Brazil insists that its space program, particularly its satellite efforts, focus on advancing research and technology to benefit Brazilian society.²⁷

Brazil pledges ongoing government support to first-rate science and technology centers such as the National Institute of Space Research. There are general policies and legislation intended to encourage scientific and technological advances. The Federal Government's Industrial, Technological and Foreign Trade Policies are composed of several axes including technological innovation of procedures, products and services. The Ministry for Science and Technology authored the Law of Innovation, which encourages integration between universities and research institutions on one side and businesses on the other. The objective is to quickly transform scientific knowledge from the academic institutions into products, jobs and incomes. This law has many advantages, including the

²⁷ Brazilian Government Web Portal, "Brazil by Topics: Science and Technology." http://www.brasil.gov.br/ingles/about_brasil/brasil_topics/science/categoria_view (accessed January 8, 2009).

authority to “incubate” private companies in public areas with the possibility to share infrastructure and equipment as well as human, public and private resources for technological development and to generate innovative products and procedures. This is very important to Brazil’s development because the ratio of scientists in research institutes to those in the business sector is currently the inverse of that in countries of more advanced scientific and technological development.²⁸

The Brazilian Space Agency is responsible for managing Brazil’s space policy while satellite and launch vehicles are managed by different agencies. Satellite development is overseen by the civilian agency, National Institute of Space Research. Both of these civilian organizations report to the Ministry of Science and Technology. The Brazilian Air Force and its national military research center, the Brazilian General-Command for Aerospace Technology (CTA) [Portuguese: Comando-Geral de Tecnologia Aeroespacial], are under the jurisdiction of the Brazilian Defense Ministry, which manages rocket and launch vehicle development.²⁹

The Brazilian Space Agency (abbreviated in Brazilian Portuguese as AEB) was established in 1994 as a civilian authority within the direct purview of the Executive Office of the President of Brazil. The AEB is responsible for pushing Brazil’s space activities forward and for coordinating the national and international co-operation necessary to help further the country’s strategic goals in space. The AEB is the central coordinator for the major activities within the institutions of the National System for the

²⁸ Ibid.

²⁹ James Martin Center for Nonproliferation Studies, “Current and Future Space Security: Brazil.” <http://cns.miis.edu/research/space/brazil/index.htm> (accessed December 19, 2008).

Development of Space Activities (SINDAE). These include the Department of Research and Development of the Ministry of Aeronautics, the National Institute for Space Research (INPE) under the aegis of the Ministry of Science and Technology, and the Institute of Aeronautics and Space under the Ministry of Aeronautics. Brazilian academic and research institutions, as well as the private sector are involved in space-related research and development projects and are contracted to develop and supply systems, equipment and services.³⁰

In international cooperative space ventures Brazil has had some disappointments and successes. In order to deal with its launch vehicle failures and the space program's funding problems, Brazil has prioritized its programs with China and Ukraine, and canceled some of its existing cooperation agreements with other countries, except for its ongoing cooperation with the United States regarding space activities.³¹ However, Brazil has gained international recognition in the remote sensing field with the highly successful CBERS project.³² Brazil builds satellites, receives and distributes remote sensing data, and develops applications and is one of the world's leaders in earth observation. In fact, Brazil is the world's largest provider of earth observation data, delivering more than 100,000 remote sensing images annually via the Internet.³³

The CBERS Program is part of the INPE's technical and scientific space segment and has allowed Brazil to join a select group of countries with remote sensing

³⁰ "The Space Sector in Brazil—An Overview," GlobalSecurity.org, <http://www.globalsecurity.org/space/library/report/2003/brazilspace.pdf> (accessed January 15, 2009).

³¹ James Martin Center for Nonproliferation Studies, "Current and Future Space Security: Brazil, Launch Capabilities." <http://cns.miis.edu/research/space/brazil/launch.htm> (accessed December 19, 2008).

³² James Martin Center for Nonproliferation Studies, "Current and Future Space Security: Brazil, Military Programs." <http://cns.miis.edu/research/space/brazil/mil.htm> (accessed December 19, 2008).

³³ Ferreira and Camara, 11.

technology. A published history of the CBERS Program proudly claims, “Brazil has obtained a powerful tool to monitor its huge territory by its own remote sensing satellites and is looking forward to consolidating an important autonomy in this segment.”³⁴ This statement shows that Brazil places high value on owning these satellites and the autonomy that ownership provides. It also shows that Brazil considers this technology its admission price into an elite group of powerful states.

Brazil does not have specific legislation on space. The Brazilian Federal Constitution states only that the Union can regulate air and space navigation.³⁵ Brazil does have space specific guidance at the policy and program level.³⁶ The National Policy on the Development of Space Activities (PNDAE) establishes the major principles, objectives and guidelines for Brazil’s space program. The objectives of the policy include establishing space-related scientific and technical competencies that will allow Brazil to act with real autonomy in well-identified situations. These situations include the selection of technological solutions to Brazilian problems; pursue its national obligations under relevant international negotiations, agreements and treaties; promote the development of space systems, and related ground infrastructure, that may provide data and services; and to prepare Brazilian industry to participate competitively in the global

³⁴ National Institute for Space Research, “CBERS Program: History.” http://www.cbers.inpe.br/en/programas/p_historico.htm (accessed December 19, 2009).

³⁵ Alvaro Fabricio dos Santos and Jose Monserrat Filho, “Toward a National Brazilian Center on Space Policy and Law Studies,” Brazilian Association of Air and Space Law. <http://www.sbda.org.br/artigos/Anterior/38.htm> (January 15, 2009).

³⁶ Antonio Machado e Silva, Frederico Liporace and Marcelo Santos, “CBERS: A Reference in the Brazilian Space Program,” Briefing given at the Civil Commercial Imagery Evaluation Workspace in 2007 sponsored by the Joint Agency Commercial Imagery Evaluation (JACIE), http://calval.cr.usgs.gov/JACIE_files/JACIE07/Files/112Siilva.pdf (accessed January 15, 2009).

market for space related goods, services, and applications.³⁷ A related governance document, National Program for Space Activities, the PNAE, covers a ten-year period and is revised yearly. The areas of priority are earth observation (remote sensing), scientific and technological missions, telecommunication, meteorology, access to space, infrastructure, research and development, human resources, industrial policy, and cross themes.³⁸

Brazil was ruled by a military regime from 1964 to 1985 and the prevailing doctrine during that time was dual-tiered. The first tier was a broad definition of national security, including defense against external aggression, internal insurgency, and communism. The second tier focused on economic development as a means of regional assertiveness. The state's role in the economy grew significantly under the military and from the 1970s onwards Brazil assumed a strategy of assertiveness as a local power. The military government promoted scientific and technological development in energy, agribusiness, telecommunication, computers, aeronautics, nuclear, and space. The military government's dual strategy of national security and regional power assertiveness resulted in high economic growth rates between 1968 and 1973 as Brazil's industrial base expanded. It also resulted in a legacy of what appeared to be contradictory actions.³⁹

The military government encouraged research and open scientific international relations, and promoted research and development institutions such as the INPE. In fact, the INPE set up a LANDSAT ground station, which has operated continuously since its

³⁷ "The Space Sector in Brazil—An Overview."

³⁸ Silva, Liporace, and Santos.

³⁹ Ferreira and Camara, 12-14.

establishment; and the government encouraged the use of many different applications and allowed distribution of the images without controls. This was primarily because the first three LANDSAT satellites had an 80-metre resolution that the military considered to have no intelligence value. This was in contrast to the military regime's rigid control of aerial surveys and the fact that all primary decisions about the space program were made by the military.⁴⁰

Until the end of the military regime in 1985, Brazil's remote sensing satellite activities were technically unregulated. However, in practice the INPE was indirectly controlled by the Brazilian Commission for Space Activities (COBAE) headed by the chief of the EMFA, Brazil's equivalent to the Chairman of the Joint Chiefs of Staff. COBAE was terminated when the AEB was established. Though the military regime was replaced by a civilian government through a negotiated transition the military continues to exert influence in areas of national security, including space policy. Also by the 1990s, remote sensing satellite data was considered to be of intelligence value and in 1997 Decree 2278/97 was enacted to regulate both aerial surveys and remote sensing. This Decree, which treats remote sensing data as aerial photography taken by satellite, is still valid.⁴¹

⁴⁰ Ibid.

⁴¹ Ibid. [Note: Ferreira and Camara, both from the National Institute for Space Research (INPE), go on to say that Decree 2278/97 ignores the technical nature of remote sensing and disregards the UN Remote Sensing Principles. The Decree's inappropriate dispositions require a satellite operator to acquire authorization from the Brazilian Ministry of Defense in order to distribute or use remote sensing data, a state of affairs that the authors refer to as "non-applicable in practice." Therefore, Brazilian companies involved in remote sensing activities, as well as international operators that distribute images in Brazil, have ignored this legislation without any practical consequences.]

The INPE recognized the need to reform the remote sensing guidance and adopted a de facto data policy in lieu of pursuing political negotiations it feared would lead to a compromise perpetuating some military control of remote sensing activities. The policy allowed free distribution via the Internet of all remote sensing data received by INPE, the resulting maps, and the software for image processing and geographic information systems. The result is that the SPRING software was placed on the Web in 1997, the Amazon deforestation maps in 2003, CBERS images in 2004, and the INPE's full 30-year LANDSAT archive in early 2008. This policy has been considered a great success by INPE and its more than 5,000 users including educational institutions; non-governmental organizations; the private sector; and federal, state and municipal governments. Brazil's policy of free images and software, and the Amazon Deforestation Monitoring project have gained international recognition for Brazil. The world has been able to watch through Brazil's lens as the state has tackled the seemingly impossible balance between modernization of its country and preservation of this enormous, yet fragile ecosystem that affects the entire planet.⁴²

Interestingly, the current debate about remote sensing is something of a flashback to earlier days in Brazil's legislative history. The Ministry of Defense, the Ministry of Science and Technology, the Ministry of Foreign Affairs, and the Brazilian Space Agency formed a working group in 2000 to update Decree 2278/97. The proposed legislation, Project Law 3587/00, that was forwarded to the Brazilian Congress from this group neglected the technological advances and conflicted with the open access policy already in place by the remote sensing community. It also ignored the UN Remote

⁴² Ibid., 15.

Sensing Principles that called for permissive rules regarding remote sensing collection and distribution of data. Specifically, the proposed language applies a very broad definition to remote sensing that would allow government control over all institutions involved in remote sensing and aerial surveys. In fact, it is so broad that it would require any citizen to obtain permission from the government before using remote sensing data. The INPE and the remote sensing community have strongly opposed PL3587/00 making Congressional approval unlikely. They believe that any public debate on the proposed legislation would result in a retraction because the flaws are too obvious and it would be untenable in practice. At the same time, the Brazilian Congress is examining the legislative proposal, Project Law 1120/07, which mandates an open access policy to all scientific works produced using public grants and directly conflicts with PL 3587/00.⁴³

Members of the Brazilian Association of Air and Space Law (SBDA) have proposed that Brazil should have a National Center on Space Policy and Law Studies. This is viewed as a “natural and crucial chapter in the Brazilian space development.” The proposal cites United Nations resolutions on space law development at the national level and discusses recent interaction with the United Nations regarding space law. This proposal also recognizes Brazil’s opportunity and potential to lead development of space law in Latin America.⁴⁴

⁴³ Ibid., 16–17. [Note: This article ends with an interesting discussion of how it is possible to be optimistic about the future of remote sensing in Brazil because the effectiveness of the Internet and the “moral companion of Immanuel Kant” supports the pro-openness faction. They quote Kant’s “transcendental principle of the publicity of public law” in *Perpetual Peace* where he writes, “All actions relating to the right of other human beings are wrong if their maxim is incompatible with publicity” from *Groundwork of the Metaphysics of Morals* 347 (1785). Then they quote Manuel Castells’ argument from “*The Internet Galaxy*” where he says, “purposely designed as a technology of free communication,” and “it is a particularly malleable technology, susceptible to be deeply modified by its social practice” from *The Internet Galaxy: Reflections on the Internet, Business, and Society* (Oxford University Press, USA, Dec. 13, 2001).]

⁴⁴ Santos and Filho, 1–3.

CASE 4: REPUBLIC OF INDIA

BACKGROUND ON THE REPUBLIC OF INDIA

The Republic of India is based on the 1950 Constitution that claims India is a “sovereign, socialist, secular, democratic republic.” India, like the United States, has a federal form of government; however the central government in India has greater power in relation to its states and India has adopted a British-style parliamentary system. India was a British colony that gained independence in 1947 and has since become a state that because of its size, population, and strategic location has prominence in international affairs. Its growing economic strength, military prowess, and scientific and technical capacity make it a state that cannot be ignored internationally or regionally.⁴⁵

India covers a geographic area of 1.27 million square miles, which is about one-third the size of the U.S and only 2.4% of the world’s land mass. However it supports over 15% of the world’s population, which is estimated at more than 1.1 billion and growing at 1.3% a year. Only China has a larger population than India. The total Indian GDP for FY 2007 was \$1.1 trillion making it a large economy. India has no compulsory education requirements resulting in a literacy rate of only 64.84%. India also has a relatively high infant mortality rate of 34.61 per 1000 and a life expectancy of 68.59 years (2007 estimate). Of note is India’s median age of twenty-five, which is one of the youngest among large economies. About 70% of India’s population lives in nearly 550,000 villages, while the remainder occupies approximately 200 towns and cities.

⁴⁵ U.S. Department of State, Bureau of South and Central Asia Affairs, “Background Note: India, June 2008.” <http://www.state.gov/r/pa/ei/bgn/3454.htm> (accessed January 2, 2009).

Religion, caste, and language remain major determinants of social and political organization in India, but a quiet social transformation has begun.⁴⁶

India and Pakistan have been locked in a tense rivalry since 1947 with the partition of the subcontinent based on the “two-nations theory” and independence from Great Britain. The principal source of contention has been Kashmir, which triggered wars between the two countries in 1947 and 1965 and provoked the Kargil conflict in 1999. In December 1971, Pakistan and India fought a war following a political crisis in what was then East Pakistan and resulted in millions of Bengali refugees fleeing to India. The brief conflict left the situation largely unchanged in the west because the two armies reached an impasse, but in the east a decisive Indian victory resulted in the creation of Bangladesh. Pakistan and India slowly normalized relations and re-established diplomatic and trade relations in 1976. The Soviet Invasion of Afghanistan in 1979 caused new strains between India and Pakistan because Pakistan supported the Afghan resistance while India staunchly supported the Soviet occupation. The following decades have been a combination of conflicts and efforts to keep communication open and reduce the tensions.⁴⁷

India conducts certain aspects of its relations within the subcontinent through the South Asian Association for Regional Cooperation (SAARC). Its members include Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, and “observers” include the People’s Republic of China, Iran, Japan, European Union, Republic of Korea, and the U.S. SAARC was established in 1985 and encourages

⁴⁶ Ibid.

⁴⁷ Ibid.

cooperation in agriculture, rural development, science and technology, culture, health, population control, as well as anti-narcotics and anti-terrorism efforts. SAARC has intentionally stressed these “core issues” and avoided issues that might prove divisive, however political dialogue is frequently conducted on the margins of SAARC meetings.⁴⁸

Sino-Indian relations have improved gradually since 1988 even though suspicions remain from a 1962 border conflict between India and China and other continuing territorial/boundary disputes. They have acknowledged their common goals and in 2003 made a commitment to build a “long-term constructive and cooperative partnership.” The objective of this partnership is to peacefully promote mutual political and economic goals without encroaching upon their good relations with other countries. India and China are using their growing economic ties to improve other aspects of their relationship such as counter-terrorism, energy and trade.⁴⁹

The Soviet Union’s collapse in 1991 and the emergence of the Commonwealth of Independent States (CIS) had major repercussions for India’s foreign policy. After the Soviet collapse, India’s substantial trade with the region plummeted and it has yet to recover. There were similar disruptions with longstanding military supply relationships due to questions over financing. However, Russia remains India’s largest supplier of military systems and spare parts. Russia and India did not renew their 1971 Indo-Soviet Peace and Friendship Treaty and they now have what both describe as a more pragmatic, less ideological relationship.⁵⁰

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

The end of the Cold War also dramatically affected India's foreign policy. India, a leader of the developing world and the Non-Aligned Movement (NAM), is now strengthening its political and commercial ties with the United States, Japan, the European Union, Iran, China, and the Association of Southeast Asian Nations. India, always an active member of the United Nations, with a long tradition of participating in UN peacekeeping operations is seeking a permanent seat on the UN Security Council.⁵¹

The United States has recognized that India is key to strategic U.S. interests and has sought to strengthen its relationship with India. The two countries are the world's largest democracies and are committed to political freedom protected by representative government. Both have a common interest in the free flow of commerce and resources, especially through the vital sea-lanes of the Indian Ocean. India and the United States also share a commitment to fighting terrorism and creating a strategically stable Asia.⁵²

India has the world's twelfth largest economy, and the third largest in Asia behind Japan and China, with services, industry, and agriculture accounting for 55%, 27%, and 18% of GDP respectively. However the workforce is inversely distributed with nearly two-thirds of the population depending on agriculture for its livelihood. India is gradually moving toward greater economic freedom by cautiously instituting market-oriented economic reforms that began in 1991. Currently, an estimated 700 million Indians live on no more than two dollars per day. In spite of this, there is a large and growing middle class estimated to be between 50 and 300 million depending on whether North American, European or Indian standards are used. Regardless, the Indian middle class is expected to

⁵¹ Ibid.

⁵² Ibid.

increase as much as ten-fold by 2025 and will potentially have disposable incomes ranging from 200,000 to 1,000,000 rupees per year (\$4166-\$20,833).⁵³

India's economic growth is hampered by inadequate infrastructure, a cumbersome bureaucracy, corruption, labor market rigidities, regulatory and foreign investment controls, the "reservation" of key products for small-scale industries, and high fiscal deficits. The United States is India's largest trading partner with bilateral merchandise trade reaching \$41.6 billion in 2007. In particular, the rapidly growing software sector is boosting service exports and modernizing India's economy.⁵⁴

INDIAN SPACE PROGRAM

The Indian Space Program began in 1962 with laboratories located in a church and a cowshed. Since those humble beginnings the program has developed telecommunications, weather monitoring, remote sensing, and launch capabilities. India's objectives in space are consistent with its national development goals to become a modern regional power. Though the military has been a user of space services since the beginning of the program, the military does not appear to be an active participant in defining the space program requirements and objectives. The space launch vehicle (SLV) program, which was a spin-off of the space program, established the ballistic missile program and is the most visible connection between the military and the space program.⁵⁵

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ Deborah Foster, "The Indian Space Program," in Baker, 247.

In 1962, the Indian government established the Indian National Committee for Space Research (INCOSPAR) to represent India at the Committee for Space Research (COSPAR) of the International Council of Scientific Unions. India was particularly interested in studying the earth's environment with satellites and the creation of INCOSPAR made it possible for India to participate in an important international scientific body. The establishment of INCOSPAR also fostered the coordination of space research within India. INCOSPAR was initially placed under the administrative auspices of the Department of Atomic Energy (DAE). In 1969 it was reconstituted into the ISRO and the Department of Space replaced DAE as the oversight agency. India's leadership recognized that space-based communications and remote sensing capabilities could be invaluable assets in support of the national development needs and these assets could help mitigate the challenges that plagued development efforts. These challenges include a large, and ever increasing population dispersed over a large area; an immature communications infrastructure; and rudimentary knowledge of the state's natural resources. However, it was not until the bureaucratic consolidation of India's space research efforts under one organization in the early 1970s that the connection between the space program and India's development efforts was formally articulated.⁵⁶

The next step was to develop the knowledge base and infrastructure necessary to support a rocketry program. India tackled this objective by establishing the Thumba Equatorial Rocket Launching Station (TERLS). The United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) approved India's request to sponsor this

⁵⁶ Ibid., 248–249.

facility. This prestigious and important support provided India with entry into the international space faring community. By receiving UN accreditation, India was able to gain access to foreign technology and technical expertise and was obligated to provide other states with access to research and launch facilities. It was at TERLS that India through collaboration with the United States, France, and the Soviet Union built the foundation for the Indian SLV and ballistic missile programs. By 1969 the rocketry program was well established and India had conducted hundreds of successful launches at TERLS.⁵⁷

The Indian Space Research Organization (ISRO) was established in 1969 to develop civilian space technologies. In 1972, the ISRO formally identified India's two primary space-program goals. These were to (1) further national development objectives in mass communications and education through the application of space science and technologies using satellites and (2) employing remote sensing technology on space platforms to survey and manage natural resources. As with other Indian high-technology programs, these goals were to be achieved by maintaining the maximum degree of self-reliance.⁵⁸

By 1980 India became the ninth state and the first developing state to own and launch its own satellite with the launch of the Rohini-1 on an Indian SLV. Since then India has launched a variety of satellites to support many civilian purposes and this program, which grew from humble beginnings has gained recognition worldwide. One of its most impressive achievements was the April 28, 2008 launch of ten satellites on a

⁵⁷ Ibid.

⁵⁸ Ibid., 249.

single Polar Satellite Space Launch Vehicle (PSLV). This was the largest launch by ISRO and included an Indian cartographic satellite, an Indian remote sensing satellite, and eight scientific satellites from other countries. The Indian space program focuses primarily on scientific and commercial uses that further India's development. For example, programs that promote the reclamation of barren farmland and telemedicine have benefited from the space program.⁵⁹

India has recently increased its investment in the space program and expanded its focus beyond furthering national development goals. The ISRO budget for 2008-2009 is approaching \$1 billion (U.S.) which is a 25% increase over the previous year's budget. Recent and planned space activities include efforts that have more prestige-based goals. On October 22, 2008, India launched its first planetary science mission, the Chandrayaan-1, which is an unmanned lunar orbiter.⁶⁰ Future plans include the launch of the Chandrayaan-2, another lunar mission planned for 2011. The ISRO is partnering with the Russian Federal Space Agency (Roskosmos) to develop the Chandrayaan-2 Lander/Rover.⁶¹ The Indian space program has not yet progressed to manned missions. However, the Indian scientific community has discussed tentative plans for a manned mission to the moon, though ISRO has historically opposed manned missions because of their high costs and they do not contribute to India's national development. A tentative proposal to launch a manned mission using India's Geosynchronous Satellite Launch Vehicle (GSLV) was unanimously endorsed at a 2004 national meeting of space experts

⁵⁹ Secure World Foundation, "India." <http://75.125.200.178/%7Eadmin23/index.php?id=81&page=India> (accessed June 26, 2009).

⁶⁰ Ibid.

⁶¹ "What is Chandrayaan-2?" Indian Space Research Organization, <http://www.chandrayaan-i.com/chandrayaan2/index2.html> (accessed July 18, 2009).

in India. Plans for a manned moon mission are in the initial planning stages, the design study on the proposed mission is nearing completion, but before the project can proceed the ISRO would have to officially endorse the project and procure funding from the Indian government. It is estimated that the mission would take approximately eight years to complete and would cost approximately \$8.5 billion (U.S.). India has even more ambitious projects in mind with its tentative plans for a mission to Mars in 2019.⁶²

ISRO has several ongoing cooperative ventures with other countries' national space agencies that are considered important to the future of the Indian space program. Perhaps the most important of these relationships is the one with Russia, which has been one of substantial cooperation for many years. Their venture includes the 10-year agreement between ISRO and Roskosmos, concluded in November 2007, on joint lunar exploration. In addition to India's Chandrayaan-2, the agreement provides for Indian scientists to participate in development of Russia's second Moon-Globe mission scheduled for launch in 2011. ISRO is also participating with Russia in the development of Yuthsat, a satellite for educational purposes, and an x-ray instrument for the Coronas-Photon, a satellite that will study the Sun. India will participate in the development of and will then use Russia's Global Navigation Satellite System (GLONASS).⁶³

India's cooperative ventures with other countries are notable but are less substantial and less integral to India's space program than those with Russia. India's joint ventures with Canada, France, and the ESA include development efforts and agreements to provide launch services. In October 2008, India and Japan signed a

⁶² Secure World Foundation, "India."

⁶³ Ibid.

bilateral security declaration, which included a provision for expanded cooperation between ISRO and JAXA in the field of disaster management. India also has limited cooperative efforts with the Chinese space program, primarily because ISRO sells some of its remote sensing satellite data to China.⁶⁴

Perhaps the most interesting of these evolving cooperative ventures is the growing military and intelligence relationship between Israel and India. In 1991, India and Israel established formal diplomatic relations through the Madrid Arab-Israeli peace process, a move that was nurtured by the United States. This positive beginning has grown into a sophisticated military relationship resulting in India being Israel's largest arms export market in the world. These ties have also resulted in cooperative efforts regarding space issues. The most important example of these strong ties was the January 21, 2008 launch of Israel's military reconnaissance satellite, the Polaris, launched on an Indian space launch vehicle by the ISRO. The Polaris is Israel's most sophisticated satellite and the first equipped with synthetic aperture radar that allows it to take high-resolution imagery in all weather conditions. The Arab press was quick to claim that India would be the recipient of data, particularly images of Pakistan, from this spy satellite. Israel, like other states with cooperative satellite ventures, did not disclose the terms for sharing potential intelligence with third parties. Israel does retain full operational control of the Polaris system, including the selection of locations imaged. Polaris's polar orbit, achieved with the launch from south India, offers new coverage of sites in Iran, which are important to Israeli defense planners. The Indian launch of the Polaris was described as a commercial

⁶⁴ Ibid.

connection and neither state will officially disclose the specific terms of potential intelligence sharing from Polaris, however it is reasonable to assume that there may be some provision for data and information sharing.⁶⁵

Recently, India and the United States have increased their collaboration in space-related activities. The “Next Steps in Strategic Partnership” (NSSP) was announced in January 2004. At the same time India and the United States concluded an agreement to expand civilian cooperation while discussing strategic stability and missile defense. Since that time the two states began several cooperative space initiatives including two U.S. scientific instruments for the Chandrayaan-1 mission, a miniature synthetic aperture radar and mineralogy mapper. India and the U.S. began policy and technical consultations in 2005 regarding Global Positioning System (GPS) cooperation. This substantive collaboration with the United States resulted in India’s removal from the U.S. Department of Commerce’s “Entity List,” which identifies foreign actors that might proliferate unconventional weapons technology and forbids exports to these actors. For India, the tangible benefit is the possibility for trade of civilian space technologies from the United States. In 2008, the chairman of ISRO and the NASA Administrator signed a framework agreement that identified potential areas of space cooperation for the two states.⁶⁶

Indian civilian officials have declared the government’s commitment to the prevention of a space arms race, insist that their satellites are used for civilian purposes

⁶⁵ Brookings Institution, “Israel & India: New Allies,” Bruce Riedel, March 21, 2008, http://www.brookings.edu/opinions/2008/0321_india_riedel.aspx?p=1 (accessed January 15, 2010).

⁶⁶ Ibid.

even though some of them could be used for dual purposes, and have signed agreements to cooperate with several states on the peaceful uses of outer space. On the other hand, military officials have expressed a desire to use Indian's space assets for military purposes. In June 2008 the Chief of Staff of the Indian Army, General Deepak Kapoor, said India should establish a space command that can deal with rapid response to emerging threats in space. He further stated that an expansion of India's space capabilities was necessary to counter China's expanding military space capabilities. Following General Kapoor's statement, an official spokesperson for the Indian Army, declared that India's military space activities would not be about deploying weapons in space, but would be for self-defense. In September 2008, a contrary statement by retired Indian Air Marshal, Vinod Patney, projected that India's military reliance on space would increase and would have to be upgraded with defensive as well as offensive capabilities.⁶⁷

⁶⁷ Ibid.

INDIAN LAUNCH CAPABILITIES

Indian has developed a relatively successful launch program around indigenous launch vehicles, which include the SLV, the Augmented Satellite Launch Vehicle (ASLV), the Polar Satellite Launch Vehicle (PSLV), and the Geosynchronous Satellite Launch Vehicle (GSLV). The PSLV can launch a one-ton payload, which is significantly greater than that of the SLV and ASLV, and it was designed to place remote-sensing satellites into polar, sun-synchronous orbits. The PSLV is also a more adaptable launch vehicle that can accept minor modifications allowing for increased payloads such as the ten-satellite configuration of the April 28, 2008 launch and the Chandrayaan-1 lunar orbiter launch on October 22, 2008.⁶⁸

The GSLV is a multi-stage launch vehicle with a solid lower stage, liquid middle stage, and cryogenic upper stage and proves that India has joined the ranks of a few states that can successfully attain such a technological feat. Even though one of the GSLV operational launches ended in failure, the other successful test flights and launches of the GSLV Mark I ensured that India became one of six states capable of launching a 2.5 ton satellite into a geostationary orbit. By November 2007, ISRO had also successfully tested an indigenously developed cryogenic engine, which was the only stage of the GSLV that India had not mastered and is a critical component for launching heavy payloads into a geostationary orbit. Adding the cryogenic technology to its indigenous capabilities allows India to end its reliance on Russian cryogenic engines. The GSLV

⁶⁸ Secure World Foundation, "Indian Launch Capability." http://75.125.200.178/%7Eadmin23/index.php?id107&page=India_Launch (accessed June 26, 2009).

Mark III will have a payload capacity of four tons, uses the indigenously developed cryogenic engine and is the only Indian rocket that would support a manned space mission.⁶⁹

In 2007, India performed its first commercial launch of a foreign satellite. India provides launch services through its marketing subsidiary, the Antrix Corporation, Ltd. ISRO is building a reputation as a cost-effective and competitive launch provider and hopes to further expand its commercial launch services. Thus far the commercial launches have carried relatively small payloads. In part, the ISRO is developing the GSLV Mark III and a reusable launch vehicle in order to launch much heavier satellites. India must develop this capability if the Antrix Corporation, Ltd. is to compete with foreign commercial launch organizations that already launch heavy satellites.⁷⁰

India's launch capabilities include facilities at the Satish Dhawan Space Center (SDSC) on Sriharikota Island in the Bay of Bengal. The SDSC is also where solid propellant space boosters are produced and tested and where new facilities will produce the solid propellants for the GSLV Mark III. Launches are monitored from the Spacecraft Control Center at Bangalore using ISRO's Telemetry, Tracking & Command Network (ISTRAC). The ISTRAC ground stations in India are located at Bangalore, Lucknow, Port Blair, Sriharikota, and Thiruvananthapuram. There are also telemetry, tracking and command stations at Mauritius, India; Bearslake, Russia; Biak, Indonesia; and Brunei.⁷¹

⁶⁹ Ibid.

⁷⁰ Ibid.

⁷¹ Ibid.

INDIAN MILITARY SPACE PROGRAM

Cooperation between ISRO and the Defense Research and Development Organization (DRDO), the primary body developing space technologies for military applications, has been limited though there have been some notable efforts. India's ballistic missile program was a likely outgrowth of the space launch vehicle SLV projects. Some experts view U.S.–Indian cooperation on space technology as the opportunity India needs to acquire the technology and knowledge to build intercontinental ballistic missiles. However, Kartik Bommakanti of the Center for Defense in Washington points out that before India could begin to convert rocket technology into missiles the state would have to make a political decision. The technical challenges of turning an SLV into an ICBM would require decreasing the weight of the rocket to make it an accurate missile and that redesign would take time.⁷²

India does not have any satellites exclusively dedicated to military operations though some ISRO satellites are dual-use and can be used for either civilian or military applications. The Technology Experiment Satellite (TES), a one-meter high-resolution satellite, and the Cartosat-1, a 2.5-meter high-resolution satellite, could be used for military reconnaissance. The Indian government disputes reports that the Cartosat-2A satellite, which uses Israeli synthetic aperture radar technology, was dedicated for military purposes. The Indian defense minister announced in 2005 that a military space-based reconnaissance system was in the advanced stage of development and should be

⁷² Secure World Foundation, "Indian Military Space Activities." http://75.125.200.178/%7Eadmin23/index.php?id=108&page=India_Military (accessed June 26, 2009).

operational by 2007 though it has never been publicly announced that the system has become operational.⁷³

India is also aware of the need for a high-resolution, all-weather remote sensing capability because areas of interest to India are often cloud covered and of course this type of satellite would have dual-use applications. There have been unconfirmed reports that earlier India modified the mission of the Cartosat-1, a satellite intended for cartographic applications, in order to fill coverage lapses that were highlighted by Pakistan's 1998 Ghauri missile test.⁷⁴ In late spring 1999, an infiltration of insurgents into Kashmir was detected through non-space means. During the post-conflict analysis, imagery analysts from the Defense Image Processing Center reported that they did not get tactically useful information from the Indian Remote Sensing (IRS) program satellites during the conflict.⁷⁵ Natural events have also highlighted the need for this capability. In October 1999, a super-cyclone hit the coast of the Indian state of Orissa. India had to purchase SAR data from Canada's RADARSAT International because cloud cover over the area prevented the collection of current IRS data for the relief effort. ISRO used the RADARSAT data with archived IRS data to identify flooded areas and support the rescue workers' relief efforts.⁷⁶

India has cooperative agreements with several states, most importantly with Russia and Israel that provide access to sophisticated satellite technology for military purposes. As Russia's sole partner in the GLONASS global navigation satellite system,

⁷³ Ibid.

⁷⁴ Foster, 253.

⁷⁵ Ibid., 258.

⁷⁶ Ibid., 255.

India will participate in development, replenishment, and future use of the system; and the GLONASS satellites can be launched from India or Russia using either Indian or Russian launch vehicles. Military cooperation with Israel might give India satellite imagery for military purposes; however as is the case with cooperative efforts of this type, neither one of the states will confirm the details of the arrangement and India claims it is a commercial activity. For example, India successfully launched Israel's TecSAR satellite on January 21, 2008 and *The Times of India* reported that Israel will allow India access to some of the data sent back to ground stations. The TecSAR satellite has a resolution of 10 centimeters, a synthetic aperture radar, all-weather capability and is thought to augment Israel's ability to monitor Iran's nuclear program. Israel and India have cooperated on other space launches and those may also offer opportunities for India to share in the data collected. An agreement allowing India access to the Israeli Ofek-5 military remote-sensing satellite could provide India with images of areas of interest such as the Kashmir region or military facilities in Pakistan.⁷⁷

The Indian Air Force and Army have been the supposed origin of rumors that India would like to use the space environment for military purposes. As early as 2003, Indian military officials were making statements about India's plans for the military uses of space. The Indian Air Chief stated in October 2003 that India had already begun development of an operations command station, which could support a space platform for nuclear weapons. Under pressure from the civilian leadership, the Air Chief retracted his

⁷⁷ Secure World Foundation, "Indian Military Space Activities." Also Haaretz Newspaper, "ANALYSIS: New Israeli spy satellite sends Iran a message," January 21, 2008, <http://www.haaretz.com/hasen/spages/946765.html> (accessed January 15, 2010).

statement within days of making it. In January 2007, another Air Chief stated that India would establish an aerospace command to protect the country's space-based assets. The Chief of Staff of the Indian Army said in June 2008 that India must optimize space applications for military purposes and establish a military space program in order to defend itself against threats such as anti-satellite weaponry. Indian military officials seem particularly concerned about Chinese capabilities and specifically cite these as a reason to develop Indian space capabilities.⁷⁸

INDIAN ARMS CONTROL ACTIVITIES

Official statements by the government of India have consistently emphasized India's commitment to preventing an arms race in space. In addition, India is a signatory to several agreements of cooperation in the peaceful uses of outer space. India is also collaborating with other states or has plans to cooperate with other states on peaceful space efforts. India and Israel signed an umbrella agreement in 2002 that provides for cooperation in the peaceful uses of space, but all the details of that agreement have not been finalized. India and Brazil also signed a framework agreement for cooperation in peaceful outer space activities. India and the United States discussed expanding civilian space cooperation after the NSSP initiative was introduced in 2004. However, officials from the Indian Army stated in 2008 that India must develop its space capabilities for defensive military purposes. Once again they cited China's expanding space capabilities as the reason for this assessment. Contrary to its public position on arms control in space, India will violate its commitments to avoid the weaponization of space if it takes concrete

⁷⁸ Ibid.

steps to augment its military capabilities in space by testing anti-satellite weaponry or similar capabilities.⁷⁹

SPECIFIC REMOTE SENSING INFORMATION

India's initial remote sensing efforts were conducted from balloons and aircraft, but by the early 1970s there was significant interest in mapping the country's natural resources using space-based assets. The ISRO conducted extensive experiments using data from foreign space assets. The foreign imagery was essential to India's early remote sensing research. It was used to augment land classification and utilization efforts, geological feature mapping, geographical classification, water surveys, and weather monitoring activities. The use of this foreign data allowed India to gain critical experience in the art of multispectral data fusion and analysis.⁸⁰

The ISRO also took advantage of using borrowed space systems such as the ATS-6 in 1975 and 1976 to conduct the Satellite Instructional Television Experiment (SITE) Program. The SITE Program was designed to demonstrate the efficacy of satellite-broadcast television as a development medium to reach remote, infrastructure-poor areas of the country. During the year-long experiment, educational television programs were broadcast to 2,400 remote villages using ISRO provided equipment, including ruggedized community-viewing television sets for direct reception of the programs. The success of this experiment highlighted the role satellite capabilities could play in the national development effort. This experiment and follow-on communications experiments

⁷⁹ Secure World Foundation, "Indian Arms Control Activities." http://75.125.200.178/%7Eadmin23/index.php?id=109&page=India_Arms_Control (accessed June 26, 2009).

⁸⁰ Foster, 249–251.

allowed ISRO to gain valuable technical expertise and provided essential contributions to the requirements definition process for India's multipurpose communication and weather satellites, the Indian National Satellite (INSAT) series. During these experiments ISRO gained invaluable experience that would later aid them in the development and management of imagery sensors.⁸¹

The Government of India states that the development and application of space science and technology is for the socio-economic benefit of the country. India's foray into space initially began with the establishment of the INCOSPAR in 1962. Considerable progress was made during the next decade including the start of the TERLS in 1962, institutionalizing the Indian space program in November 1969 with the formation of the ISRO, the constitution of the Space Commission and the establishment of the Department of Space (DOS) in June 1979, and the subordination of the ISRO under the DOS in September 1972.⁸²

The Space Commission is responsible for formulating the policies and overseeing the implementation of the Indian space program. The DOS, in turn, implements the program primarily through the ISRO, the National Remote Sensing Agency (NRSA), the Physical Research Laboratory (PRL), the National Atmospheric Research Laboratory (NARL), the North Eastern-Space Applications Centre (NE-SAC) and the Semi-Conductor Laboratory (SCL). There are three national level committees that coordinate the establishment of space systems and their applications. The Antrix Corporation was

⁸¹ Ibid.

⁸² Indian Space Research Organization, "Organization." <http://www.isro.org/rep2008/citizens.htm#> (accessed January 13, 2009).

established in 1992 and is a government owned company, which markets the space products and services.⁸³

The NRSA was established in 1975 under the auspices of the Department of Science and Technology. The primary purpose of this organization is to take advantage of remote sensing technology and techniques for the survey, planning, and management of India's natural resources. The NRSA also serves as ISRO's liaison with the users of remote sensing products. The ISRO accomplished a broad range of objectives through the NRSA. The NRSA continued remote sensing experimentation focused on renewable and nonrenewable resources in order to meet the ISRO goal to establish a signature database of crops and earth-surface features in the visible and infrared spectra. NRSA continued to use foreign data in their imagery products and a downlink station was established near Hyderabad to facilitate the receipt, processing, and integration of the foreign data.⁸⁴

The ISRO began the Joint Experiments Program (JEP) in 1979 to educate the ministries, state governments, and national agencies involved in natural resource survey and management. The objective was to demonstrate the potential uses of remote sensing techniques for natural resource survey and management efforts. In turn the ministries, state government, and national agencies provided their comments and reactions, which helped the ISRO to define performance requirements for the IRS-1A sensor suite. In 1980, there was a reorganization that transferred the NRSA from the Department of Science and Technology to the DOS. The importance of this reorganization was that it

⁸³ Ibid.

⁸⁴ Foster, 251.

put remote sensing activities under one organization and resulted in more effective management of financial resources and coordination of products.⁸⁵

This bureaucratic reorganization also made the DOS the central point of contact for potential users of remote sensing data, which would prove to make remote sensing data and products more accessible. By 1985, the growing demand for remote sensing products and the desire to generate additional awareness of remote sensing products demanded another organizational change. The ISRO established the National Natural Resources Management System (NNRMS) to facilitate the use of remote sensing data for resource management and to train the necessary personnel to integrate remote sensing data with other types of data used in resource management. The NNRMS program greatly expanded the reach of the ISRO by establishing five regional remote sensing service centers (RRSSC) dispersed across India and linked to the NRSA's data center (NDC) near Hyderabad. The NNRMS was led by the DOS but was jointly funded by the DOS, the Department of Science and Technology, the Geological Survey of India, the Department of Mines, the Indian Council of Agricultural Research, and the Oil and Natural Gas Commission.⁸⁶

The investment by this group of national government entities shows that the Indian government was clearly dedicated to the use of remote sensing assets. The Integrated Mission for Sustainable Development (IMSD), initiated in 1992, brought the benefits of remote sensing to the local level. IMSD brought NRSA, universities, local entities, private entrepreneurs, and nongovernmental organizations together in

⁸⁵ Ibid.

⁸⁶ Ibid, 251–252.

collaborative efforts to achieve sustainable development goals using locale-specific action plans. Additional support at the local level is provided by RRSSC managed state Remote Sensing Applications Centers that assist local agents to integrate satellite remote sensing data with socioeconomic data.⁸⁷

In addition to the basic goal of creating a space-based architecture, the ISRO had more ambitious goals. India, ever conscience of being self-reliant, also wanted to develop the supporting launch and satellite control infrastructure. Carefully planned remote sensing experimentation contributed to all of these goals. The experimental Satellite for Earth Observations (SEO) program was the initial step toward satellite development and resulted in the Bhaskara-I satellite, launched in 1979, and the Bhaskara-II satellite, launched in 1981. These first Indian satellites had 1-km resolution television cameras and microwave radiometers that provided data to support hydrology, forestry, and meteorology applications. India relied on foreign suppliers for some of the onboard sensors (cameras), and depended on the former Soviet Union for launch assistance.⁸⁸

The importance of the experimental SEO program to the later success of the Indian Remote Sensing Satellite (IRS) program cannot be overstated. However the goals of the IRS program were very ambitious and proved to be a greater challenge than anticipated. India planned to develop and deploy a fully integrated spacecraft with a three-year on-orbit life and construct data-product facilities to ensure user access to the satellite data; and India planned to do this within the span of approximately four years.

⁸⁷ Ibid.

⁸⁸ Ibid., 252.

The launch of the IRS-1A was originally planned for 1984, but did not occur until 1988 and the IRS-1B followed several years later. The early disappointment was overcome and India began to produce significant improvements with each successive satellite. The IRS-1C had a panchromatic camera with a 5.8M resolution. The IRS-D had an on-board data recorder that enabled the satellite to image sections of the earth outside the range of the satellite downlink stations which increased the coverage area and improved India's potential to generate income from the sale of data products. The initial IRS satellite series was followed with the P series, a lower-cost application-specific satellite series with fast turnarounds from design to launch. The IRS-P4, designed specifically for surveying ocean resources and the first Indian satellite of its kind, was launched in 1999. In twenty relatively short years, the Indian satellite development program had made tremendous strides toward its overall goals.⁸⁹

DOS established Antrix, Ltd. in 1992 to market Indian space products and space services abroad now that India's space program was sufficiently mature to support a commercial enterprise. By 1994, Antrix, Ltd. had successfully negotiated an agreement with EOSAT, a U.S. company, to market IRS imagery products globally; and in 1997 Antrix renegotiated the contract with Space Imaging after the Space Imaging Group purchased EOSAT. Ground stations that receive IRS data are located worldwide and work with Indian-supplied hardware.⁹⁰

Within India the central point of contact for distribution of remote sensing data products is the NRSA's NDC. The NRSA not only maintains the downlinks for IRS

⁸⁹ Ibid., 253.

⁹⁰ Ibid., 256.

data, but also maintains downlink terminals for many foreign remote sensing sources. The NRSA is able to effectively act as the central dissemination point for all satellite imagery and enforce the data control policies established by India's Ministry of Defense (MOD). NRSA also restricts the availability of geographical imagery and applies these restrictions to an 80-km belt along border areas and coastal zones. These restrictions include gravity maps, high-resolution maps of geological formations and rocks, and topographical maps of Jammu and Kashmir.⁹¹

The distribution of images showing military facilities is prohibited. The NRSA has confirmed that IRS imagery products are altered to "erase" military installations, nuclear facilities, and other areas sensitive to national security. It was reported by an official of the Geological Society of India, the government's official mapmaker, that security restrictions prevent public release of maps covering more than 60% of the Indian land mass. These restrictions apply to users inside and outside of India. The bureaucratic process for obtaining access to this information is reported to require a minimum of fifteen stages of negotiations and requests.⁹²

India's space budget is approximately \$500 million, however this is the estimated amount of funding received by the ISRO. It is unclear how much of this money, if any, is used for other purposes. India's space program focuses largely on scientific and commercial uses. The military has no dedicated satellites for exclusive operations, however certain satellites such as the high-resolution TES are dual-use and therefore

⁹¹ Ibid., 255.

⁹² Ibid.

could be used for civilian and military applications.⁹³ The ISRO launched the one-meter TES in 2001, making it the only civilian space agency to possess this technology beside the American, privately owned Ikonos satellite. When TES was launched, India released statements that said the satellite was meant for “civilian use consistent with our security concerns,” however, in 2002 defense sources in India referred to TES as a spy satellite. India followed the launch of TES with Resourcesat-1, another dual-use capable satellite, which is considered a very sophisticated remote sensing satellite. Additional dual-use developments continued to expand the Indian space inventory and in September 2005, the Indian defense minister announced a forthcoming military space-based reconnaissance system.⁹⁴ There is little doubt that security is of the highest concern to India, particularly with a nuclear capable neighbor with whom it is in almost constant conflict. The ability to monitor Pakistan’s military capabilities is most certainly a primary objective for India’s current and future remote sensing program. General Depak Kapoor, the Indian Army Chief of Staff, has publicly confirmed that India’s imagery satellite capability is now critical to the nation’s early warning capability with regards to both Pakistan and China.⁹⁵

The Government of India proudly claims the largest constellation of remote sensing satellites, which are providing services at the national and global levels.⁹⁶ The Indian national space program, including its remote sensing assets, is supported by a

⁹³ James Martin Center for Nonproliferation Studies, “Current and Future Space Security: India.” <http://cns.miis.edu/research/space/india/index.htm> (accessed December 19, 2008).

⁹⁴ James Martin Center for Nonproliferation Studies, “Current and Future Space Security: India, Military Programs.” <http://cns.miis.edu/research/space/india/mil.htm> (accessed December 19, 2008).

⁹⁵ Brookings Institution.

⁹⁶ National Portal of India, “Indian Remote Sensing Satellite System.” http://india.gov.in/sectors/science/indian_remote.php (accessed January 13, 2009).

number of institutions representing government at all levels, research and academic institutions, professional societies, and industry. Recently, the Government of India has been committed to increasing the societal application and services of its space assets for the general population through academic institutions and universities and hospitals. The Indian space program has continued to grow and now reaches most levels of Indian society in some way. At the lowest level is a new concept, the Village Resource Centre, which provides information on natural resources, land and water resources management, tele-medicine, tele-education, adult education, vocational training, and health and family welfare programs. At least 335 VRCs have been established in the country to date.⁹⁷

India is also developing capacity building and public awareness to position itself for the future and build support.⁹⁸ In order to meet the growing demands of the space program, the DOS established the Indian Institute of Space Science and Technology (IIST) in 2007. The Institute offers high quality education in space science and technology, including a Bachelors degree in Space Technology with specialization in avionics and aerospace engineering, and an Integrated Masters degree in Applied Sciences with special emphasis on space related subjects.⁹⁹ India is actively creating awareness among the general public about the benefits to society from the application driven space program and the government has given “utmost importance” to awareness of

⁹⁷ Indian Space Research Organization, “Organization.”

⁹⁸ Indian Space Research Organization, “Introduction.” <http://www.isro.org/rep2008/citizens.htm> (accessed January 13, 2009).

⁹⁹ Indian Space Research Organization, “Introduction: Indian Institute of Space Science and Technology.” <http://www.isro.org/rep2008/citizens.htm> (accessed January 13, 2009).

the country's progress in space technology. The Indian space program has also participated in international events abroad to increase awareness.¹⁰⁰

The Government of India claims that it is committed to ensuring transparency. In support of these claims the DOS implemented the Right to Information Act 2005, for stage one appeals, by identifying the appropriate public offices responsible for responding to requests and publishing the requisite information on the worldwide web.¹⁰¹

The DOS also states that its commitments include, among others, “carrying out research and development in satellite and launch vehicle technology with a goal to achieve self reliance” and “provide satellite imagery required for the natural resources survey and security needs of the country.”¹⁰² However there is little doubt that in India security will always override transparency in decisions about distribution of remote sensing data.

India's remote sensing program was established to manage its natural resources, particularly facilitating sustainable development and for much of its history has progressed with that as the primary goal. However, remote sensing applications are becoming more important to India as its security position as a nuclear weapons power and its increased interests beyond its borders change the state's situation and focus.

The importance of space capabilities in recent conflicts, such as the Gulf Wars and the Bosnian and Kosovo operations, has not been lost on the Indian military and civilian leaders. The 1999 Kargil infiltration was a humiliation for the Indian military

¹⁰⁰ Indian Space Research Organization, “Introduction: Public Awareness on Space Programme.” <http://www.isro.org/rep2008/citizens.htm#> (accessed January 13, 2009).

¹⁰¹ Indian Space Research Organization, “Introduction: Right to Information–Ensuring Transparency.” <http://www.isro.org/rep2008/citizens.htm#> (accessed January 13, 2009).

¹⁰² Indian Space Research Organization, “Citizens' Charter of Department of Space.” <http://www.isro.org/rep2008/citizens.htm> (January 13, 2009).

establishment and highlighted the failure of their space constellation to support military operations. Collectively these events support the military proponents' that want to integrate current space assets into military operations and develop military-specific systems. India has traditionally been uncomfortable with transparency. Government leaders often appear to be more concerned about restricting access to information than using that information to support both military and civilian operations. There is even a culture of mistrust between the civilian strategic planning apparatus and the military.¹⁰³

Since the early 1990s, India capitalized on its remote sensing capabilities by providing 5.8-meter resolution imagery, the highest-resolution panchromatic imagery that was regularly available in the commercial market. India maintained this position until September 1999 when Space Imaging Corporation launched its IKONOS satellite that collects images at a one-meter panchromatic resolution.¹⁰⁴

¹⁰³ Foster, 259.

¹⁰⁴ Ibid., 248.

Chapter IV

Case Studies:

The People's Republic of China
and the Russian Federation

INTRODUCTION TO THE PEOPLE'S REPUBLIC OF CHINA AND THE RUSSIAN FEDERATION

On any list prioritizing space-faring countries by their accomplishments China and Russia are in the top three. China and Russia, along with the United States, are the only three countries that have successfully sent humans into space using their own indigenous launchers and spacecraft. They have technologically advanced space programs that include a full range of space activities and a stable of satellites, launchers, and spacecraft that represent the peak of space technology to date. Both countries have a history of political and military opposition with the United States and both countries have their sights set squarely on the United States as the country to emulate and overtake.

China and Russia acknowledge the accomplishments of other space faring countries and often collaborate with them when cooperative efforts further their own objectives. Sometimes these cooperative efforts are long-term and extensive. For example, China's CBERS program with Brazil is such an effort as are Russia's cooperative efforts with India, the United States and the ESA, which allowed the economically challenged country to continue operating the MIR space station after the Soviet collapse.

Russia inherited much from the Soviet Union, including the legacy of being the first space-faring country. For the purposes of this investigation, references to the Russian space program include all of the history and accomplishments of its Soviet predecessor. Russia has had decades of close competition with the United States in many

areas of science and technology, particularly space and nuclear programs. The Soviet Union was the first to launch a satellite into space, the first to launch a live animal into space, and the first to launch a human into space; and then it set its sights on the moon and for a time continued to lead the space race. However, when it became obvious that the U.S. would win the ultimate prize of putting a man on the moon, the Soviet Union refocused its space program on a space station. Just as in space, the Soviet Union led the arms race in the early years of ICBM development. When the United States perfected its own ICBM the Soviet lead fell away, and from that point on, the countries' nuclear forces were roughly balanced until the end of the Cold War.¹

Post-Cold War Russia and the United States compete and cooperate in many areas such as commercial enterprises and scientific endeavors, including space programs. Though Russia may now appear to be less threatening to the United States, U.S. government assessments still consider offensive forces to be the cornerstone of Russia's military power. Russia's political position in the world order, its offensive military capabilities and extraordinary achievements in space continue to make it a challenging competitor for the United States, China and other space faring countries. However, Russia is facing serious problems such as a declining birth rate, an education system that is out of sync with the country's needs, and the effects of a worldwide economic crisis—all of which make maintaining its current place among space faring countries and in the world order a daunting challenge.²

¹ Central Intelligence Agency, "The Dawn of the Space Age."

² Central Intelligence Agency, "Foreign Missile Developments and the Ballistic Missile Threat," Statement for the Record to the Senate Foreign Relations Committee on Foreign Missile Threat to the United States Through 2015 by Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs,

Along with Russia, China is one of five countries assessed to have or most likely to develop ICBMs capable of threatening the United States in the near term. Of course, China's remarkable achievements in space have relied on the same technological advances in rocketry that make it possible for China to threaten the United States with an ICBM. Though China is rapidly catching up with the United States and Russia in terms of military offensive capability and achievements in space, it still exhibits some of the self-consciousness of a developing nation that wants to be taken seriously by the advanced countries of the world. On the other hand, some countries—perhaps even China itself—believes that it is only a matter of time until Western domination of the globe will cease and Asia, led by China, will “rule” the world. To prepare for that time China is aggressively investing in science and technology while simultaneously entering the world's economic system on its own terms. However, not everyone agrees that the rise of the East is the inevitable outcome. Since World War II, sustained rapid economic growth and major advances in science and technology have increased Asia's economic output and military capabilities. There are still a few strong voices that say it is an exaggeration to predict that Asia's rise will lead to China's emergence as the predominant global power. These experts believe that Asia's rise may lead to a multipolar world in which China is a great power, but it is unlikely to result in another unipolar world with China as the hegemon.³

September 16, 1999. <https://www.cia.gov/news-information/speeches-testimony/1999/walpole.htm> (accessed July 27, 2009).

³ Minxin Pei, “Think Again: Asia's Rise,” *Foreign Policy* (June 22, 2009), http://www.foreignpolicy.com/articles/2009/06/22/think_again_asias_rise (accessed June 26, 2009).

Waltz points out that theory makes it possible to know that a new balance of power will form, but not when it will form, or precisely the role each state will play in the new order. However, it is possible to identify the most likely candidates for leading positions in a newly balanced international environment. Waltz states that the movement from unipolarity to multipolarity is all-but-inevitable and it is taking place in Asia with China and Japan rising to assume their new positions. He predicts that China will have the greater long-term potential; however Japan's ability to produce the most technologically advanced weaponry coupled with one of the world's largest defense budgets makes it closer to great power status. China and Japan worry about the progress of each other toward great power status. According to Waltz, the interaction among China and Japan as well as other states in the region is creating a new balance of power in East Asia. He concludes that with or without American participation this new East Asian balance of power is becoming part of the new balance of power in the world.⁴

Though China and Russia were allies who planned to spread the Communist influence across the globe, there were, in fact, basic issues of incompatible national and party interests between the two major communist states. There were also significant territorial disputes that contributed to their discord. In addition, the Soviet Communist Party had treated the Chinese Communist Party in a disdainful manner over the years with disastrous consequences and that subordinating manner became intolerable to the Chinese. This relationship has gone through many stages since 1950. First China was an uneasy junior partner of the senior Communist state, then it was an enemy of the USSR,

⁴ Kenneth N. Waltz, "Structural Realism after the Cold War," *International Security* 25, no.1 (Summer, 2000), 30-36. <http://libraries.cua.edu> (accessed March 8, 2009).

and now it is an emerging power with seemingly unlimited potential that is cooperating with the new Russia. Though this latest arrangement benefits both states, it is unlikely that they will become formal allies again. However, they have jointly pledged to reduce the United States' influence in the world and they remain the two great powers that could seriously challenge U.S. security in the future.⁵

⁵ Ibid. Also: Harold P. Ford, "Calling the Sino-Soviet Split," Central Intelligence Agency. <https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/docs/v42i5a05p.html> (accessed August 24, 2009).

CASE 5: THE PEOPLE'S REPUBLIC OF CHINA

BACKGROUND INFORMATION ON THE PEOPLE'S REPUBLIC OF CHINA

The People's Republic of China (P.R.C.) is a Communist party-led state founded in 1949 whose initial government was based on the Soviet model. However, in 1958 the Soviet model was abandoned and China struggled through a number of government experiments, often with disastrous consequences, until a more pragmatic leadership was installed and the current constitution was put in place in 1982.⁶

Since its establishment China has worked vigorously to win international support for its claim that it is the sole legitimate government of all China, including Hong Kong, Macau, and Taiwan. Beijing was recognized diplomatically by most world powers in the early 1970s. In 1971, Beijing assumed the United Nations' China seat and has since become increasingly active in multilateral organizations. Japan established diplomatic relations with China in 1972 and the United States followed in 1979. Many countries reduced their diplomatic contacts with China as well as their economic assistance programs in June 1989 immediately after the Tiananmen crackdown. In response, China worked diligently to reestablish its lost diplomatic relations, and by late 1990, had succeeded with almost all nations. China also opened diplomatic relations with the republics of the former Soviet Union after the collapse of the USSR in late 1991. By

⁶ U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China, October 2008." <http://www.state.gov/r/pa/ei/bgn/18902.htm> (accessed January 2, 2009).

March 2008, twenty-three countries retained relations with Taiwan while 171 had established diplomatic relations with Beijing.⁷

China is the world's most populous country with over 1.3 billion (July, 2007 estimate) and an estimated growth rate of about 0.6%, while it geographically covers about 3.7 million square miles. China's population growth is a concern and China has attempted, with mixed results, to implement a very strict birth limitation policy. Citizens receive nine years of compulsory education resulting in a current literacy rate of 90.9%. The infant mortality rate is 22.12 per 1000 and the overall life expectancy rate is 72.88 years.⁸

Initially, the foreign policy of the P.R.C. focused on solidarity with the Soviet Union and other communist countries. For example, in 1950 China sent the People's Liberation Army into North Korea to help North Korea halt the UN offensive that was approaching the Yalu River. However after the conclusion of the Korean conflict, China worked specifically to balance its identification as a member of the Soviet bloc and initially did this by establishing friendly relations with Pakistan and other Third World countries, particularly in Southeast Asia.⁹

During the 1960s, Beijing competed with Moscow for political influence among communist parties and the developing world. China consistently maintained its opposition to "superpower hegemony," and focused almost exclusively on the expansionist actions of the Soviet Union and the Soviet proxies, Vietnam and Cuba.

⁷ Kegley, 165. Also U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

⁸ Ibid., 120.

⁹ U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

During this time, China also placed growing emphasis on a foreign policy independent of the Soviet Union and the United States. China continued to improve ties with the West, but also attempted to closely follow economic and other positions of the Third World nonaligned movement even though China was not a formal member.¹⁰

In recent years, China has sought a higher profile in the UN through its permanent seat on the United Nations Security Council and other multilateral organizations. As a result, Chinese leaders have been regular travelers to all parts of the globe. China has also worked to reduce tensions in Asia by hosting the Six-Party Talks on North Korea's nuclear weapons program, cultivating a more cooperative relationship with members of the Association of Southeast Asian Nations (ASEAN), and participating in the ASEAN Regional Forum.¹¹

In addition, China has made an effort to improve other relationships. For example, China is seeking closer ties with countries in South Asia, including India. China has likewise improved ties with Russia, playing a prominent role in the Shanghai Cooperation Organization (SCO), which is a regional grouping that includes Russia and the Central Asian nations of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan.¹²

Although disagreements remain over islands in the South China Sea, China has resolved many of its border and maritime disputes. In November 1997, China and Russia concluded an agreement that resolved most of their outstanding border issues. China and Vietnam signed an agreement in 2000 that resolved differences over their maritime

¹⁰ Ibid.

¹¹ Kegley, 165; and U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

¹² Kegley, 478–479.

border though the two states continue to have disagreements over islands in the South China Sea. Though relations between China and Japan remain cautious they have improved during Prime Minister Fukuda's term in office. However, the historical and competing claims to portions of the East China Sea are still a source of tension.¹³

U.S. and Chinese relations started to unravel when the People's Liberation Army (PLA) completed the communist conquest of China in 1949. The American Embassy followed the Nationalist government, which finally settled in Taipei, and the remaining U.S. consular officials in mainland China were met with hostility. By 1950 all U.S. personnel were withdrawn from the Chinese mainland and any hope of normalizing relations ended when the U.S. and Chinese communist forces fought on opposing sides in the Korean conflict. Between 1954 and 1970, China and the U.S. held 136 ambassadorial level meetings. In 1969, the U.S. began to relax trade restrictions and other impediments to bilateral contact. Dr. Henry Kissinger, Assistant for National Security Affairs, made a secret trip to China in 1971 that resulted in an invitation for President Nixon to visit China. The U.S. President's 1972 visit to China ended with the U.S. and Chinese governments issuing the "Shanghai Communiqué," a statement of their foreign policy views and a pledge to work toward full normalization of diplomatic relations. The U.S. acknowledged that all Chinese agree there is only one China and that Taiwan is part of China, setting aside the crucial question of China and opening trade and other contacts. In 1973, the U.S. established the United States Liaison Office (USLO) in Beijing and China

¹³ U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

established an equivalent office in Washington, D.C.; and the countries finally established diplomatic relations in 1979.¹⁴

Since 1979, China has reformed and opened its economy, resulting in the largest reduction of poverty and one of the fastest increases in income levels ever seen. Beijing has adopted a more pragmatic perspective on many political and socioeconomic problems, and reduced the role of ideology in economic policy. The market-oriented reforms China implemented during the past two decades unleashed individual initiative and entrepreneurship with a profound impact not only on China but on the world.¹⁵

China's (exchange rate-based) GDP in 2007 was \$3.249 trillion. China is one of the largest producers and consumers of agricultural products though agriculture contributes only 13% of China's GDP. Industry and construction now account for about 46% of China's GDP, and China has become a preferred destination for global manufacturing facilities. Though China's economy has expanded rapidly, its regulatory environment has not kept pace and the growth of new businesses has outpaced the government's ability to regulate them. This has created a situation where businesses, faced with mounting competition and poor oversight take drastic measures to increase profit margins and risk consumer safety. This issue gained worldwide attention in 2007. In fact, Beijing recently concluded that up to 20% of the country's products are

¹⁴ Kegley, 478–479. Also U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

¹⁵ Kegley, 121. Also U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

substandard or tainted and is undertaking efforts in coordination with the United States and others to better regulate the problem.¹⁶

China's demand for energy has surged rapidly as its economy has grown. In 2003, China's energy requirements surpassed those of Japan making China the second-largest consumer of primary energy, after the United States. Increased pollution and degradation of natural resources are serious negative consequences of China's rapid industrial development. Analysts estimate that by 2008, China had surpassed the United States as the world's largest emitter of carbon dioxide and other greenhouse gases. China has severe environmental problems and the leadership is beginning to address those problems. For example, in 1998 the State Environmental Protection Administration (SEPA) became a ministry-level agency reflecting the growing importance placed on environmental protection. Recently, the Government of China has strengthened environmental legislation and has begun to make some progress in stemming environmental deterioration.¹⁷

Using the "great power status test" that judges whether a state is powerful to the degree that it is a valued friend or feared foe, one can conclude that China has been a potential power for some time. There are five areas that can be observed to arrive at this conclusion. These areas are economic growth, technological base, a sufficiently sized and skilled workforce, a modern military force, and national leadership.¹⁸

¹⁶ U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China."

¹⁷ Ibid.

¹⁸ "The Outlook for China," Remarks by John C. Gannon, Chairman, National Intelligence Council to the World Affairs Council, Albright College, Reading, Pennsylvania, December 1, 1998. https://www.cia.gov/news-information/speeches-testimony/1998/nic_speech-120198.html (accessed August 24, 2009).

China's economy has been growing faster than any other major economy. It is expected to surpass the United States in GDP at some point. Aggressive steps to overcome the boom-bust cycle resulting from Deng Xiaoping's reforms have also accompanied this rapid growth. Economic stability is important to China's social stability as well as Asia's economic health. Therefore it was important for China to deal with its troubled state enterprise sector. Part of the solution has been to establish laws that will strengthen the performance of the most important state enterprises while instituting ownership reform in others.¹⁹

The evolving economic structure in China has a direct impact on the second element of national power, the technological base. China's scientific and technological capabilities are rapidly growing. The evidence for this is visible in the composition of its exports, which include fiber optics and semiconductors not just tourist trinkets. This nation of peasant farmers is aggressively becoming a nation that commands respect among the technologically advanced nations of the world. China has deliberately planned for their space program to be the centerpiece of their technological progress.²⁰

The Chinese workforce, though primarily agriculturally based, is also energetic, extremely motivated, and has demonstrated a talent for business. They value education, so much so, that it is considered an obligation to succeed academically. Chinese culture has a tradition of sacrifice and respect for authority. In exchange for the government maintaining order locally and protecting China's interests globally, the population has traditionally asked little of Beijing. This understanding between government and

¹⁹ Ibid.

²⁰ Ibid.

population has been an important key to the dramatic and thus-far successful transformation from agricultural nation to a technologically advancing nation. The government called upon the people to support this technological evolution by pursuing education and careers in non-traditional fields. Especially in the early years of this transformation, it required leaving China and obtaining technical degrees at foreign universities. Their dutiful response has allowed China to develop and grow several indigenous technologically advanced sectors, including portions of the space program.²¹

The modernization of China's military in the post-Cold War era, has few rivals. China has concentrated its efforts on defending its strategic perimeter out to the first island chain off of its vast coastline by building its force-projection capabilities. China no longer looks inward relying on Mao's strategy of "luring the enemy in deep and drowning him in the sea of the people's war." To the contrary, China is developing and acquiring the military capabilities necessary to carry out an active defense beyond its borders. For example, China has purchased modern aircraft and missiles from the states of the former Soviet Union. But more important in the long term is the pace and success of China's indigenous capabilities. These include aircraft, naval systems, and for the purposes of this study, space capabilities. China has improved and expanded its strategic forces, including developing missiles that can launch warheads or satellites. This is also evidence of China's improved economy that can support this sort of investment, as well

²¹ Ibid.

as the advanced technological base and educated work force that can support military research and development in advanced technical applications.²²

However, these changes in China's military go beyond the acquisition and development of equipment and operational capability. China has also experienced an evolution in military doctrine. According to John Gannon, the Chairman of the National Intelligence Council, in the 1996 Taiwan Straits exercise China exhibited a level of sophistication and integration that had not been seen before in using its most advanced military hardware. This heavily scripted exercise demonstrated the necessary skills to effectively use the advanced hardware. It also demonstrated China's willingness to use intimidation and force to achieve political goals, which in this instance was to send a strong message to Taiwan about the efforts to raise its international profile. He also stated that China is learning quickly how to integrate sophisticated weaponry, including space based assets, with political coercion, which is an important skill for a state that seeks great power status and goes to the heart of this study.²³

However, there is disagreement about whether China successfully conducted a coercive campaign during the 1996 Taiwan Straits exercise. Wallace Thies and Patrick Bratton state that China was largely unsuccessful in coercing Taipei and Washington during this military exercise. In fact, they concluded that China's policy and actions likely strengthened the relationship between Taiwan and the U.S. and also between the

²² Ibid.

²³ Ibid.

U.S. and Japan. However, this apparent lack of success to achieve political goals through intimidation does not lessen the actual threat that China poses to Taiwan.²⁴

The fifth element, Chinese leadership, has also evolved in recent years. Since Deng Xiaoping, the Chinese leadership has been younger, better-educated and more technically competent than its predecessors. This group takes great pride in China's recent accomplishments; however it is also wary of the social forces that have been unleashed in the process. Memories of the social chaos of the Cultural Revolution remain just below the surface and create a cautious approach to policymaking. Additionally, the de facto death of Marxism as an ideology encourages this group to rely more on nationalist appeals for popular support, which serves to unnerve China's neighbors.²⁵

China scholars argue that China is a major regional power and not a "status quo power." They point out that the real questions focus on how big a power China will be and how it will use its power. Beijing wants recognition from the international community and it also wants change, but more importantly it wants to participate in making the rules, especially on matters of global trade and proliferation and arms control. Above all China wants respect. Beijing believes that the unequal treatment it continues to experience is in part because of U.S. intervention. China experienced a long civil war, one that is not over, and one where foreign powers denied them their rights of sovereignty on their own soil. China clearly remembers brutal Japanese invaders, the fact

²⁴ Wallace J. Thies and Patrick C. Bratton, "When Governments Collide in the Taiwan Strait," *The Journal of Strategic Studies* 27, no. 4 (December 2004), 556-584. <http://libraries.cua.edu> (accessed December, 31, 2009).

²⁵ "The Outlook for China."

that Stalin sacrificed their interests for his domestic political needs, and the consequences of international isolation.²⁶

The modern day Chinese leadership feels that they, as well as their predecessors, have been humiliated at the hands of the West. This slight cannot be underestimated as a factor in the Chinese intensity to acquire those things that will bring recognition and respect. Chinese scholars can attest to the fact that the Chinese time horizon is exceptionally long as compared to the Western time horizon. In fact, even modern Chinese think in terms of centuries and dynasties rather than years or decades. For example, Kissinger asked Zhou Enlai for his views on the French Revolution and he replied, "It is too soon to tell."²⁷

The Chinese leadership is very proud of their ancient civilization, aware of their history, and sometimes wary of the United States' global reach and popular culture that has "infected" much of the globe. China bristles at the United States supportive relationships with Taiwan and Japan, and its criticism of China's human rights record, proliferation policies and trade surpluses. Some Chinese political leaders interpret these actions as an effort by the United States to contain China. Though China may have ambivalent feelings about the United States, it also recognizes that a peaceful East Asia is critical for continued economic development of the area. In addition, China does recognize the vital role that U.S. forces play in guaranteeing peace in the region. However, Beijing believes that the role of peacekeeper in the region is rightfully theirs. Some elements of the leadership and especially the military see the United States as the

²⁶ Ibid.

²⁷ Ibid.

main obstacle preventing Beijing from resuming its historical place as the paramount power in Asia.²⁸

The relationship between the United States and China is not one of constant conflict. U.S. interests and Chinese interests are parallel in many areas and the two states have productive, successful ventures in many activities. U.S. leadership recognizes that a stable, secure China is critical for regional peace and is in the best interest of the United States. Of course, the relationship between the two powers is somewhat dependent on the relationship that China develops with its neighbors because they must be comfortable with one another for regional peace to be lasting. There is no doubt that China represents a major foreign policy challenge for the United States, but it also represents a major challenge for the international community. China is no longer an isolated giant.²⁹

Economically China is addressing major challenges. It continues to transition its antiquated, marginal state-owned enterprises, increase its ability to produce energy, replace inadequate transportation and communication systems, and retrain a huge underemployed agricultural work force. The reversion of Hong Kong to Chinese rule was extremely important to China and was considered an important symbol of China's reemergence as a world leader. In addition to the symbolic victory, the economic value of Hong Kong to China cannot be overestimated.³⁰

²⁸ Ibid.

²⁹ Ibid.

³⁰ Central Intelligence Agency, "Current and Projected National Security Threats," Statement by Acting Director of Central Intelligence, George J. Tenet Before the Senate Select Committee on Intelligence Hearing on Current and Projected Security Threats to the United States, February 5, 1997. www.cia.gov/news-information/speeches-testimony/1997/dci_testimony.020597.html (accessed August 24, 2009).

China has the potential to become the first new great power since World War II. China, with one-fifth of the world's population, also has the world's largest standing army. This emerging great power continues to modernize its military despite a number of economic and technical challenges. Beijing has difficulty raising revenues from some of its relatively autonomous provinces at the same time that the state controlled entities, such as the military, are for the first time in competition with a newly urbanized population for all types of resources. China believes that it must be self-reliant and that dictates its plan to establish indigenous capabilities creating numerous technical challenges with designing, developing and fielding advanced weapons systems. China's foreign exchange reserve is second only to Japan's and can be used to purchase military related supplies, parts, and in some cases, expertise from abroad. China has purchased weapons and weapons technology from Russia that included modern fighter aircraft, air defense systems, and submarines. This business relationship between the two countries has evolved into a new cooperative strategic partnership that stops short of being a strategic alliance. Conflict between China and the United States has grown somewhat as China has asserted itself internationally. The United States is particularly concerned about weapons proliferation by China, particularly in Pakistan and Iran.³¹

China is positioning itself to achieve its territorial goals, surpass its neighbors and constrain the United States' power in Asia. At the same time China is trying to sustain its economic growth while preserving the political system. Though these are significant challenges, China has shown itself to be resilient politically and China experts believe

³¹ Ibid.

that the state can introduce enough political reform by 2015 to adapt to domestic pressures for change while continuing to grow economically. China's stability and growth are important for both the United States and its allies. An overly assertive China or a weak, disintegrating China could pose a major security challenge in the region. Either one of these extremes would create a China that is willing to use its economic power and military capabilities to pursue a strategic advantage in the region. Some China watchers believe that China sees peace as critical to its economic growth and internal stability.³²

Chinese strategic nuclear doctrine calls for a survivable long-range missile force that has the capability to hold a portion of the U.S. population at risk in a retaliatory strike. Currently, China has an ICBM force that can reach U.S. targets; however, it considers its own silos vulnerable. China has also tested a mobile ICBM with a range that makes Russia and the rest of Asia its primary target. China continues to make other improvements to its inventory including a longer range mobile ICBM and a sea-launched ballistic missile (SLBM) that can reach the United States, continued research and development of a multiple-RV payload probably for the CSS-4, and greater numbers of more capable theater missiles with some of those deployed against Taiwan.³³

³² Central Intelligence Agency, "National Security in the Next Generation," Address by John C. Gannon Chairman, National Intelligence Council to the Academy of Senior Professionals at Eckerd College, St. Petersburg, Florida, March 27, 2001. https://www.cia.gov/news-information/speeches-testimony/2001/gannon_speech_03272001.html (accessed August 24, 2009).

³³ "The Ballistic Missile Threat to the United States," Statement for the Record to the Senate Subcommittee on International Security, Proliferation, and Federal Services on The Ballistic Missile Threat to the United States by Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, February 9, 2000. https://www.cia.gov/news-information/speeches-testimony/2000/nio_speech_020900.html (accessed August 24, 2009).

Beijing has taken some steps to improve and strengthen ballistic missile related export controls. However, China's technology firms continue to work with other countries on ballistic missile-related projects and they continue to be a leading source of advanced technology.³⁴

China is certainly challenging the United States as it emerges as a great power and exerts its influence in regional and international politics. Nevertheless, Beijing does cooperate with Washington on key strategic issues. For example, China has cooperated with the United States in the war on terrorism. The Chinese have also hosted and facilitated multilateral dialogue about the North Korean nuclear problem.³⁵

China's neighbors are suspicious of Beijing's intentions and favor a sustained United States military presence in the region to counter potential Chinese hegemony. In spite of their misgivings, Beijing has made considerable progress in asserting its influence among its neighbors in East Asia. Its activist diplomacy is helped by China's robust economy and China's growth significantly outpaces all of its neighbors. This helps China convince its neighbors that what is good for China is good for them.³⁶

China's military buildup continues to accelerate and that concerns its neighbors and the United States. China's announced defense budget, though estimated to be half of the actual spending on defense, tripled in the decade between 1994 and 2004 and continues to grow. However, growth is not the only change in China's military. In fact,

³⁴ Central Intelligence Agency, "Challenges in a Changing Global Context," Testimony of Director of Central Intelligence George J. Tenet before the Senate Armed Services Committee, March 9, 2004. https://www.cia.gov/news-information/speeches-testimony/2004/tenet_testimony_03092004.html (accessed August 24, 2009).

³⁵ Ibid.

³⁶ Ibid.

there has also been downsizing and restructuring of its forces with a focus on enhancing capabilities for the modern battle space. These qualitative enhancements will make China a formidable force in the future.³⁷

CHINESE SPACE PROGRAM

China began to develop its space program in 1956. During the fifty-three years since, China has for the most part worked independently and has achieved a level of success shared by only a few countries. China has clear goals for its space program and country. Its strategic goal is to “build itself” into a country that ranks among those with the “best innovative capabilities in the first twenty years of the 21st century.” China intends to “do its best to make the country’s space industry develop faster and better”.³⁸

China is very proud of its accomplishments in space. On its official website in a “Factfile” about development, China points out that in 1900 the country was devoid of modern science and technology with fewer than ten people in all of China understanding calculus. However by 2004, China had become only the third country to successfully launch a human into space and was planning its Moon Probe Project. China views accomplishments in space as the highest order of technological achievement.³⁹

The Chinese Space Program conducts activities for both civilian and military purposes; and China is one of only three nations to have achieved success in recovering

³⁷ Ibid.

³⁸ Chinese Government’s Official Web Portal, “White Paper Full Text: China’s Space Activities in 2006,” Information Office of China’s State Council, October, 12, 2006. http://sousuo.gov.cn/pagephoto?photopage=gw gw_js%2Fen%2Fphoto.jsp&ch...ace%2Claw&url=http://english.gov.cn/2006-10/12/content_410983.htm (accessed January 8, 2009).

³⁹ Chinese Government’s Official Web Portal, “China Factfile: Development.” http://english.gov.cn/2006-02/09/content_184084.htm (accessed January 8, 2009).

satellites and executing a manned space mission. The China Aerospace Science and Technology Corporation is the primary entity responsible for China's domestic space activities, including the development of satellites and launch vehicles and the execution of launches. The Chinese National Space Administration is responsible for coordinating China's activities with other national space programs.⁴⁰

China has an aggressive plan and lofty goals for its space program during the first decade of the 21st century. This plan includes a satellite navigation and positioning system, an independent telecommunications satellite network, an earth observation system, and a complete satellite remote-sensing application system. In addition, the plan includes upgrading the capability of its Long March launch vehicles and establishing a research, development, and testing system for a manned space program.⁴¹

"China's Space Program: Options for U.S.-China Cooperation," is a report published by the Congressional Research Service (CRS) on December 14, 2007 about China's civilian space activities. The report covers recent activities, future plans, and benefits and trade-offs of potential U.S.-China cooperative space activities. The report also discusses the January 2007 Chinese anti-satellite test that reinforced international concerns about Chinese intentions for outer space. Not only did the Chinese anti-satellite test create concerns for the future, it actually created an immediate threat to the space assets of more than two dozen countries because of a large cloud of orbital space debris. Some space experts believe that current Chinese capabilities threaten U.S. space assets in

⁴⁰ Secure World Foundation, "China." <http://75.125.200.178/%7Eadmin23/index.php?id=79&page=China> (accessed June 26, 2009).

⁴¹ Ibid.

low earth orbit and others believe that an expanded dialogue by the two countries and others is urgently needed.⁴²

CHINESE LAUNCH CAPABILITIES

China's indigenous launch vehicle family, the Long March rocket, includes twelve different versions of this highly capable launcher. The Long March rockets can place satellites into low-earth (LEO), geo-stationary (GEO), and sun-synchronous orbits making it a highly successful launch program, which the Chinese continue to improve with more advanced and sophisticated technologies. In October 2003, China used the upgraded Long March-2F rocket with improved guidance and control systems, engines, and computer systems to launch its first man into space aboard the Shenzhou-5 spacecraft, which is similar to the Russian Soyuz spacecraft. China had already successfully launched four unmanned Shenzhou rockets. Even though this first manned launch only placed one man into orbit for twenty-one hours, its success brought China new prestige. The Shenzhou-6 launch on October 12, 2005 placed two astronauts (taikonauts) into orbit for several days.⁴³

China expects its experiments with heavy-lift space launch vehicles to result in the capability to launch twenty-five tons into a low-earth orbit and fourteen tons into a geo-stationary orbit. Known as the Long March-5 rocket this heavy-lift vehicle will triple the GEO payload capability of the current Long March-2F rocket, which was used

⁴² Ibid. (Note: The CRS report was made available by Secrecy News, from the Federation of American Scientists Project on Government Secrecy.)

⁴³ Secure World Foundation, "Chinese Launch Capability." http://75.125.200.178/%7Eadmin23/index.php?id=101&page=China_Launch (accessed June 26, 2009).

to launch the first Chinese manned mission into space. China successfully tested its first four-stage solid-fuel launch vehicle, the Kaituoze-1 (KT-1), in September 2003. This launcher can be used to place micro-satellites in orbit. In addition to these achievements, the Chinese have made advances in reusable vehicle technology for the manned space program initiated in 1992 and known as Project 921.⁴⁴

There are four Chinese launch sites. The Jiuquan Satellite Launch Center, located in Gansu province in northwest China, is China's oldest space launch base and primarily supports scientific, technical, and experimental satellites in lower-and medium-earth orbits. Jiuquan was also the launch site of China's first manned space mission. The second site is Taiyuan Satellite Launch Center in Kelan County in Shanxi Province and is probably the ideal site for launching sun-synchronous satellites because of its dry weather conditions. The third site, Xichang Satellite Launch Center is situated in the Liangshan Yi Autonomous Prefecture in Sichuan Province and supports launches of geostationary satellites. A fourth Chinese launch site on Hainan Island will be more efficient in terms of fuel and payload capacity for launches into geo-stationary orbits.⁴⁵

China has an advanced telemetry, tracking and command network (TT&C) that includes eight domestic, ground-tracking stations; two foreign-based ground-tracking stations in Kiribati, located in southwestern Africa; four Yuanwang-class tracking ships; and two control facilities, the Xian Satellite Control Center in central China and the Beijing Spaceflight Command and Control Center. This sophisticated TT&C network was upgraded in 2000 when an S-band tracking capability was added that specifically

⁴⁴ Ibid.

⁴⁵ Ibid.

supports geo-stationary satellite tracking. In March 2005, China established the Space Target and Debris Observation and Research Center to assist in the prevention of debris strikes against satellites and manned spacecraft.⁴⁶

CHINESE MILITARY SPACE ACTIVITIES

According to reports, the Chinese civilian space program provides cover for military space activities. For example, in January 2000 China launched the civilian telecommunications satellite, Chinasat-22 (Zhongxing-22), which was supposed to be used for ground communications under the direction of the China Telecommunications and Broadcasting Satellite Corporation. Later in January 2000, a *Washington Times* article reported that a classified U.S. Defense Intelligence Agency report identified the Chinasat-22 as Feng Huo-1, a military communications satellite providing C-band and UHF communications. According to reports, the Feng Huo-1 was the first of several communications satellites that would comprise the Qu Dian system, an integrated military command control, communications, computer, and intelligence system. Also, the state-owned company China Galileo Industries signed contracts in July 2005 for involvement in the European Union's Galileo satellite navigation system. It is reported that in the future China may utilize this capability to enhance its own military capabilities.⁴⁷

⁴⁶ Ibid.

⁴⁷ Secure World Foundation, "Chinese Military Space Activities." http://75.125.200.178/%7Eadmin23/index.php?id=102&page=China_Military (accessed June 26, 2009).

China plans to establish a regional navigation system by 2010 with the second-generation Beidou constellation and in support of that China launched three Beidou-1 satellites and has applied for GEO slots for four Beidou-2 satellites. The Beidou satellites can be used for civilian purposes, however it is believed that the Beidou system will improve the precision of its long-range weapons and the data available to its military units.⁴⁸

China has at least one dedicated imaging reconnaissance satellite, one remote sensing satellite, one meteorological satellite, and one remote sensing microsatellite with potential dual-use capabilities. China insists that these satellites are used only for civilian purposes. The FSW-2 imaging reconnaissance satellite was launched in November 2003. The FSW series, which was first launched in 1975, stays in orbit for eighteen days before returning to Earth with its data. Some analysts and government officials believe the Zi Yuan remote sensing satellite, developed as part of the China-Brazil Earth Resources (CBERS) program, is used for military purposes with its three to nine meter resolution. The Feng Yun series of meteorological satellites, with a three-meter resolution, are also reported to provide data to the military. Paris's *Liberation* reported in June 2003 that China plans to upgrade its satellite imaging capabilities to less than one meter resolution and is interested in purchasing a satellite comparable to France's Helios-1. The Dong Fang Hong-4 (DFH-4) communications satellite, with direct broadcast capabilities, could potentially be adapted to transmit military data, such as maps and enemy deployments to small, distant field stations. China has built and launched its first remote sensing

⁴⁸ Ibid.

microsatellite, the Tsinghua-1, with the assistance of UK-based Surrey Satellite Technology Ltd. The first launch of the Tsinghua-1 was in June 2000 and the second followed in October 2002. China maintains that the satellites will track natural- and human-related disasters though analysts contend that these microsatellites may also be used for military purposes.⁴⁹

There is much debate about whether or not China's manned space program, "Project 921," is linked with the development of advanced military technology. It has been reported that China used the Shenzhou missions for electronic and imaging intelligence-gathering. *SpaceDaily* reported that the Shenzhou 1 through Shenzhou 4 test-flights probably carried military payloads of electronic intelligence or imaging reconnaissance equipment. The article further speculated that the primary mission of the first Chinese manned spaceflight may have been one of imaging reconnaissance.⁵⁰

China has very ambitious goals for the future of its space program including sending a satellite into lunar orbit, putting a robotic explorer on the moon, and eventually conducting a moonwalk. In addition, China plans to build a space station on the Moon. The Chinese military's participation in these planned lunar efforts is unknown at this time. These ambitious goals have prompted China to seek cooperative arrangements with a country having comparable or better capabilities. Therefore China concluded an agreement with Russia in August 2003 to jointly pursue space exploration efforts. However, according to some Russian analysts, it is unlikely that Russia will cooperate on

⁴⁹ Ibid.

⁵⁰ Ibid.

military-related space projects with China because of concerns over assisting the development of potential Chinese military space capabilities.⁵¹

There has been much debate about China's interest in anti-satellite (ASAT) weapons. Hong Kong newspapers reported in 2001 that China is interested in and may be involved in research about ASAT technology, specifically "parasitic" satellites. It was claimed that these satellites were ground tested and would also be tested in space. In a 2005 report to Congress on China's military capabilities the Pentagon suggested that China is developing ASAT weapons. Some analysts questioned whether or not China was actually developing ASAT weapons because of its support for preventing an arms race in space and its limited capabilities vis-à-vis ASAT technology. However, at that time it was thought their current capabilities may be limited to the possible use of a nuclear-tipped launch vehicle. China was also thought to have the capability to develop a land-based laser weapon for use against satellites and navigation satellite jammers that could be used against U.S. GPS satellites.⁵²

CHINESE ARMS CONTROL ACTIVITIES

China's official statements oppose the weaponization of outer space. China and Russia through discussions within an ad hoc committee of the Conference on Disarmament have led an initiative to establish an international treaty banning all weapons in space. Since 2002, the Chinese Ambassador has regularly addressed the

⁵¹ Ibid.

⁵² Ibid.

Conference on Disarmament and the UN First Committee about the dangers of a space arms race and the weaponization of outer space.⁵³

REMOTE SENSING SPECIFIC INFORMATION

China's political leadership has always been preoccupied with science and technology for which they have a high regard. In fact, the political leadership comes almost exclusively from technical backgrounds. Deng referred to science as "the first productive force." The U.S. space program is considered the standard of scientific modernity in China. China has what it considers to be a small but growing space program, which is a focus of national pride.⁵⁴

China identifies itself as a developing country that has advanced technologies.⁵⁵ The Chinese are intent on closing the gap in high-technology research and development between China and the world's advanced countries. According to the Chinese government, 60% of technologies, including atomic energy, space, high-energy physics, biology, computer and information technology, have reached or are close to the world advanced level. The Chinese Government's Official Web Portal gives an example of how China is rapidly closing the technology gap. The example is space: "On October 15, 2003, the successful launch of the "Shenzhou V" manned spacecraft made China the third

⁵³ Secure World Foundation, "Chinese Arms Control Activities." http://75.123.200.178/%7Eadmin23/index.php?id=103&page=China_Arms_Control (accessed June 26, 2009).

⁵⁴ U.S. Department of State, Bureau of East Asian and Pacific Affairs, "Background Note: China, October 2008."

⁵⁵ Chinese Government's Official Web Portal, "Foreign Ministry press briefing on June 21 (Full Text)." http://sousuo.gov.cn/pagephoto?photopage=gw_js%2Fen%2Fphoto.jsp&ch...ace%2Claw&url=http://english.gov.cn/2007-06/22/content_660888.htm (accessed January 8, 2009).

country to master manned spaceflight technology. According to the Moon Probe Project started in February 2004, China will launch unmanned probes to the moon before 2010, and gather moon soil samples before 2020.” China clearly views achievements in space as reasons for national pride and proof that they are to be reckoned with on an international level.⁵⁶

China pursues projects in both civilian and military space technology. The Chinese National Space Administration coordinates China’s activities with other national space programs. The China Aerospace Science and Technology Corporation is the organization responsible for China’s domestic space needs, including the development of launch vehicles and satellites and the conduct of launches.⁵⁷ China is the fifth country to develop and launch independent man-made satellites and the third to master satellite recovery technology which puts it in the “world’s front ranks” in important technological fields, one of which is remote-sensing satellites. By the end of 2000, China had successfully launched seventy-five satellites, including forty-eight developed by China and twenty-seven commercial satellites for foreign customers; and their development and launch pace has continued unabated.⁵⁸ Some analysts and foreign officials believe that the Chinese satellites developed as part of the China-Brazil Earth Resources (CBERS)

⁵⁶ Chinese Government’s Official Web Portal, “China Factfile: Development.”

⁵⁷ James Martin Center for Nonproliferation Studies, “Current and Future Space Security: China.” <http://cns.miis.edu/research/space/china/index.htm> (accessed January 19, 2009).

⁵⁸ Chinese Government’s Official Web Portal, “China Factfile: Astronautics.” http://English.gov.cn/2006-02/09/content_184006.htm (January 19, 2009).

program and others are used for military purposes. However, China claims that these satellites are used for civilian purposes only.⁵⁹

The Basic Law on Progress of Science and Technology, which underpins China's development of science and technology and the system of granting science and technology awards was promulgated in July 1993. This law governs the objectives, functions and sources of funds, and the system of rewards for science and technology development. In 2002, the Law on Popularization of Science and Technology was promoted with the societal goal of popularizing science and technology and increasing the knowledge about science and technology among all citizens. At the local level, regulations have been issued for attracting talented people in science and technology thereby ensuring capacity.⁶⁰

China has also greatly increased spending on science and technology at all levels. For example, in 2004 China spent 1.35% of its GDP on scientific research and development, the highest in its history, according to the current national plan China will increase this to 2% by 2010 and 3% by 2020. Since 2002, the national strategy for developing science and technology shifted from "following on the heels of others to making independent innovations and technological strides" aimed at reaching the "world advanced level" in key areas of science and technology by 2010 and by 2020 "China's competitiveness in science and technology will step up to the world's first rank."⁶¹

⁵⁹ James Martin Center for Nonproliferation Studies, "China: Military Programs." <http://cns.miis.edu/research/space/china/mil.htm> (accessed January 19, 2009).

⁶⁰ Chinese Government's Official Web Portal, "China Factfile: Development."

⁶¹ Ibid.

China launched its first satellite in 1970 and ten years later became a full member of the UNCOPUOS. China has focused on technological development in outer space rather than development of and research in space law. However, China has occasionally acknowledged the importance of space law in the development of space exploration and, since joining UNCOPUOS, has accelerated its efforts in space legislation by ratifying four space treaties during the 1980s.⁶²

The government of China began developing national space legislation around 1994, but the most substantial work occurred after the administrative system for the industries was reformed in 1998. These efforts have not yet resulted in national space laws, however several regulations have been implemented concerning registration and launching of space objects. China's ambitious plan to put a satellite in the moon's orbit, explore the surface with robotics and build a space station on the surface of the moon, as well as China's less ambitious space projects emphasize the urgent need for national space legislation.⁶³

In general, China claims that its space activities are for peaceful purposes and its space policies aim to improve the human condition while improving the lives of the Chinese people. The White Paper "China's Space Activities in 2006" lays out the principles for the development of the Chinese space industry.⁶⁴ For the purposes of this research, one of the more interesting phrases in the White Paper is that which speaks to

⁶² Yun Zhao, "Commentary: National Space Legislation in Mainland China," *Journal of Space Law* 33, no. 2 (Mississippi: University of Mississippi School of Law, 2007), 427.

⁶³ Ibid., 428 [Note: The regulations include: the Provision and Procedures for the Registration of Space Objects, 8 February 2001 and the Interim Measures on the Administration of Permits for Civil Space Launch Projects, 21 November 2002.]

⁶⁴ Ibid.

“upholding independence and self-reliance policy, making innovations independently.”⁶⁵

Though not contradictory, China also claims great interest in active international space exchanges and cooperation. In fact, this statement appears in both the 2006 White Paper as well as the 2000 White Paper.⁶⁶

The Eighth National People’s Congress (NPC) established the China National Space Administration (CNSA) as a government institution to develop and fulfill China’s international obligations. CNSA, which was made part of the Commission of Science, Technology and Industry for National Defense (COSTIND) by the Ninth NPC, has four departments: General Planning; System Engineering; Science, Technology and Quality Control; and Foreign Affairs. CNSA is responsible for signing governmental agreements in the space arena on behalf of the organization, administering inter-governmental scientific and technical exchanges; enforcing national space policies and managing the national space science, technology and industry. CNSA is also the main administrative body in charge of national space industry and civil space activities. It is the most important authority responsible for preparing space legislation, formulating policies for space industry and technology while developing plans for space development and setting standards in these areas.⁶⁷

The authority for examining, approving and supervising all civil space launch projects is COSTIND. In 2001, COSTIND and the Ministry of Foreign Affairs published the Provisions and Procedures for the Registration of Space Objects, which is the first

⁶⁵ Chinese Government’s Official Web Portal, “Foreign Ministry press briefing on March 1, 2007.” http://sousuo.gov.cn/pagephoto?photopage=gw_js%2Fen%2Fphoto.jsp&ch...ace%2Claw&url=http://english.gov.cn/2007-03/02/content_543623.htm (accessed January 19, 2009).

⁶⁶ Zhao, 429.

⁶⁷ Ibid., 430.

domestic administrative regulation adopted by China on space activities. China enacted this regulation to fulfill its commitments under the Registration Convention, while taking into account the practical situation in China. In 2002, COSTIND released the Interim Measures on the Administration of Permits for Civil Space Launch Projects, which established the licensing regime for all spacecraft launched within the territory of China to conduct civilian missions.⁶⁸

There are some regulations, which relate to military space activities. The Regulations on Control of the Military Products Export was enacted in 1997 and revived in 2002. This regulation strengthens unified management of military products export. In 2003, the COSTIND and the PLA General Armament Department drafted the Military Products Export Control List, which includes launch vehicles, missile weapon systems, and military satellites. In 2002 the State Council, in an effort to prevent the proliferation of missiles and delivery systems that can be used for weapons of mass destruction, published the Regulations of the People's Republic of China on Export Control of Missiles and Missile-related Items and Technologies, and the Missiles and Missile-related Items and Technologies Export Control List.⁶⁹

Currently, space legislation is among the highest priorities on the CNSA's agenda and a special task force was created to study the issue of national space legislation. Though the plan is to proceed slowly, the goal is to have a national space law, complemented by a set of administrative laws, regulations and departmental rules. The Eleventh Five-Year Program for National Space Development, the first overall aerospace

⁶⁸ Ibid., 431–432.

⁶⁹ Ibid., 433–434.

blueprint, was released in 2007 and mentions the development of space law. The plan identifies the Regulation on the Administration of Space Activities as one law that will be published within the next five years. The Eleventh Program provides for the development of a National Space Law (no time schedule identified), including the policy of incentives for using domestic space products (including satellites, remote sensing data, and rockets), and the policy of space commercialization and privatization. China also plans to improve the current price system for space products, develop rules on the administration of scientific research and production in outer space, and the administration of import and export of space technology.⁷⁰

Another item of interest is the consistent and frequent explanation of “China’s diplomatic philosophy” when China is addressing questions about their space activities, particularly if those activities are characterized as a potential threat. Basically, the government of China states that it does not seek hegemony but advocates multilateralism, believes outer space is the common wealth of humankind, supports all activities that use outer space for peaceful purposes, abides by the UN authority/Charter and international law and norms, and faithfully honors its international duties and obligations. In typical bureaucratic fashion, Chinese officials always turn any question about potential Chinese threats to the international community into a counter response about Chinese peaceful uses of space.⁷¹

⁷⁰ Ibid., 434–435.

⁷¹ Chinese Government’s Official Web Portal, “Foreign Ministry press briefing on March 1, 2007.”

CASE 6: THE RUSSIAN FEDERATION

BACKGROUND INFORMATION ON THE RUSSIAN FEDERATION

The Russian Federation was established by the 1993 constitution; however, the precise distribution of powers between the central government and the regional and local authorities is still evolving. The president has considerably more power than the legislative branch and the prime minister is the chairman of the government. After the 1991 dissolution of the Soviet Union, Russia not only inherited the Soviet Union's place in the international order, but also the bulk of the Soviet Union's foreign assets and debt.⁷²

Russia has about 6.5 million square miles, which is about 1.8 times the size of the United States. Geographically, Russia is the largest country in the world by more than 2.5 million square miles. However, it is sparsely populated with a population density of about twenty-two persons per square mile and most of its residents live in urban areas. Its population was estimated at 142 million in January 2008.⁷³

The life expectancy varies significantly between the sexes with approximately sixty years for men and seventy-three years for women based on 2007 estimates. There has been a steady decline in the health of the Russian people that began with the unraveling of the Soviet Union in its last decades and continued during the 1990s with the physical and psychological traumas of transition. Currently births lag far behind

⁷² U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: Russia, July 2008." <http://www.state.gov/r/pa/ei/bgn/3183.htm> (accessed January 2, 2009).

⁷³ Ibid.

deaths and there is a skyrocketing rate of deaths among working-age males due to cardiovascular disease, both of which are creating a demographic crisis in Russia. A rapid increase in HIV/AIDS infections and tuberculosis is compounding the demographic problem. It is estimated that Russia's population will decrease by 30% over the next fifty years due to the large annual excess of deaths over births. The concept of a demographic policy for the years 2008–2025 was approved in October 2007 to combat the looming demographic crisis.⁷⁴

The literacy rate is 99.4% for the total Russian population. However, Russia must continue to reform its educational system in order to produce students with appropriate skills for a market economy. Great emphasis is placed on science and technology in education. As a result, Russian medical, mathematical, scientific, and space and aviation research is still generally of a high order, although medical care in Russia, even in the major cities, is generally far below Western standards. Although the labor force is well educated and skilled, it is largely mismatched to the rapidly changing needs of the Russian economy, which is undergoing tremendous changes.⁷⁵

After the collapse of the Soviet Union in 1991 and the economic dislocation it engendered, the standard of living fell dramatically. However, the situation has significantly improved and real disposable incomes have doubled since 1999. In fact, experts estimate that the middle class ranges from one-fifth to one-third of the population.

⁷⁴ Ibid.

⁷⁵ Ibid.

By the end of the third quarter in 2007, 14.8% of the population lived below the subsistence level, in contrast to 38.1% in 1998.⁷⁶

The Russian Federation in the years after the dissolution of the Soviet Union took important steps to become a full partner in the world's principal political groups. On December 27, 1991, Russia assumed the permanent UN Security Council seat, which had formerly been held by the Soviet Union; and Russian remains one of the six official languages of the United Nations. Russia is a member of the Euro-Atlantic Partnership Council (EAPC) and the Organization for Security and Cooperation in Europe (OSCE). Russia signed a Partnership and Cooperation Agreement with the European Union.⁷⁷

Russia has taken important steps towards normalizing relations with the North Atlantic Treaty Organization (NATO) including signing the NATO Partnership for Peace Initiative in 1994. Since 1997, Russia has interacted with NATO, first through the Permanent Joint Council (PJC) and since 2002 as an equal through the NATO- Russia Council which superseded the PJC, however it does not have veto power over NATO decisions. Despite misgivings Russia did not actively oppose when members of the former Warsaw Pact and the Baltic states joined NATO, which was a move that enlarged NATO. In contrast, the membership aspirations of Ukraine and Georgia have drawn strong opposition from Russia.⁷⁸

Russia has recently increased its international profile, been more involved in regional issues, and become more assertive in dealing with its neighbors. The rise in

⁷⁶ Kegley, 123. Also U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: Russia."

⁷⁷ Ibid.

⁷⁸ Ibid.

energy prices has given Russia leverage over countries, which are dependent on its energy sources. Russia also continues to support separatist regimes in Moldova and Georgia.⁷⁹

In the 1990s, the Russian economy underwent tremendous stress as it transitioned from a centrally planned economy to a free market system. There were difficulties in implementing the fiscal reforms necessary to raise government revenues. The situation was further complicated by a dependence on short-term borrowing to finance budget deficits that resulted in a serious financial crisis in 1998. Still, Russia weathered the crisis and the 2007 estimated GDP was \$1.34 trillion with a growth rate of 8.1%. Although the economy has begun to diversify, the government budget remains dependent on oil and gas revenues. Consumption and investment are beginning to contribute to an increasing share to GDP growth despite a slowdown in manufacturing.⁸⁰

When the Soviet Union collapsed Russia was forced, literally overnight, to begin the process of building new social, economic and political institutions. The nature of the Soviet collapse left little time to prepare for the great transformation that was thrust upon the new country. There was a long tradition of central control that dated back hundreds of years and no historical experience with democracy. Yet even with those challenges, Moscow has succeeded in many ways.⁸¹

For the purposes of this study, several areas of progress are worth mentioning. Russia dismantled the world's largest command economy and is building a genuine

⁷⁹ Kegley, 123; and U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: Russia."

⁸⁰ U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: Russia."

⁸¹ Central Intelligence Agency, "Current and Projected National Security Threats."

market-driven economy to replace it. Though thoroughly shaken, Russia has managed to achieve some measure of financial stability without total economic collapse. Russia has also taken a number of steps to integrate itself into the world financial system including, joining the World Bank and the International Monetary Fund (IMF), privatizing most small and medium size industries, and ending the dominant role of the country's defense industries. It has managed to do this without eliminating its military force, liquidating its military assets, or dismantling its nuclear capability or space program.⁸²

Under the centrally controlled economy, the military was a favored son and elite units such as the nuclear forces and space program were held in even higher regard. Under the new Russia the military, including the nuclear forces and the space program, had to learn a new way to do business; and Russia had to make choices and assign priorities that were even more difficult than the choices and priorities made by the Soviet government. In the end, Russia maintained its military, nuclear forces, and space program because the alternative would have been unacceptable. However, the economic circumstances have forced Russia to be more creative than its predecessor. For example, across the Russian military the Soviet approach that bigger is better has been replaced. Russia military officials have adopted the philosophy of their Western counterparts that smaller quantities of better quality are preferable to a larger, less capable force. Arms control agreements have allowed the Russians to save face while reducing the nuclear force as they maintain the remaining arsenal. The space program has embraced

⁸² Ibid.

commercial opportunities wherever possible to create an influx of hard currency that can be devoted to maintaining the program.⁸³

The difficulties for the Russian military have been unprecedented, both socially and economically. The challenges have included reorganizing and downsizing, a significant reduction in defense resources, as well as adjusting to new and emerging missions. A thorough review of arms control regimes and treaties by military planners was necessary to ensure that Russia protected its key security needs in the long term as well as during the transitional period of uncertainty and change. Not only Russia, but the world, was concerned about Russia's ability to secure and control their nuclear weapons and fissile materials. In addition the military also faced a number of personnel challenges that added to these concerns including deteriorating morale, corruption, and extreme economic hardships.⁸⁴

Moscow has worked diligently to insure its great power status in the international arena. Russia quickly reinforced its ties with France, Germany, Japan and China. It also demanded an equal role in determining the resolution of international issues and was particularly insistent about that role when the issues involved NATO and the European security architecture. Though concerned with the United States' position as the hegemon in what had become a unipolar world, Russia sought close cooperation with the United States when it supported Russia's national interests.⁸⁵ Though they are competitors, Russia and the United States share important common interests on a variety of issues

⁸³ Ibid.

⁸⁴ Ibid.

⁸⁵ Ibid.

including counterterrorism, the drastic reduction of U.S.-Russian strategic arsenals, stemming the proliferation of weapons of mass destruction, combating human trafficking, and the fight against HIV/AIDS.⁸⁶

Russia also had to deal with the newly independent states that emerged from the collapse of the Soviet Union. There were two priorities: one was to maintain its influence over these new states and the second was to limit outside influence. Russia used multilateral mechanisms such as the Commonwealth of Independent States as well as bilateral agreements. For the purposes of this study, those mechanisms and agreements have been very important to Russia's space program, particularly because some of the more desirable launch sites are not within Russia's borders.⁸⁷

Some Russia watchers are concerned that Russia will continue to face daunting challenges that will test its governance and economic policies. They question whether Russia can adjust its expectations about its international leadership position to match its drastically reduced resources. Russia may continue to be weak internally, making its link to the international system through its permanent seat on the UN Security Council all the more important. It is very important to the United States and Europe that Russia adjusts to its diminished status in such a way that its actions preserve, rather than upset, regional stability.⁸⁸

The vulnerability of Russian weapons of mass destruction (WMD) materials and technology to theft or diversion remains a worldwide concern. Russian expertise is a

⁸⁶ U.S. Department of State, Bureau of European and Eurasian Affairs, "Background Note: Russia."

⁸⁷ Ibid.

⁸⁸ Central Intelligence Agency, "National Security in the Next Generation."

desirable target for groups or countries seeking WMD and missile-related assistance. The cash-strapped industries at risk are defense, biotechnology, chemical, aerospace, and nuclear industries—all of which are eager to raise funds via transfers or exports.⁸⁹

Russia's improvement in its military capabilities and the reclamation of some of its former military strength paralleled its increasing assertiveness with its neighboring states of the former Soviet Union. Russia's war in Chechnya, and the Kremlin's agenda in Georgia, Ukraine, and Moldova are examples of this assertiveness. However, "soft" power has been the primary approach with economic incentives, and shared history and culture being the primary approach Russia has used to rebuild influence and lost power. Relative stability on Russia's borders is important to Russia domestically as well as an important element in positive relations with Europe and the United States.⁹⁰

The relationship between the United States and Russia continues to be one of both competition and cooperation. On the whole, there is more cooperation now than competition. Russia has been supportive of U.S. deployments in Central Asia, however Russia has growing concerns about the presence of the United States in its own backyard.⁹¹

⁸⁹ Ibid.

⁹⁰ Ibid.

⁹¹ Ibid.

RUSSIAN SPACE PROGRAM

Russia's achievements in space are legendary. The Russian Federal Space Agency (Roskosmos) is responsible for oversight of Russia's civilian space activities which include a variety of satellites, advanced launch vehicles and a long successful history of manned space flights. The Russian Space Forces (VKS) was created in June 2001 to counter the armed forces lack of combat readiness by increasing the use of space. The VKS controls military satellite launches, space object tracking and military flight control assets.⁹²

RUSSIAN LAUNCH CAPABILITIES

Russia's stable of launch vehicles currently includes more than a dozen types of vehicles. These vehicles are used for Russian government launches, civil and military, as well as commercial launches for clients.⁹³

Russia's history in rocketry began more than a century ago. Konstantin Eduardovich Tsiolkovsky (1857–1935), the Russian mathematician, developed the basic equation for rocket propulsion that is still used today. Tsiolkovsky's equation is found in "The Exploration of Cosmic Space by Means of Reaction Devices" published in 1903. In his book, Tsiolkovsky describes the horizontal speed required for a minimal orbit around the Earth as eight kilometers per second. He also explained that this could be achieved by using a multistage rocket fueled by liquid oxygen and liquid hydrogen, but Tsiolkovsky never built the rocket he so accurately described. Across the globe another

⁹² Secure World Foundation, "Russia."

<http://75.125.200.178/%7Eadmin23/index.php?id=91&page=Russia> (accessed June 26, 2009).

⁹³ Secure World Foundation, "Russian Launch Capability."

http://75.125.200.178/~admin23/index.php?id=139&page=Russia_Launch (accessed June 26, 2009).

man had independently determined the means to send payloads into space. An American, Robert Goddard, who apparently never heard of Tsiolkovsky, built and launched the first liquid-fueled rocket.⁹⁴

Tsiolkovsky influenced at least one leader in the Soviet Union's early rocket program. The famous mathematician corresponded with Vladimir Petrovich Glushko (1908–1989), the man who would head the OKB-456 (later NPO Energomash), which was the design bureau that developed engines for a variety of vehicles during the space race with the United States. It is possible that he also influenced, though not as directly, Sergei Pavlovich Korolev (1907 -1966) who was the Chief Designer for Soviet rocketry and spacecraft until his death. Korolev was a pilot and aircraft designer, primarily for bombers, who became interested in rocketry in 1930. He was one of the founders of the Jet Propulsion Research Group (GIRD) that merged with the Gas Dynamics Laboratory (GDL) in 1933 to create the Jet Propulsion Research Institute (RNII). The head of the RNII, Ivan Kleimenov, was an engineer and also a disciple of Tsiolkovsky. Soviet Premier Josef Stalin considered rocket development a state priority after World War II. He established the NII-88 OKB-1 special design bureau to achieve that objective and Korolev was the chief designer of long-range missiles within the NII-88 OKB-1 special design bureau. OKB-1 would later be renamed the S.P. Korolev Rocket and Space Corporation Energia which continues to develop launch vehicles and spacecraft today.⁹⁵

Even though the Americans had taken most of the research information and materials belonging to Wernher von Braun's rocket team in Peenemunde, Germany, the

⁹⁴ Ibid.

⁹⁵ Ibid.

Soviets managed to acquire some leftover blueprints. Using these blueprints, Korolev's team would eventually design and field the R-7 ICBM. The R-7 would become the foundation for a series of launch vehicles that would be used to launch Sputnik, Soyuz, and a number of other payloads into orbit during the next five decades. Among its other accomplishments, OKB-1 also developed the powerful N-1 lunar rocket intended to challenge the U. S. Saturn 5 rocket during the race to the Moon. There were four launches of the N-1 and each was a spectacular failure.⁹⁶

At the same time the N-1 was being developed, the Soviet leadership decided to conduct a parallel launch vehicle development with a similar mission profile. This parallel development activity was assigned to Vladimir Nikolayevich Chelomei (1914–1984), Korolev's rival, and head of the OKB-52 bureau, which later became the Khrunichev State Research and Production Space Center. The OKB-52 bureau developed the UR-500, later known as the Proton, which is still in use today. However by the time the United States won the race to the Moon, the Soviet Union had shifted their focus to space station development for low Earth orbit. The Proton, originally developed for a lunar mission, became the heavy-lift workhorse for Russia. It is used to send science payloads to other planets, send up components for the International Space Station, and recently its primary roles has been to send Russian government payloads and commercial communication satellites into geosynchronous orbit.⁹⁷

Russia maintains an active commercial launch business using its varied stable of launch vehicles, numerous land and submarine based launch facilities, monitoring and

⁹⁶ Ibid.

⁹⁷ Ibid.

tracking centers, and an experienced space launch workforce. The cost of a commercial launch ranges from \$500,000 to \$70 million. Russia has also allowed access to its advanced space technology in return for assistance in financing the upgrade of its launch centers, such as Plesetsk.⁹⁸

Russia markets its launch services through a number of enterprises. For example, the sale of Proton launches from Baikonur to international clients is accomplished through the U.S. based International Launch Services, which is an independent firm that was formerly a joint venture between Lockheed Martin and Khrunichev. The Eurockot Launch Services GmbH, a joint venture between Europe's EADS Space Transportation and the Khrunichev markets the small-class vehicle, Rockot, which is launched from Plesetsk. Foreign military spacecraft were launched from Plesetsk during 2005 to 2007 as part of a contract between Russia and the German company OHB System. Starsem internationally markets the medium-class Soyuz through a joint venture between the Russian Federal Space Agency (25%), TsSKB-Progress (25%), EADS Space Transportation (35%) and Arianespace (15%). Government Soyuz launches are conducted from Baikonur and Plesetsk while commercial launches are conducted from the European Space Agency's (ESA) Kourou Launch Center in French Guiana.

ZAO Puskovie Usługi markets the commercially available START-1 launch vehicle that is launched from a mobile platform in Svobodny and Plesetsk. SeaLaunch, a joint

⁹⁸ Ibid.

company composed of Boeing (40%), Yuzhnoye (15%), Aker Kvaerner (20%) and NPO Energia (25%), markets the Zenit heavy-class launch vehicle.⁹⁹

The most famous of the Soviet launch vehicles is the R-7 Semyorka which was used to launch the first satellite and the first human into space. The R-7 was a liquid-fueled ICBM that was launched from a platform rather than a silo. It required at least fifteen minutes to fuel, which meant it was an unlikely counter strike weapon. However, Korolev who designed the R-7 launch vehicle recognized its potential and on October 4, 1957 it was used to launch the world's first satellite, Sputnik 1, into orbit. A variant of this vehicle also sent the world's first human into space. Yuri Gagarin was launched into space in a two-seater Voskhod spacecraft using the R-7 and this world-altering event was followed by a long list of three-person Soyuz spacecraft launches. Today, the R-7 is known as the Soyuz rocket and sends two Soyuz spacecraft to the International Space Station (ISS) per year as well as five to six Progress resupply spacecraft to the station each year. The Soyuz rocket is also used to send commercial payloads into orbit for international customers. A variant of the Soyuz rocket, the Molniya, is used to launch Molniya communications satellites into special orbits that permit long loiter times over the Russian mainland.¹⁰⁰

Russia continues to expand its launcher inventory through continued development. The military is strongly supporting the development of the Khrunichev-built Angara class rockets, which are planned to carry a payload of thirty metric tons into orbit and will be able to place satellites into geostationary orbit from Russian territory.

⁹⁹ Ibid.

¹⁰⁰ Ibid.

At one time the Moscow Aviation Institute was developing a Mikron rocket that could launch from beneath a MiG-31 fighter at an altitude of 21,000 meters and carry small satellites into a low Earth orbit. However, this program may have been discontinued.¹⁰¹

The Russian Space Forces under the Ministry of Defense conduct launches at three launch facilities: the Baikonur Cosmodrome in Kazakhstan (leased from Kazakhstan), the Svobodny Cosmodrome in eastern Russia, and the Plesetsk Cosmodrome in northwestern Russia. Russia plans to modernize both of its national launch sites, Svobodny and Plesetsk, which will increase its indigenous launch infrastructure and ultimately save money, which can be used for the Russian space program. Russia began upgrades to Plesetsk in 2001 and increased its focus on the facility improvements in 2003. In August 2005, Russian Space Forces Commander Colonel-General Vladimir Popovkin said that eventually all military launches would be conducted from Plesetsk. Until that time only light Strela and START rockets will be launched from Svobodny and further work on the Svobodny site is planned to begin not earlier than 2010. The significance of the Svobodny site is that it allows rockets to be launched into solar-synchronous and polar orbits without crossing over foreign states which reduces the potential liability issues should an accident occur between launch and reaching orbit. The Russian Defense Minister Sergei Ivanov reiterated in June 2005 that the Russian government is committed to lease the Baikonur Cosmodrome through 2050 for 94 million euros per year. Russia must continue using Baikonur for manned space launches, and communication, navigation and television satellite launches into

¹⁰¹ Ibid.

geostationary orbit. In addition, development of the joint Russian-Kazakh Baiterek launch complex will continue and will be based on the launch requirements of the Angara rockets in development.¹⁰²

Russia's supporting space infrastructure is also based in several locations and the space tracking system includes two networks. The space systems command center is located in Krasnosnamensk in the Moscow region. The Measurement Complex (IP) network has stations near launch sites and along the orbital path as well as mobile stations and scientific installations. The Command-Measurement Complex (OKIK) network is comprised of eleven operational stations within Russia.¹⁰³

RUSSIAN MILITARY SPACE ACTIVITIES

Colonel-General Vladimir Popovkin, the Russian Space Forces Commander, admits to approximately sixty military satellites currently in orbit, which represents a two-and-a-half fold decrease since 1990. Though this is a dramatic numerical change, there has been a corresponding qualitative change in Russia's military satellite fleet. The percentage of satellites functioning within their normal service lives has increased from 19% in 1999 to 40% now. Russia has also begun to test new technologies to improve its military space program.¹⁰⁴

Russia has five types of imagery reconnaissance satellites with at least one other series in development. Three types of Russian satellites use film, which limits their

¹⁰² Ibid.

¹⁰³ Ibid.

¹⁰⁴ Secure World Foundation, "Russian Military Space Activities." http://75.125.200.178/~admin23/index.php?id=140&page=Russia_Military (accessed June 26, 2009).

orbital life. The Kometa (Yantar-1KT) satellite is launched at least every two years for forty-five days and updates military topographic and mapping data by imaging a wide area. The Kobalt (Yantar-4K2) satellite provides detailed photo-reconnaissance data using retrievable film capsules to deliver the exposed film while still in orbit. A modernized Kobalt is estimated to carry twenty film capsules and have an orbital life of six months. The Yenisey (Orlets-2) satellites have an orbital life of approximately one year and take high-resolution, wide-format photographs. The Araks and the Neman (Yantar-4KS1) satellites are no longer operational; however, they used digital imaging sensors and had estimated orbital lives of three and one year, respectively. It is estimated that the Monitor satellite series has military applications. The original Monitor satellite has an eight-meter resolution, however later versions are expected to have resolutions better than one meter. The lightweight Monitor costs significantly less to manufacture and orbit than the older, heavier satellites; however the performance is equal or better.¹⁰⁵

Russia has two electronic intelligence (ELINT) satellite series. The Tselina-2 is a land target reconnaissance satellite that has an estimated one to two years of orbital life. The EORSAT satellites have an estimated orbital life of eighteen months.¹⁰⁶

The Parus satellite system and the Global National Satellite System (GLONASS) constitute Russia's navigation satellites. The Parus satellite system supports the Russian navy with navigation and communication services. Russia continues to develop the GLONASS navigation satellites. GLONASS is very similar to the U.S. GPS and is a dual-use constellation that will have twenty-four satellites in operation by 2010, though

¹⁰⁵ Ibid.

¹⁰⁶ Ibid.

only eighteen are required for continuous coverage. The original GLONASS satellites are expected to have only a three year orbital life, while plans are to increase the orbital life span to as much as twelve years. Commander Popovkin insists that the GLONASS system is meeting all of the Armed Forces needs. However there are concerns that general Russian users will need to rely on the U.S. GPS system or the European Galileo system to meet their demands for navigation services.¹⁰⁷

Russia also operates four types of communications satellites dedicated solely to military support. The Strela-3 satellites are the central communications system for the Main Intelligence Directorate and they receive and transmit communications from isolated areas. The Raduga satellites support leadership and strategic forces with real-time military communications services. The Geizer satellite relays data for the Neman and Araks reconnaissance satellites. The Molniya satellites are used for general purpose military communications, but after the launch failure of a Molniya-3K satellite in July 2005, it was announced that the Molniya-3K would be replaced with a new communications satellite.¹⁰⁸

Russia also owns ballistic missile early warning, space monitoring, anti-ballistic missile (ABM) and anti-satellite (ASAT) systems produced by the Soviet Union that could support military operations. These systems are now in varying stages of deterioration. Russia has indicated a commitment to restoring these capabilities,

¹⁰⁷ Ibid.

¹⁰⁸ Ibid.

especially those that could support ballistic missile early warning and space monitoring.¹⁰⁹

The ballistic missile early warning network is composed of a ground-based system known as the Soviet Missile Attack Warning System (SPRN) and a supporting satellite network. The SPRN stations are scattered throughout the former Soviet Union's territories. Not all of the governments that now control these stations have been willing to cooperate with Russian attempts to upgrade the stations. However, one notable success of these efforts was the reactivation of the Volga radar station in Belarus. This sealed what had been reported as a breach in the northwestern sector because of the shutdown of Latvia's Skrunda radar station in the 1990s.¹¹⁰

The satellite component of Russia's ballistic missile early warning network consists of two types of satellites in different orbits. The Oko satellites are in high elliptical orbits while the Prognoz satellites are in geostationary orbit. The Prognoz satellites also operate as a backup to the Oko component of the system. The ideal constellation is nine Oko satellites and seven Prognoz satellites; and the effectiveness of the system depends on the composition of the constellation. Russia has dealt with significant gaps in this system. For example, in February 2004 the on orbit operational constellation was composed of two Oko satellites and one Prognoz.¹¹¹

The SKKP is the Russian space monitoring system that tracks and controls Russian satellites and detects and identifies space objects. The system is composed of a

¹⁰⁹ Ibid.

¹¹⁰ Ibid.

¹¹¹ Ibid.

network of ground-based tracking stations, a group of ship-based space-tracking radars, the SPRN and ABM radars, and the opto-electronic and laser sensors located in Tajikistan. The Okno opto-electronic system in Tajikistan was a significant upgrade in 2003 that allows detection of space objects at a distance of up to 40,000 kilometers.¹¹²

It is believed that the ASAT technologies developed during the Cold War still exist though the ASAT program is considered inactive. The IS-M was the primary ASAT system which could launch a missile armed with conventional explosives into orbit close to that of the target. The debris of the exploding warhead was the means by which the target satellite would be destroyed. The last IS-M test was in 1982. In 1983, the Soviet Union declared a moratorium on launching ASATs as long as no other country deployed them. Russia has continued to observe this policy set forth by the Soviet Union.¹¹³

RUSSIAN ARMS CONTROL ACTIVITIES

Russia has been a vocal and strong supporter of an international legal agreement banning weapons in space. Russia has also lobbied for the creation of an ad hoc committee of the Conference on Disarmament, believing that would provide the best forum to create such a committee. The Russian Ambassador regularly addresses the Conference on Disarmament and the Foreign Minister and President have also made public statements supporting Russia individual and cooperative efforts towards arms control.¹¹⁴

¹¹² Ibid.

¹¹³ Ibid.

¹¹⁴ Secure World Foundation, "Russian Arms Control Activities."

http://75.125.200.178/~admin23/index.php?id=141&page=Russia_Arms_Control (accessed June 26, 2009).

REMOTE SENSING SPECIFIC INFORMATION

As the legitimate successor of the Soviet Union, the original space faring nation, Russia has an extensive history in space. Russia has developed both advanced launch vehicles and military space capabilities. Civilian space activities are the responsibility of the Russian Federal Space Agency (Roskosmos) while military satellite launches, space object tracking and military flight control assets are the responsibility of the Russian Space Forces (VKS). In 2001, the VKS was established to remedy the lack of combat readiness of the armed forces by increasing the use of space for Russia's military information-gathering needs.¹¹⁵

In 2005, the Roskosmos' Federal Space Program (2006-15) was approved, however the associated budget request increase, which would have put the agency's budget in line with civilian space expenditures of the United States as a percentage of GDP was denied. Russia plans to fund many of its space programs by furthering its commercial launch prospects, developing more sophisticated cost-effective technologies, and cultivating its international partnerships.¹¹⁶

Since 1990, there has been a quantitative decrease in Russia's military satellite assets on orbit, however there as been an increase in the percentage of satellites functioning within their normal service lives. The VKS attributes this to a qualitative change in Russia's military satellite fleet and notes that Russia is again testing new technologies.¹¹⁷

¹¹⁵ James Martin Center for Nonproliferation Studies, "Current and Future Space Security: Russia." <http://cns.miis.edu/research/space/russia/index.htm> (accessed January 19, 2009).

¹¹⁶ Ibid.

¹¹⁷ James Martin Center for Nonproliferation Studies, "Russia: Military Programs, Satellites." <http://cns.miis.edu/research/space/russia/mil.htm> (accessed January 19, 2009).

In 1991, SOVINFORMSPUTNIK was founded in order to supply “unique earth surface remote sensing data, not previously allowed for commercial distribution and use” to customers and users worldwide. Basically an Association was founded by organizations and enterprises from the defense branches of industry, responsible for development, manufacturing and operation of modern remote sensing systems. The founders included the Central Specialized Design Bureau, the State Scientific-Production Space-rocket Center (TsSKB-Progress), the joint stock company “Krasnogorskiy Zavod,” the State Scientific and Production Center (“Priroda”) and others. Previously these remote sensing systems were only used for defense purposes, however the company was founded to commercially distribute remote sensing data and provide value added products and services for peaceful and scientific purposes. SOVINFORMSPUTNIK possesses an archive of satellite images; a staff of experts in remote sensing satellite systems, data interpretation and processing; business and scientific relations with research and manufacturing organizations; and commercial ties with Russian and Western companies, which provides access to a wide range of specialized companies and experts. The company is officially licensed by the Russian Space Agency to provide archive and newly acquired data configured to meet customer specifications. Russia needs the revenue that this commercial venture can provide if it hopes to meet its space plan goals.¹¹⁸

¹¹⁸ “Sovinformsputnik Association (Russian Federation), Space Industry–Joint Ventures,” Jane’s Space Systems and Industry, <http://www.janes.com/articles/Janes-Space-Systems-and-Industry/Sovinformsputnik-Association-Russian-Federation.html> (accessed August 24, 2009).

The Russian Federation has broad federal legislation that covers remote sensing activities. These regulations cover licensing, certification, liability, safety, insurance and government controls. These regulations not only protect domestic interests, but they also protect the IP and commercial secrets of foreign entities operating under the Russian Federation's jurisdiction. The regulations have changed over time, but there have always been instances of request for images that have been denied, delayed or canceled due to national secrecy concerns. This was particularly true prior to 1992. The Russian Federation does have specific space laws and policies, including the federal Law on Space Activities, Law No. 5663-1 enacted in 1993 and amended by federal law No. 147-F3 in 1996; the Rules on the Licensing of Space Activities, Rule No. 403, established in 2006; the unpublished 1996 National Space Policy Concept; and the National Remote Sensing Development Concept which is currently in development. The breadth and depth of Russia's legislation regarding remote sensing is evidence of the long history and maturity of the program.¹¹⁹

¹¹⁹ Gabrynowicz, Chart B.

Chapter V

Conclusions, Implications, and Recommendations for Further Study

CONCLUSIONS

In each of the six cases analyzed for this research, there are sufficient indicators to conclude that these states have pursued remote sensing capabilities to improve their position in the world order and achieve national objectives, particularly security; and that they view the hegemon's capabilities as the standard to attain. However, this does not mean that each of these states wants or expects to challenge and catch up with the hegemon. Waltz says that states will try to emulate the hegemon either to gain or neutralize areas that, if controlled by an adversary, could menace them. Waltz's theory provides an explanation for these states' behavior.

The finding that all six of these cases choose to invest in indigenous satellite reconnaissance programs rather than free-ride or purchase images is important. These states could have obtained many of the images they desire from other sources, essentially for free. However, the case research shows that these states place a very high priority on their ability to control access to remote sensing capabilities and that they recognize in an anarchic environment the only sure way to protect that access is to own the capability. The research also shows that these states view their space assets as an essential tool to meet a wide range of their national objectives from resource management to security.

Each of these states uses remote sensing data and acquires that data in a number of ways including publicly available data, purchases from commercial sources, and agreements with other states. However, unlike most states, these six are among the few states that own and operate their own remote sensing satellites. They give such a high

priority to the value of remote sensing data that they dedicate significant resources to owning, thereby controlling, the ability to acquire remote sensing data. This means that within the technical limitations of their remote sensing systems, they can acquire exactly the images they want when they want them. It also means if the other sources of remote sensing data are no longer available to them because of war or conflicts, sharing agreement disputes, or other unforeseen circumstances then they will still have a source of remote sensing data. Realists thinkers in general and Waltz in particular would say that these states' investment in remote sensing capabilities is an indicator they believe the international system is anarchic, and self-help the only real insurance against the potential loss of this essential capability.

Neo-realism recognizes the importance of both self-reliance and conserving scarce resources but it is ambiguous about which approach may be more important to the state. The behavior of these six states shows a clear choice for self-reliance. Their choice to own an indigenous remote sensing capability, in spite of the costs, suggests that hedging against the corrosive effects of anarchy trumps free-riding every time. These states have concluded that free riding is not sufficient to protect them from outside threats or the loss of an ally's protection in the anarchic international environment.

France and Japan, the first pair, are U.S. allies and both are concerned about possible decline relative to recent arrivals like India and China. One would expect this pair to use their mature remote sensing programs to help maintain their current positions in the international system. In order to do this, they may need to use their remote sensing assets in different ways than their current programs allow. France is the United States'

oldest ally and participates in many cooperative efforts, but it engages in economic competition and sometimes differs politically with the United States.¹ France has publicly stated that its Satellite Pour l'Observation de la Terre (SPOT), as is common with other French high-technology programs, is a strategic tool for sovereignty and therefore is supported regardless of its real or supposed commercial value.² Japan, whose security is tied to the United States, is fundamental to regional stability in East Asia and seeks increasingly closer ties to the multilateral global institutions that made its post World War II prosperity possible.³ Japan's crowded neighborhood is filled with potential threats; therefore it hedges against a change in U.S. policy by maintaining an independent intelligence gathering capability that includes space-based assets. When this research began Japan's remote sensing program was at a crossroads, but since that time Japan has enacted a Law of Space that enhances national security, supports Japanese industry, and promotes research and development.

France and Japan are mature states, politically and economically. They have been widely viewed as major powers for over a century. However, maintaining their positions is becoming more difficult as the new international arrivals gain capability and prominence. Their remote sensing programs are also mature; and both governments continue to maintain their space programs in spite of financial challenges. In these well-educated, technical, modern societies public support for the space programs is the norm. In 2008, France and Japan made remarkably similar decisions. The French President

¹ Woods, 140-141 & 149.

² Sourbes-Verger and Xavier Pasco, 187.

³ Kegley, 122-123.

announced the release of a White Paper on Defense and the Japanese Prime Minister announced the enactment of a Basic Law on Space. Both documents outlined national security concerns and the critical role of national space assets in the defense of the country. Also, both strategies authorized the use of space for military activities to support national security objectives. Implementation of these new strategies was accompanied by organizational changes in both governments. France created a Defense and National Security Council composed of the President, Prime Minister, and Ministers of Foreign Affairs, Interior, Defense, Economy and Budget; and Japan created a Cabinet Level Office to facilitate institutional arrangements.

France and Japan are different in many ways. France does not fear military action by its closest neighbors, while Japan sits in the middle of a region that requires the Japanese leadership to be ever wary of other states' actions. However, in 2008 France's and Japan's decisions, rationale, and execution of national security strategy regarding space were very similar. Neo-realists would suggest that France should be more inclined to free ride than Japan because its neighborhood is safer. However, the similarity in the two states' actions indicates that the security imperative overrules free riding, even in Europe. If free riding had a higher priority for France, we would have expected to see France edge closer to free riding during the period leading up to and after the Soviet collapse. To the contrary, France not only maintained and improved its SPOT program during this period, but also increased its overall capability with the continued development and launch of the Helios military observation satellites.

France and Japan are not so much concerned about the militarization of space because that has already happened, but they are concerned about the weaponization of space. The rapidly increasing technical capabilities of new arrivals on the international scene are also reason for concern. In an anarchic system, France and Japan must prepare to protect themselves and the best way to do that is to emulate the global hegemon namely, the United States. It is also important to note that in both cases, the person holding the highest office made the announcement regarding a revised space program and the announcement itself was very straightforward. National defense and security is the issue—there was no attempt to disguise the intent in a more “acceptable” way.

Both of these states benefit from their relationship with the United States. They may challenge or disagree with the hegemon on those issues that are particularly important to them, but overall they cooperate with the United States. They choose to emulate the hegemon’s preeminence in this area of expertise because they recognize this as a way to neutralize threats from an adversary and hedge against the loss of U.S. protection.

Brazil and India, the second pair, are in the upper ranks of the regional powers and have long been ignored, but are now pressing hard for admission into the ranks of the great powers.⁴ One would expect this pair to aggressively employ their remote sensing assets to minimize their vulnerabilities as they improve their international standing. Brazil has a strong state structure capable of promoting economic development and effective at bargaining with foreign capitals. Brazil has also defined its own international

⁴ Buzan, 189.

policy that, though friendly with the United States, maintains its distance from American foreign policy on some important issues.⁵ Brazil's remote sensing satellites are used for environmental monitoring and urban planning, and are seriously being considered for military purposes.⁶ India is a regional power that shares its region with another two nuclear-armed states: Pakistan and China. It also has the potential to be a major ally to the United States as well as a fellow democratic nation particularly since the United States is concerned about nuclear proliferation and terrorism in this region.⁷ India is an important remote sensing state and says that its remote sensing program is for the socio-economic benefit of the country consistent with security concerns.⁸

Brazil and India are important powers in their part of the world, but they are no longer satisfied with remaining "below the radar;" and they both look to the United States for the blueprint on how to gain international status. In both cases, they are preoccupied with recognition as a modern state—in this case India more so than Brazil. Of course, India's image is a bit more tarnished because of the crushing poverty of its lower social classes. India frequently defends its expenditures on modern technology, especially military-related technology, when challenged about its inability to care for its large poverty-stricken population. In its defense, India only has to point to its neighbors, Pakistan and China, to justify its acquisition of high-tech military capability. Brazil on the other hand, has no real threats on its borders. What it does have is an immense territory with fragile, valuable resources to protect. The only practical way to do this is

⁵ Woods, 169.

⁶ James Martin Center for Nonproliferation Studies, "Brazil" and "Brazil: Military Programs."

⁷ Buzan, 194-195.

⁸ Indian Space Research Organization, "Organization."

with high-tech capabilities, particularly remote sensing assets. The area where these two different perspectives show most clearly is in these two states' approach to data dissemination. India is very concerned about dissemination control and even takes issue with commercial companies like Google Earth, while Brazil has made not only its remote sensing images available free on the internet, but it has also made the associated software available.

Both Brazil and India are committed to retaining their remote sensing assets and in the face of financial challenges have made organizational changes and reprioritized their space program plans in order to maintain these assets. In some ways, India has farther to go than Brazil because India has the additional challenge of capacity building in a country where illiteracy is hampered by the lack of compulsory education and a caste system that stifles the potential of the "best and brightest" if they are from the wrong social group. The official statements about their remote sensing assets can be found on their government websites, usually the national space center websites, and in both states they say that these assets are essential to their modernization and the welfare of their citizens. Both states tend to downplay the military capabilities of these dual-use assets, but it is clear that the military is not only involved but holds significant decision-making responsibilities. Both states have national remote sensing policies that they are strengthening, but they currently have no specific remote sensing legislation.

These states choose to emulate the hegemon because they hope to improve their status and become major powers in the international realm. Both Brazil and India have benefited from cooperating with the United States. Both have also had periods of

political conflict with the U.S, usually about military issues. Brazil's military administrations and India's nuclear program are just two examples significant issues of disagreement, though the U.S. had since de facto endorsed India's nuclear program. However, neither of these countries exhibits a desire to challenge the United States for preeminence or expects to achieve parity with the United States on multiple fronts. However, both are working diligently to attain the highest level of remote sensing expertise possible, India primarily for security and Brazil primarily for resource management.

China and Russia, the third pair, are potential competitors for preeminence. This pair can be expected to use their remote sensing assets to improve their current standing in the world order and reclaim some of their historical prestige. China, the third largest economy in the world, is Brazil's partner in remote sensing.⁹ China has implemented an aggressive military modernization program while insisting that it seeks peaceful relations with all great powers. However, it has condemned the United States for pursuing "hegemonic domination of the world" while the U.S. has supported integration of China into the global economic system. The two countries cooperate on many levels though relations are sometimes complicated by events in Taiwan and Hong Kong.¹⁰ Russia has weathered numerous challenges during its post-Soviet years and has taken important steps to be recognized as a great power once again. And as in the past American

⁹ James Martin Center for Nonproliferation Studies, "China: Military Programs."

¹⁰ Kegley, 119–121.

dominance, power and policy remain the most important challenge.¹¹ Russia has a long heritage in earth observation and a broad variety of sensing platforms and instruments.¹²

China and Russia are both undergoing complex transitions politically, socially, and economically. Both hope to be great powers and they recognize that it was the capitalistic United States that became the hegemon not them. They have abandoned their communist plans and socialistic ways in exchange for as much of the western hegemon's strategy as they can tolerate. Both China and Russia recognize that they must rise to the technical level of the United States if they are to challenge the United States.

The government of China publicly uses the United States space program as its standard for modernity. Their ambitious space program, announced in the White Paper of 2006, duplicates as much of the United States space program as is possible. China even established a space agency modeled on NASA and has begun the process of developing space legislation while, in the interim, relying on basic laws covering science and technology, and national policy on space and remote sensing.

Russia is the original space faring nation and has held on tightly to its space program in spite of major financial challenges. It refused to lose the assets that had helped make its predecessor a great power in a bi-polar world. However during the tumultuous period following the breakup of the Soviet Union, Russia has not been able to maintain its space assets at the same level as the Soviets, however qualitative improvements have been made. Russia recognizes that in order to challenge the United States that must change. Russia already has the government structure to support a space

¹¹ Ibid., 123–124.

¹² Tahu, 165.

program, but it needs an infusion of capital, so the establishment of a company that could provide images and services for a fee helped to offset some costs of maintaining the assets. The president and prime minister frequently refer to the space program or specific components of it. There is broad federal legislation that covers remote sensing and legislation on space activities.

Both of these states, in their previous incarnations, had hopes of being the sole leader of the world. Both have benefited from cooperation with the United States in recent years, but they have also challenged the U.S. on many issues. Today, China is the only one of the two that has a realistic expectation of successfully challenging the United States on multiple fronts. China is emulating the hegemon with the goal of eventually succeeding, though it recognizes that the journey may be lengthy. China views the United States' space program as the standard for modernity so its pursuit of remote sensing expertise is a logical goal. Russia, on the other hand, is emulating the hegemon in hopes of maintaining its current status. Though Russia would like to regain parity with the United States its internal problems make that unlikely on most fronts, but its own expertise in space can be enhanced by following the U.S. lead.

India and China publicly and proudly hold up their space programs as evidence of development and modernization. Both are investing heavily in science and technology as their entry into the international leaders' arena; and specifically view investments in space programs as the elite portion of scientific achievements possible by an international leader.

All six cases are committed to continuing space programs. Long range plans include continuing development and increased use of space assets. Most of these states are maintaining or increasing space related budgets over the long-term. Brazil and Russia face budgetary constraints that do not allow for budgetary increases and in some areas, decreases are actually necessary. However, these decreases or maintenance at current levels are implemented in such a way as to protect quality of operations and mitigate risk. All of these states seek to capitalize on opportunities for revenue from their space assets, but they do not do so at the risk of their security or the risk of losing technical preeminence relative to another state.

IMPLICATIONS

When embarking on the research for this dissertation it was assumed that Kenneth Waltz's theory might provide an explanation why some of the selected cases choose to develop and support an indigenous remote sensing capability rather than free ride, but it would have been overly optimistic to assume that the theory would provide an explanation for all six cases. Therefore the results were surprising and striking. The research accomplished the original purpose of investigating whether states view indigenous remote sensing assets as a capability, which helped the hegemon attain its position in the world order and therefore is one to emulate because it can provide a path to global preeminence. The dissertation conclusions also provide a new indicator that political scientists can and should use in future studies and research. The anarchic nature of the international environment will remain with us for the foreseeable future so any additional insights that can be provided by a new indicator should be of value to the study of international relations.

These insights have implications for how we study international relations and what we might expect to discover. Space capabilities have been viewed as a luxury within the reach of only the richest and most technically advanced states. In addition, space capabilities have been considered an enabler for those rich and technically advanced states, but they were not thought to be essential for rising powers or for warfare. The findings of this research support a different notion, one where space capabilities are an essential asset rather than an option for ambitious states.

Some leaders believe that space capabilities are no longer an “enabler” but are core assets in modern war fighting. “Space is a critical component in the United States’ ability to conduct military operations.” Other states have recognized this and are developing indigenous space capabilities.¹³ In reference to U.S. space capabilities, Admiral James Ellis, former Commander of the U.S. Strategic Command, declared: “I guarantee you that our adversaries understand where the source of our technical prowess is.”¹⁴ In 1999, U.S. military spending accounted for 94.8% of the global military space budgets.¹⁵ The U.S. had 110 military-related space satellites while Russia had forty and the rest of the world combined possessed twenty.¹⁶ The United States is still considered to have a commanding lead in space technology; however other states—friendly and foe—are rapidly developing autonomous military and commercial space capabilities.¹⁷

If we accept the notion that space capabilities are core assets and essential to a states’ ability to maintain its coveted position or attain a better position in the world order then observing states’ space based programs should provide some insight into the states’ ambitions. As political scientists we should no longer view space assets as a capability of only the richest and most advanced states. It is true that the number of states capable of owning indigenous space capabilities is likely to remain limited for some time to come, but by observing those states that do commit to owning space based assets we may be

¹³ The Jewish Institute for National Security Affairs (JINSA), “Foes See U.S. Satellite Dependence as Vulnerable Asymmetric Target, December 4, 2003. <http://www.jinsa.org> (accessed November 21, 2006) (Extract from statement by Army Lt. Gen. Edward G. Anderson III, Deputy Commander of U.S. Space Command at the time of statement. Statement made at the 2001 Fletcher Conference, an annual meeting co-sponsored by the U.S. Army and Tufts University.)

¹⁴ Ibid., (Statement made by Adm. Ellis to Defense News on September 15, 2003.)

¹⁵ Ibid., (According to a December 18, 2002 article by the Center for Defense Information on space weapons.)

¹⁶ Ibid., (According to a 2001 study conducted by the Stockholm International Peace Research Institute.)

¹⁷ Ibid.

able to identify those states who intend to improve their position within their own region of the world if not globally.

President John F. Kennedy was asked to explain the difference between Atlas missiles and the Atlas launcher that sent the Mercury astronauts into space. He responded, "Attitude."¹⁸ Space activities are by nature dual-use, so attitude is everything especially in an anarchic environment. The six case states are in competition with each other and the United States for preeminence as exhibited by their attitudes and actions regarding space activities in general and remote sensing in particular.

¹⁸ Glenn Harlan Reynolds, "Commentary: Space Law in its Second Half-Century," *Journal of Space Law* 31, no. 2, (2008), 421.

RECOMMENDATIONS FOR FURTHER STUDY

The possibilities for further study are numerous. However, one of the most interesting is the weaponization of space. The explanatory power of Waltz's theory would again be useful if such a line of inquiry were pursued. In fact, these six cases could continue to be the focus of such research. We are already seeing events that could be interpreted as the forerunner to the weaponization of space.

For example, one of the most dramatic recent space events and one that highlights the anarchic nature of the international environment was the Chinese anti-satellite (ASAT) test on January 11, 2007. This event has had the space community in an agitated state ever since and it clearly highlights the inability of current legislation to prevent such an action. According to Dr. Nair, technically the Chinese did not violate the prevailing laws with respect to outer space. China did however capitalize on the legal lacunae of Article 4 of the 1967 Outer Space Treaty, which prohibits placing objects carrying nuclear weapons or other kinds of weapons of mass destruction into orbit. In strictly legal terms, China did not use nuclear weapons or other weapons of mass destruction therefore the test did not violate existing legislation. Also, they destroyed their own satellite so they cannot be charged under Article 7, which says that states are internationally liable for any damage caused to another state by their space objects.¹⁹ However, they can be held accountable under Article 9 for failing to conduct international consultations before proceeding with activities that could potentially harm

¹⁹ K. K. Nair, "China's ASAT Test: A Demonstrated Need for Legal Reform," *Journal of Space Law* 33, no. 1 (2007), 191-192.

other parties.²⁰ The policy and legal communities will continue to debate what should be done to strengthen legislation to deter if not prevent states from such activities.

Waltz would say that in an anarchic environment, by definition an environment without a controller, no amount of legislation can deter or prevent such an action—in this case the development and testing—if the states view these capabilities as important to their national security. Also deterrence will only be successful if states view the alternative as unacceptable. The increasing discourse on the weaponization of space is evidence that the weaponization of space is a very real possibility and no longer a “What if ...?” scenario.

Another area for consideration would be an assessment of those states that previously indicated an interest in acquiring their own remote sensing capabilities, but did not pursue that avenue to completion. Why did they not pursue this acquisition? Was it too expensive? Was it politically unacceptable within the state? Would it have generated more aggression among their neighbors than they could deal with successfully? Are they comfortable with their current method of acquiring remote sensing data and believe that method is safe and reliable well into the future? Or were their ambitions successfully countered by the reigning space-faring states?

²⁰ Ibid., 192.

APPENDICES

APPENDIX A

Descriptions of Concepts and Terms Related to Remote Sensing and Space Technologies

COMMERCIAL:

The distinction between “public” and “private” in the remote sensing space segment has almost disappeared worldwide. What constitutes “commercial” operations varies among states. For example: in Europe the term commercial means to generate revenue and it applies to any entity that does so, regardless of by whom. In the United States, the term commercial means a private sector activity, and in general is not applied to government activities. The policy implications are the same regardless of the definition used. “The close relationships between revenue-generating remote sensing space systems, regardless of public or private designation, and their states of origin; the high degree of direct or indirect subsidies, and targeted contractual funding appear to be creating hybrid entities worldwide that increasingly embody elements of both public and private institutions.” The emerging trend for space segments and ground segments of remote sensing activities is toward “public-private partnerships.” The term public-private partnership has no uniform definition but it usually implies risk sharing.¹

HIGH-RESOLUTION:

There is no uniform definition of “high-resolution.” Depending on a state’s or company’s history and capabilities it can range from 5.8 meters to well less than one meter.² A number of factors affect what can actually be identified in an image. However, the spatial resolution of the sensor (on the satellite) is a key factor in the detail discernible in an image and it refers to the size of the smallest possible feature that can be detected. The higher the resolution the smaller the object that can be detected.³

¹ Gabynowicz, 15-16.

² Ibid., 12.

³ Canada Centre for Remote Sensing.

MILITARIZATION (of space):

The militarization of space, in the broadest terms, connotes the “non-aggressive” use of the medium of outer space for military functions. These functions include, but are not limited to, communications, navigation, and observation.⁴

REMOTE SENSING:

“In its common or normal usage (by tacit implication), remote sensing is a technology for sampling electromagnetic radiation to acquire and interpret non-contiguous geospatial data from which to extract information about features, objects, and classes on the Earth’s land surface, oceans, and atmosphere.”⁵

REMOTE SENSING SPACE SEGMENT:

This research effort is focused on states remote sensing space segments. Simply put, this segment collects images, which in their fully processed form can look like photographs. Where useful this document includes references to other components of a state’s space program like launch capabilities, research efforts, etc. This is done deliberately to emphasize total capabilities, commitment, etc.

The variety of types and capabilities within the broad category of remote sensing are numerous. Also without exception any satellite is but a piece within an extensive system that includes research and development; production; launch; collection; retrieval, processing, exploitation, production, dissemination, etc. Most of it is highly technical and scientific requiring large budgets, specialized and highly educated personnel, and commitment to a long-term plan. However there are parts of the system/process, such as the interpretation of images, that are more like art merged with high-tech. It requires specially trained people and equipment to download the data, manipulate it and turn it into a “readable” image, and then produce a usable product that may include “value-added,” –an explanation of what the user is seeing.

SHUTTER CONTROL:

Shutter controls are government-authorized mechanisms to interrupt, withhold or prevent data access. A prior form of control or restriction was “resolution control” which preventing sales of images with less than a certain resolution. This was used primarily by the U.S. because the U.S. had the highest resolutions. Such

⁴ Nair, 194.

⁵ Nicholas Short, “Remote Sensing Tutorial,” NASA at http://rst.gsfc.nasa.gov/Intro/Part2_1.html (This definition most appropriately applies to the way remote sensing is used in this research. Dr. Short’s tutorial also includes a very broad, scientifically precise definition for the technically brave reader as well as a more simplistic definition for the techno-babble weary reader.)

restrictions were initially put in place by the Clinton space policy.⁶ One of the most interesting cases was based on Israeli fears not U.S. concerns. In 1996, Congress passed an amendment which prohibited U.S. firms from selling images of Israeli territory with less than a two-meter resolution. This occurred after an effort by Saudi Arabia to buy a U.S.-made satellite for imaging the Middle East. In 1998, the U.S. allowed general sales of images down to one-meter, Israel protested and the exception for coverage of Israel (no less than two meters) remained in place.⁷

TRANSPARENCY OF LAWS AND POLICIES:

Laws and policies are rarely transparent though there are indications that this is improving. The National Center for Remote Sensing, Air and Space Law defines transparency as legal, regulatory and policy materials being readily accessible in official sources like published legal codes, regulations and policies. The United States is one of the most open with unclassified laws and policies that are available in published national legal codes and on numerous Internet sites. This type of transparency is rare for many reasons including differences between legal systems, cultural attitudes toward the availability of information and privacy, and language differences. Developing states may view transparency as a “weapon” of some developed states. English is the accepted language of aerospace activities, but all remote sensing related laws and policies are not routinely translated into English.⁸

WEAPONISATION (of space):

The weaponisation of space implies the actual placement of weapons in outer space, or their use in outer space or from outer space.⁹

⁶ Gabrynowicz, 14.

⁷ Ibid. (Reported by the Center for Defense Information reports in a 14 Feb 2004 article by Theresa Hitchens, “Space Security - Commercial Imagery: Benefits and Risks” at <http://www.cdi.org/friendlyversion/printversion.cfm?documentID=2111>.)

⁸ Ibid., 7-11.

⁹ Nair, 194.

APPENDIX B

UNITED NATIONS GENERAL ASSEMBLY

Resolutions and Treaties Pertaining to the Peaceful Uses of Outer Space¹⁰

Five treaties and five sets of legal principles form the approved core of UN documentation on matters relating to the exploration and uses of outer space. Each of these documents emphasizes that the province of outer space, the activities carried out there and all benefits that might accrue from them should be peaceful and undertaken for the benefit of all humankind. In general, the treaties are based on the principle of promoting international cooperation in all outer space activities. The five declarations and set of principles provide for the application of international law and enhancement of international understanding. In addition, they endorse the dissemination and exchange of information through the direct use of satellite television and the sharing of data obtained from satellite observations of Earth's resources. They also provide general standards regulating the safe use of nuclear power sources necessary for the exploration and use of outer space.

The international legal principles in the five treaties establish the exploration and use of outer space as the province of all humankind free from national appropriation. These principles ban the placement of nuclear weapons in outer space, provide liability for damage caused by space objects, and provide for the safety and rescue of spacecraft

¹⁰ UN. (All of the information in this Appendix is Background Information from UNISPACE III and can be found at <http://www.un.org/events/unispace3/bginfo/gares.htm>)

and astronauts. They endorse the prevention of harmful interference in space activities, as well as the avoidance of harmful contamination of celestial bodies and adverse changes in the Earth's environment. The principles provide for the notification and registration of objects launched into outer space and the regulation of scientific investigation and exploitation of natural resources found on the Moon and other celestial bodies.

THE TREATIES

The 1966 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies:

This treaty is known as the "Outer Space Treaty" and entered into force on October 10, 1967; and as of February 1, 1999 there are 95 ratifications and 27 signatures. It states that space exploration shall be carried out for the benefit of all humankind, irrespective of their degree of development. It seeks to maintain outer space as the province for all humankind, free for exploration and use by all States and not subject to national appropriation.

The 1967 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space:

This treaty is known as "The Rescue Agreement" and entered into force on December 3, 1968; and as of February 1, 1999 there are 85 ratifications and 26 signatures. Generally, it provides for aiding the crews of spacecraft in the event of accident or emergency landing. It also establishes a procedure for returning space objects to a launching authority found beyond the territorial limits of that authority.

The 1971 Convention on International Liability for Damage Caused by Space Objects:

This treaty is known as "The Liability Convention" and entered into force on September 1, 1972; and as of February 1, 1999 there are 80 ratifications and 26 signatures. It provides that launching States are liable for damage on the Earth's surface, to aircraft in flight and/or to space objects of another State, or to persons or property on board those craft which is caused by their space objects.

The 1974 Convention on Registration of Objects Launched into Outer Space:

This treaty is known as “The Registration Convention” and entered into force on September 15, 1976; and as of February 1, 1999 there are 40 ratifications and 4 signatures. It provides that launching States furnish specified information on each launched space object to the UN for inclusion in a central register.

The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies:

This treaty is known as “The Moon Agreement” and entered into force on December 18, 1979; and as of February 1, 1999 there are 9 ratifications and 5 signatures. It elaborates, in more specific terms, the principles relating to the Moon and other celestial bodies that are documented in the 1966 Treaty. In addition, it provides the basis for future regulation of the exploration and the exploitation of natural resource found on such bodies.

THE PRINCIPLES

The Declaration of Legal Principles Governing the Activities of State in the Exploration and Uses of Outer Space:

This principle was the precursor to the Outer Space Treaty and was adopted by the General Assembly in 1963 (resolution 1962 (XVIII)). It provided the basic components of international space law and included the notion that exploration of space should be for the benefit of all States.

The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting:

This principle considers that such use has international political, economic, social, and cultural implications; and it was adopted in 1982 (resolution 37/92). Specifically it stipulates that any State intending to establish a broadcasting service should notify all receiving States and establish such a service only on the basis of agreements with those States.

The Principle Relating to Remote Sensing of the Earth from Space:

This principle was adopted in 1986 (resolution 41/65). It states that remote sensing activities are to be conducted for the benefit of all countries, with respect for the sovereignty of all States and people over their own natural resources, and for the rights and interests of other States.

The Principles Relevant to the Use of Nuclear Power Source in Outer Space:

This principle was adopted in 1992 (resolution 47/68). It recognizes that nuclear power sources are essential for some space-related missions; however those systems should be designed to minimize public exposure to radiation in the case of an accident.

The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries:

This principle was adopted in 1996 (resolution 51/122). It recognizes the particular needs of developing countries and how those needs might be served through international cooperation in the exploration and use of outer space. Therefore it places high importance on using space for the benefit and interest of all States.

APPENDIX C

ACRONYMS

ABM	anti-ballistic missile
AEB	Brazilian Space Agency
ALADI	Latin American Integration Association
ASAT	anti-satellite
ASEAN	Association of Southeast Asian Nations
ASLV	Augmented Satellite Launch Vehicle
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BBC	British Broadcasting Corporation
BMD	Ballistic Missile Defense
CBERS	China-Brazil Earth Resources Satellite
CIS	Commonwealth of Independent States
CNES	Centre National d'Etudes Spatiales (National Space Studies Center)
CNSA	China National Space Administration
COBAE	Brazilian Commission for Space Activities
COSPAR	Committee for Space Research
COSTIND	Commission of Science, Technology and Industry for National Defense
CRS	Congressional Research Service
DAE	Department of Atomic Energy
DGA	Délégation générale pour l'armement (Defense Procurement Agency)
DOS	Department of Space
DRDO	Defense Research and Development Organization
ELINT	electronic intelligence
EPA	Economic Partnership Agreements
ESA	European Space Agency
ESDP	European Security and Defense Policy
EU	European Union
G-8	Group of eight economic power nations
G-20	an international financial forum from 20 economies
GCE	Groupe de coordination espace (Space Coordination Group)
GDP	Gross Domestic Product
GDTA	Groupe pour le Développement de la Télédétection Aérospatiale

GDL	Gas Dynamics Laboratory (Association for the Development of Remote Sensing)
GEO	Geo-stationary orbit
GIRD	Jet Propulsion Research Group
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
GRT	Groupe des Ressources Terrestres (Terrestrial Resource Group)
GSLV	Geosynchronous Satellite Launch Vehicle
IAEA	International Atomic Energy Agency
ICBM	intercontinental-range ballistic missile
IGN	Institut Geographique National (National Geographical Institute)
IGS	Information Gathering Satellites
IMF	International Monetary Fund
IMSD	Integrated Mission for Sustainable Development
INCOSPAR	Indian National Committee for Space Research
INPE	National Institute of Space Research
INSAT	Indian National Satellite
IP	Measurement Complex
IRS	Indian Remote Sensing satellite
ISRO	Indian Space Research Organization
ISS	International Space Station
ISTRO	ISRO's Telemetry, Tracking & Command Network
ITU	International Telecommunications Union
ICBM	intercontinental-range ballistic missile
JAXA	Japan Aerospace Exploration Agency
JDA	Japan Defense Agency
JEP	Joint Experiments Program
JERS	Japanese Earth Resources Satellite
LDP	Liberal Democratic Party
LEO	Low-earth orbit
MITI	Ministry of International Trade and Industry
MOFA	Ministry of Foreign Affairs
MOS	Marine Observation Satellites
MOU	Memorandum of Understanding
MTCR	Missile Technology Control Regime
NAM	Non-Aligned Movement
NARL	National Atmospheric Research Laboratory
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NATO	North Atlantic Treaty Organization

NDC	NRSA's data center
NE-SAC	North Eastern-Space Applications Centre
NIE	National Intelligence Estimate
NNRMS	National Natural Resources Management System
NPC	National People's Congress
NPT	Non-Proliferation Treaty
NRSA	National Remote Sensing Agency
NSSP	Next Steps in Strategic Partnership
OAS	Organization of American States
OKIK	Command-Measurement Complex
OSCE	Organization for Security and Cooperation in Europe
PJC	Permanent Joint Council
PLA	People's Liberation Army
PNAE	National Space Activities Program
PND AE	National Policy on the Development of Space Activities
PRL	Physical Research Laboratory
PSLV	Polar Satellite Space Launch Vehicle
RNII	Jet Propulsion Research Institute
RRSSC	regional remote sensing service center
SAARC	South Asian Association for Regional Cooperation
SBDA	Brazilian Association of Air and Space Law
SCL	Semi-Conductor Laboratory
SCO	Shanghai Cooperation Organization
SDSC	Sadish Dhawan Space Center
SEO	Satellite for Earth Observations
SGDN	Secretariat General a la Defense Nationale (General Secretariat for National Defense)
SINDAE	National System for the Development of Space Activities
SITE	Satellite Instructional Television Experiment
SKKP	Russian Space Monitoring System
SLBM	Sea-launched ballistic missile
SLV	space launch vehicle
SPOT	Satellite Pour l'Observation de la Terre
SPRN	Soviet Missile Attack Warning System
STA	Science and Technology Agency
TERLS	Thumba Equatorial Rocket Launching Station
TES	Technology Experiment Satellite
TRMM	Tropical Rainfall Measuring Mission

UN	United Nations
UNASUL	Union of South American Nations
UNCOPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UNOOSA	United Nations Office for Outer Space Affairs
US	United States of America
USD	United States Dollars
USLO	United States Liaison Office
USSR	Union of Soviet Socialist Republics
VKS	Russian Space Forces
VLS	Vehiculo Lancador de Satelite
VSF	Brazilian Sounding Vehicle
WEU	Western European Union
WMD	weapons of mass destruction
WTO	World Trade Organization

APPENDIX D

Results of Analysis

	States	Commitment	Laws/Policies	Official Statements
International Environment (Anarchy)	France	Restructured to meet financial challenges and maintain program Established Defense and National Security Council Double spending on military space assets by 2020 (White Paper)	2008 White Paper on Defense	President announces White Paper conclusions and implementation strategy
	Japan	Sufficient funding to execute Created Cabinet-level Office	2008 Basic Law on Space focused on national security (military use of space)	Prime Minister announced Basic Law passed and introduced implementation strategy
	Brazil	Significant investment in Science & Technology Restructure/reprioritize in order to deal with financial issues New emphasis on commercial side to bring in revenue but not to detriment of program Emerging military component	No specific legislation Specific Nation Policy	Statements by National Institute for Space Research (about CBERS)
	India	Viewed as critical to modernization and national security Emphasis on capacity building Establishing education programs and institutions Investment in related S&T research & applications Developing public support for space program	No specific legislation Remote Sensing Policy Concerned about dissemination issues	Government statements about “socio-economic” benefit to country Government statements reveal pride in having the largest constellation providing national and global services
	China	Views modernity as prerequisite for global status (U.S. space program standard of modernity) Ambitious space program with long-range goals Established NASA-like space agency Active military component of program	Basic Laws on S&T. No specific laws on remote sensing 2006 White Paper on Space (Policy) Since joining UNCOPOS, exploring specific legislation	Government of China announced 2006 White Paper Conclusions Government of China always announces successful civilian remote sensing and space-related accomplishments
	Russia	National pride to retain space program Developed commercial side for revenue to offset financial challenges Restructured program with quantitative decreases while maintaining quality	Broad federal legislation covers remote sensing Regulations on space activities	President and Prime Minister frequently refer to space program

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