Strategy Research Project

U.S. – China Space Cooperation: A Partnership Long Overdue

by

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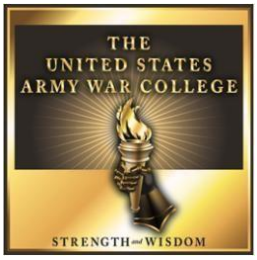

United States Army War College
Class of 2015

REPORT DOCUMENTATION PAGE

Form Approved--OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
01-04-2015	STRATEGY RESEARCH PROJECT	

4. TITLE AND SUBTITLE
U.S. – China Space Cooperation: A Partnership Long Overdue

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Lieutenant Colonel Eric D. Little
United States Army

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Colonel Michael C. Howitz
Department of Military Strategy, Planning, and Operations

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army War College, 122 Forbes Avenue, Carlisle, PA 17013

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Distribution A: Approved for Public Release. Distribution is Unlimited.

13. SUPPLEMENTARY NOTES
Word Count: 5314

14. ABSTRACT

The announced rebalance towards the Pacific by the United States comes with a renewed effort to establish partnerships and adopt a cooperative posture with not just friends and partners in the region, but also with potential adversaries. Despite U.S. policy clearly stressing the importance of expanded partnerships and cooperation with China, there is a continued adversarial posture maintained by the U.S. in the space realm. Failing to cooperate with China will result in a contested and congested space environment that will lead to catastrophic and irreversible consequences. Additionally, the exorbitant cost associated with space acquisition, combined with the very robust inventory of systems providing capabilities to end-users is not sustainable in the current fiscal environment. A U.S. – China space partnership comes with risk, however, these risks do not outweigh the advantages of a positive U.S.-China relationship, nor do they outweigh the consequences of a failure to establish this relationship.

15. SUBJECT TERMS
Contested, Congested, Satellite, Space Systems

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPHONE NUMBER** *(w/ area code)*
UU	UU	UU	UU	30	

USAWC STRATEGY RESEARCH PROJECT

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This manuscript is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

Abstract

Title: U.S. – China Space Cooperation: A Partnership Long Overdue

Report Date: 01 April 2015

Page Count: 30

Word Count: 5314

Key Terms: Contested, Congested, Satellite, Space Systems

Classification: Unclassified

The announced rebalance towards the Pacific by the United States comes with a renewed effort to establish partnerships and adopt a cooperative posture with not just friends and partners in the region, but also with potential adversaries. Despite U.S. policy clearly stressing the importance of expanded partnerships and cooperation with China, there is a continued adversarial posture maintained by the U.S. in the space realm. Failing to cooperate with China will result in a contested and congested space environment that will lead to catastrophic and irreversible consequences. Additionally, the exorbitant cost associated with space acquisition, combined with the very robust inventory of systems providing capabilities to end-users is not sustainable in the current fiscal environment. A U.S. – China space partnership comes with risk, however, these risks do not outweigh the advantages of a positive U.S.-China relationship, nor do they outweigh the consequences of a failure to establish this relationship.

U.S. – China Space Cooperation: A Partnership Long Overdue

The announced rebalance towards the Pacific by the United States comes with a renewed effort to establish partnerships and adopt a cooperative posture with not just friends and partners in the region, but also with potential adversaries. There are numerous examples of increased collaboration and cooperation between the U.S. and China, to include climate change, public health, economic growth, and the denuclearization of the Korean Peninsula. For obvious reasons, the increased cooperation is very cautious and measured, but it exists and it is growing. Absent in this pursuit for increased cooperation with China is any effort to partner in the space domain. Despite a strong emphasis throughout current policy and strategy towards an expanded partnership and increased cooperation with China, the U.S. continues to maintain an adversarial approach with all things space related. This paper will explore why a relationship with China is necessary in space; it will address the risks associated with the establishment of this relationship; and finally, it will prescribe a methodology of how to best initiate this relationship.

The 2010 National Space Policy of the United States of America highlights the need for international cooperation with allies and space partners. Two of the highlighted goals in the policy follow-[1]

> **Expand international cooperation** on mutually beneficial space activities to: broaden and extend the benefits of space; further the peaceful use of space; and enhance collection and partnership in sharing of space-derived information
>
> **Strengthen stability in space** through: domestic and international measures to promote safe and responsible operations in space; improved information collection and sharing for space object collision avoidance; protection of critical space systems and supporting infrastructures, with special attention to the critical interdependence of space and information systems; and strengthening measures to mitigate orbital debris.

The inclusion of ‘space partners’ implies that cooperation is necessary beyond those nations that the U.S. considers friends or allies. The relationship between the U.S. and Russia provides a good example of a space partnership that is working out of mutual interest and even necessity despite an abundance of adversarial viewpoints in other areas. This ‘partnering’ element of the space policy is consistent with overarching U.S. strategy. The 2015 National Security Strategy states that the United States welcomes the rise of a stable, peaceful, and prosperous China…we seek to develop a constructive relationship with China that delivers benefits for our two peoples and promotes security and prosperity in Asia and around the world.[2] Although refreshing to see a push for cooperation with China in the National Security Strategy, it neglects cooperation in the space domain. There are two primary reasons why inclusion of a space partnership with China is necessary in this policy. First, a partnership with China will serve great lengths to mitigate the rising competition and congestion in space. A failure of space faring nations to cooperate will result in the continued competitive pursuit of the domain, ultimately leading to an environment that is so congested and competitive that it will be rendered useless. During a recent National Space Symposium briefing, Deputy Assistant Secretary of Bureau of Arms Control, Verification and Compliance, Frank A. Rose stated, “Today, there are approximately sixty nations and government consortia, as well as numerous private sector organizations that operate in space, and that number is expected to continue to grow. This increasing use – coupled with space debris resulting from past launches, space operations, orbital accidents, and testing of destructive ASATs which generated long-lived debris – has resulted in increased orbital congestion, complicating space operations for all those that

seek to benefit from space."[3] The second reason to partner with China involves simple economics. The costs to maintain cutting edge technology necessary to meet the high demand from the military, commercial, and private sectors are far too high for any nation to sustain alone.

Looking at the core U.S. national interests as well as national policy and strategy, it is evident that a cooperative stance between the U.S. and China in the space arena is necessary. Unfortunately for the U.S., our friends and allies, as well as the rest of the world, this cooperative stance is glaringly absent. In fact, the U.S. has assumed a very closed and adversarial posture with China regarding operations in space. The U.S. currently cooperates in space with the nations of India, Vietnam, Japan, Russia, and Australia to name a few.[4] However, the U.S. has not pursued, nor is there any indication of intent to pursue cooperation with China. The U.S. recently participated in the ASEAN Regional Forum (ARF) workshop on space security, and is increasing engagement with ASEAN members as part of a broader effort to deepen U.S. commitment to the region to ensure a sustainable and secure space environment.[5] Absent in these engagements is the largest and most capable space nation in the region, China. With this in mind, why does the U.S. continue to keep China at arms length? There are several very defendable reasons as to why this is the case. The primary reason to maintain a closed relationship with China is due to the risk of information and technology loss. Additionally, as China continues to emerge as a world power and regional hegemon, there is significant concern that they will be our next major adversary in conflict or war. Although both valid concerns, these risks do not

outweigh the advantages of a positive U.S.-China relationship, nor do they outweigh the consequences of a failure to establish this relationship.

The Space Environment

The non-cooperative and competitive posture the U.S. is taking with China is serving as a catalyst to worsen the conditions in space and is increasing the risk of a catastrophe with irreversible effects. In order to better understand the impact and risks associated with an increasingly congested and contested space environment, a brief description of orbital mechanics and the space environment is helpful.

Newton's laws of motion and Kepler's laws of planetary motion in simple terms equate to the notion that objects in space orbit around the earth at thousands of miles per hour and are acted upon by a gravitational pull from the earth. In Lehman's terms, the objects are very gradually falling towards earth as they orbit.[6] As objects orbit around the earth, they do so with very limited ability to maneuver for either defensive or mission related purposes. There is a very inaccurate perception that maneuvering satellites is a common occurrence that it is done with relative ease. This is an important characteristic because as the space environment becomes more and more congested, collision avoidance via maneuver is not really an option. Another important consideration with the space environment is that satellites are essentially 'fire and forget type systems with regard to fueling and replenishment. This means that technology is very limited to conduct a rendezvous with satellites for repair, replenishment, or upgrade purposes.[7] This consideration is relevant because space systems must be continually replaced at the end of their life cycle. Although solar power is a technology that most space systems leverage to extend lifespan, all satellites will eventually run out of fuel and either reenter the earth's atmosphere or they will be intentionally "super-synched"

into deep space in order to minimize space debris. This aspect also greatly influences the acquisition process for space systems. Specifically, timelines are often extended in an effort to add on the latest technology prior to launch because once a system launches there are no opportunities for further modification. All of these characteristics are important because as the space environment becomes increasingly contested and congested, protective measures via maneuver or posturing are simply not possible. The end result is satellites and space systems becoming increasingly vulnerable to collisions in space.

The lowest and most easily accessible orbit in outer space to reach is a Low Earth Orbit (LEO). Objects such as satellites and space debris are most common in this orbit due to the lower cost to access, as well as the relative ease to put a satellite in LEO compared to the higher orbits.[8] Geo-synchronous orbits (GEO), Medium Earth Orbits (MEO), and a Highly Elliptical Orbits (HEO) are three additional orbits that have unique and distinct characteristics but are all used by several space faring nations. Generally speaking, there is much more congestion in the lower orbits due to the cost and access traits already mentioned. This congestion presents a problem not just for satellites in LEO, but the higher orbits as well because they have to travel through LEO to reach their destination in space.

Already introduced, an important aspect of the space environment that will assist in understanding the issue of orbital debris is gravity. Although there is a gravitational pull on objects in outer space, the force acting upon it is much less than what we experience inside the earth's atmosphere. The closer an object in space is to earth, the more gravitational force is acting upon it. Additionally, the more drag the object

possesses, the more gravity will act upon it. Conversely, the further out an object is from earth and the less drag it possesses, the less gravitational force is acting upon it. The issue with gravity in space (or the lack thereof) is orbital debris can take hundreds or even thousands of years to deorbit. To put the force of gravity and its effect on orbital debris into perspective, debris from a Chinese Anti-Satellite (ASAT) test in 2007 is still in orbit and is expected to remain for hundreds of years. The official debris count from China's anti-satellite missile test has reached 2,317 pieces big enough to be tracked and NASA's Orbital Debris Program Office is estimating more than 35,000 pieces larger than 1 cm. This makes the January 11 test the largest debris-generating event in history.[9] In 2009, NASA's chief scientist Nicholas Johnson said that the debris cloud extends from less than 125 miles (200 kilometers), to more than 2,292 miles (3,850 kilometers), encompassing all of low earth orbit. The majority of the debris have mean altitudes of 528 miles (850 kilometers) or greater, "which means most will be very long-lived," he said.[10] Debris the size of a paint chip traveling in excess of 17,000 mph can cause significant damage to space systems. The bottom line is although an attack on a satellite in space can be very discriminate, as proven by the Chinese ASAT test, the consequences and damage caused by the resultant debris is absolutely indiscriminate and impacts all space faring nations.

The impact of space debris on satellites or any functioning system in space is significant. In 1983, the space shuttle Challenger had a tiny chip of paint contact the windshield, penetrating several layers of the surface.[11] In 2007, the space shuttle Endeavor also sustained windshield damage from a small micrometeorite.[12] An unfortunate incident that demonstrates the overall vulnerability of space systems

occurred in 2009 when a Russian Cosmos satellite unintentionally slammed into a U.S. Iridium communications satellite over Siberia at an altitude of 490 miles (790 km), destroying both satellites. The result was not only thousands of pieces of space debris, but also a degradation of communications capability for the U.S.[13] The risk to systems in space is significant and it compounds with every incident.

A Contested, Congested, and Competitive Domain

The space environment is already a contested, congested, and competitive domain. Globalization, technological advancements, and a desire to demonstrate power are all factors leading more and more nations to enter the space race. There are two particular areas of concern associated with this growth. The first involves unnecessary redundancy of capabilities at the global level. For example, although the majority of the world leverages and utilizes Positioning, Navigation and Timing (PNT) capabilities from the Global Positioning System (GPS) constellation, multiple nations have already completed or initiated development of their own independent Global Navigation Satellite Systems (GNSS).[14] Beidou, GLONASS, and Galileo are all examples of GNSS that provide similar capabilities as GPS. The push to establish their own PNT systems derives from a fear that the U.S. will deprive them access and use of GPS. The U.S. does have a selective availability policy that promises the world at large that it will not take GPS away from any user, however this policy alone is not enough to convince many nations that they should not build their own system.[15] Improved policy and stronger assurances from the U.S. might help to assure these nations that GPS will always be available. PNT is only one of many areas where nations could partner, increasing efficiencies and reducing costs all while minimizing congestion and competition in space.

U.S. leadership recognizes the vulnerability of objects in space and is investing in terrestrial, “air-breathing” systems as a redundant backup to space systems. The high altitude airship is one example of a terrestrial system designed to duplicate many capabilities currently provided from space. Two shortfalls associated with terrestrial systems include system endurance and sovereignty. While systems inside the earth’s atmosphere possess station time that is measured in days and months, systems in space have endurance of years. A second, and more compelling reason to favor space over terrestrial systems involves sovereignty. On October 4, 1957, the Soviet satellite Sputnik became the first artificial satellite to orbit the Earth and thereby set an important legal precedent, establishing the principle of freedom of space which recognizes that satellites in orbit can pass overhead sovereign territory, waters, and airspace with the reasonable expectation on non-interference by the sovereign state over which they pass.[16] The point here is capabilities provided from space are done so in sovereign territory. This provides a significant advantage over other terrestrial based alternatives to space. The space domain in its entirety is essentially a global commons.

Space Policy

The aforementioned description of the space environment helps to better understand why the U.S. must make every effort to establish a positive, working partnership with China in the space arena. First and foremost, a closed and adversarial approach to space is leading to an arms race in space that is very similar to the nuclear race and cold war that occurred for nearly half a century between the U.S. and former Soviet Union. A policy of containment similar to the National Security Council Report 68 (NSC-68) will not suffice in this instance for a myriad of reasons that will be addressed. The most notable concern with a policy of containment is that the risks of arming space

are far too great, with possibilities of a sequential chain of events having irreversible consequences. A second and very compelling reason necessitating a U.S.-China partnership is the cost to operate in space. Space systems are outrageously expensive and the effects they provide are now commonplace and expected throughout government as well as civilian life. There is no turning back from the luxuries, comforts, and protection that come from space, but the exorbitant costs associated with the acquisition of space systems, combined with the current fiscal environment simply do not allow for the U.S. to maintain a competitive advantage alone.

NSC-68 issued in 1950 established a U.S. policy of containment towards the Soviet Union regarding nuclear weapons. NSC-68 recommended policies that emphasized military over diplomatic action. Further, NSC-68 thought of containment as "a policy of calculated and gradual coercion." NSC-68 called for significant peacetime military spending, in which the U.S. possessed "superior overall power" and "in dependable combination with other like-minded nations."[17] Past U.S. space policy maintained an informal strategy of “space dominance” which called for discouraging and restraining others to our benefit.[18] This strategy was eerily similar to the policy outlined in NSC-68 and will not work for several reasons. First and foremost, a space containment policy is completely contrary to current national policy and strategy which both stress increasing partnerships and cooperation. Secondly, the containment policy of the 1950’s necessitated tripling the defense-spending budget to remain competitive.[19] The U.S. cannot afford to maintain the current defense budget, let alone tripling it in order to ensure space dominance. Current U.S. space policy has moved away from the coercive and dominant methodology and now encourages building partnerships

following an approach more similar to détente. This approach is certainly more appropriate and in line with senior-level policy and guidance. The issue however is that a U.S. – China relationship is not part of this approach. The omittance of China in this effort is very contradictory and counterproductive to the purpose of the policy.

In addition to the 2007 ASAT test previously mentioned, in July 2014 China conducted a non-destructive test of a missile designed to destroy satellites in Low Earth Orbit (LEO).[20] Looking at the current world order, it is not difficult to draw conclusions as to which country this system is designed to attack. China continues to develop weapons and capabilities to defeat U.S. systems because of the adversarial posture the U.S. maintains. Despite this posture, the Chinese government is actively seeking more international cooperation with the U.S. Xu Dazhe, the current chief of China's space industry stated during a 2013 International Space Exploration Forum held at the U.S. State Department that, "We are willing to cooperate with all the countries in the world, including the United States and developing countries."[21] Despite the public declaration of a desire for more cooperation with the U.S., China maintains a very defensive and aggressive posture towards the U.S. From a Chinese perspective, it is understandable why they have assumed this posture. One could argue that the Thucydides trap is in full effect. China is a rising power and regional hegemon that is seeking increased global influence. This growth has resulted in the U.S. shifting focus to the Pacific region in order to "rebalance." In the words of Thucydides, 'Fear, honor, and interest' are in play.[22] China continues to develop space weaponry out of fear of the U.S. and the non-cooperative approach that exists. The U.S. is shifting focus towards the Pacific and maintaining a non-cooperative approach in space, fearing China's growing influence

and power in the region. Chinese interests are also at stake as they strive to be a regional leader and a world power in the space domain. Finally, the element of honor is a strong factor in the Chinese culture and is certainly an element in their pursuit of space. The elements of fear, honor, and interest previously described are being driven in large part by the adversarial approach to space that the U.S. maintains. A space partnership with China will go a long way to mitigate this Thucydides trap.

U.S. – China Cooperation

Despite the fear, honor, and interest factors previously mentioned, the United States and China both demonstrate a capacity to engage and partner in many areas. The annual U.S. Pacific Command (USPACOM) exercise Rim of the Pacific (RIMPAC) provides a shining example of a U.S. – China partnership in a military environment. RIMPAC 2014 was the world's largest international maritime exercise and had participation from 22 nations to include the People's Republic of China.[23] According to the commander of U.S. Army Pacific (USARPAC), GEN Vincent Brooks, the opportunities to engage with China are abundant. He goes further to state that those opportunities are limited by policy, specifically citing the National Defense Authorization Act which outlines areas U.S. forces are permitted to engage 'mil to mil' with China.[24] The conditions are ripe for an expanded partnership with China and U.S. policy is moving in the direction of increased engagement. Senior leaders and policymakers need to maintain this momentum and incorporate a U.S. – China space partnership into the policy.

Just as the opportunities to partner with China are abundant, the opportunities to partner with China in space are equally abundant. The national space policy lists several cooperative areas for consideration-

> **Identify Areas for Potential International Cooperation.** Departments and agencies shall identify potential areas for international cooperation that may include, but are not limited to: space science; space exploration, including human space flight activities; space nuclear power to support space science and exploration; space transportation; space surveillance for debris monitoring and awareness; missile warning; Earth science and observation; environmental monitoring; satellite communications; GNSS; geospatial information products and services; disaster mitigation and relief; search and rescue; use of space for maritime domain awareness; and long-term preservation of the space environment for human activity and use.[25]

With or without the U.S. as a partner, China is demonstrating that they will continue to advance their space technology and capabilities. For example, the Chinese now possess their own global navigation satellite system similar to GPS known as Beidou. Much of the technology seen in the Beidou system was gained from a technical partnership with the European Union and their comparable Galileo system.[26] Additionally, China accomplished their first soft landing on the moon in late 2013, and is working on a Chinese space station forecast to be operational in 2022.[27] It is important to note that the U.S. currently relies on the International Space Station (ISS), which is only funded through 2024 and due to the recent suspension of its manned space launch program, is heavily reliant on a relationship and cooperation with a very unreliable Russia.[28] These circumstances highlight that China is gaining capability and relevance in space and they are doing it without the assistance of the U.S.

As China pursues partnerships in space and advances their capabilities, the U.S. is struggling to keep up with growing requirements. In the past, funding for the development, operation, and sustainment of space systems was abundant. Unfortunately, the days of large budgets for space systems are over. The national security space budget has steadily decreased from approximately $15 billion in fiscal year (FY) 2000 to around $8.5 billion in FY 2010. In February 2012 the Obama

Administration announced it would seek a 22 percent cut in military space spending in the FY 2013 defense budget.[29] Unfortunately, as the budget for new and improved space systems declines, the reliance on these systems for both military and commercial use is rapidly increasing.

U.S. Space Systems and Capabilities

Despite the decreasing capability gap between the U.S. and other space faring nations, the U.S. is without question the global leader in space. In this capacity, the U.S. maintains capabilities in five space mission areas. Joint Publication 3-14, Space Operations, identifies the following space mission areas: space situational awareness (SSA), space force enhancement, space support, space control, and space force application.[30] The space force enhancement functions include: Intelligence, Surveillance, and Reconnaissance (ISR), missile warning, environmental monitoring, Satellite Communication (SATCOM), and Positioning, Navigation and Timing (PNT). Space Support includes space lift, satellite operations, and reconstitution of space forces. Space control includes Offensive Space Control (OSC) and Defensive Space Control (DSC).[31] These areas are all worth mentioning in order to provide a perspective of the demand and requirements needed to maintain status as the global leader in space. There are substantial expectations from the military, commercial, and private sectors within the U.S., as well as expectations from allied nations, for the U.S. to provide leading capabilities in all of these areas. Unfortunately, the U.S. is no longer able to keep up with this demand.

The Global Positioning System provides a good example of a space system that provides overwhelming capabilities to users both nationally and internationally but is not keeping up with the growing demand and environmental challenges. Although there is

an evolutionary acquisition process on going to progressively replace the antiquated satellites that make-up the 27 satellite constellation, the U.S. cannot afford to design and upgrade all of the components necessary to keep up with demand.[32] The cost is simply too high to design and operate an optimal system to meet the changing environment. The trends of warfare and future conflict are moving towards operations in an Anti-Access / Area Denial (A2/AD) environment, and this includes a PNT denied/degraded environment. Because GPS is not keeping up with the A2/AD environment, there is a resultant lack of capability that is driving many elements of the U.S. military to develop alternate tactics and techniques to operate in an environment with degraded or denied GPS. Technology exists to improve GPS capabilities within both the space and user segments (receivers), however the cost is untenable to pursue all improvements.[33]

The Space Based Infrared Satellite System (SBIRS) provides an example of a space system that received funding, but had tremendous acquisition difficulties resulting in delays and cost overruns in order to reach operational status. SBIRS was designed to replace the Defense Support Program (DSP) satellite constellation. DSP and its replacement (SBIRS) were designed to detect Infrared (IR) signatures in order to provide early warning of missile launches as well as providing nuclear detection.[34] Because the much more advanced SBIRS is slow to come on-line, many of the aged DSP satellites remain on orbit and continue to perform their designed mission. One of these satellites is DSP Flight 14, which was launched in 1989.[35] Although the satellite is still highly reliable and continues to provide its designed service, the technology is greatly outdated. SBIRS has much more capability and is vital to U.S. national defense,

but due to budgetary constraints is slow to come on-line. When the U.S. is responsible to provide satellites to support the weather, environmental monitoring, PNT, and the myriad of other space missions and functions, it cannot provide sufficient resources to those systems crucial to national defense. It is time for the U.S. to really focus on shedding some of the low-risk areas of space technology with partners in order balance resources and prioritize limited funding where it makes most sense. The impacts of not building partnerships are evident not only with the lack of modernization as described with GPS and DSP/SBIRS, but also with the cancellation of satellite systems. The Precision Tracking Space System (PTSS), a constellation of missile tracking satellites, and the Space Based Space Surveillance (SBSS) follow-on satellite system are two space programs that were cut in 2014 in an effort to reduce spending.[36]

In addition to the cost issues associated with maintaining modern and relevant satellites for a very robust space program, force strength reductions in the Department of Defense (DoD) is a reality that is further stressing space acquisition. For example, as the Army force decreases from approximately 560,000 to an estimated 440,000 to 450,000 by 2017, there is an increased reliance and expectation that technology from space will compensate for these force reductions.[37] Specifically, better ISR, improved SATCOM, and better precision with PNT are examples of areas that a smaller force will have to rely on. Space is without question a tremendous enabler for U.S forces in all of the domains, but current policy and restrictions on which countries the U.S. can or cannot partner with is limiting the ability to optimize capabilities for a shrinking force. Space does provide the U.S. a distinct advantage militarily, as well as providing tremendous capabilities to a very technologically advanced and dependent commercial

sector, both nationally and internationally. However, the fiscal environment simply will not allow the U.S. to solely maintain state-of-the-art systems in each of the identified areas. It is not difficult to decipher that the increasing demand and high cost of space systems combined with a decreasing budget simply do not add up. Something has to give, and unfortunately, it is the maintenance and modernization of space systems. Unfortunately, maintaining the status quo will result in further degradation of U.S. space capabilities. The U.S. must look towards partnering with other leading space faring nations.

Risk

A valid concern and risk associated with a China partnership in the space realm involves the loss of information and technology vital to U.S. security interests. In 2011, former Virginia Congressman, Representative Frank Wolf inserted measures into funding legislation that prohibits any joint scientific activity between the U.S. and China that involves NASA or is coordinated by the White House Office of Science and Technology Policy (OSTP).[38] This policy endures today and as a result, NASA and OSTP remain banned from bilateral activity with China.[39] The primary justification for this litigation surrounds the concern over a loss of technology. Validating this concern, a Department of Homeland Security Cyberspace specialist recently briefed during a U.S. Army War College lecture that NASA is one of the most targeted organizations in the U.S. for intellectual property theft.[40] The expression of 'keep your friends close, and your enemies closer' could have some meaning in this instance. Although categorizing China as an enemy is not recommended, there is no denying their intellectual theft efforts via cyberspace. Opening a relationship in space could serve to reverse, or at least slow this aggression and animosity.

The risk of technology loss can be mitigated by the methodology of how a partnership is established and carried out. From a ways, means, and ends perspective, it is important to look at the methodology or the 'way' to best implement a partnership with China as well as the associated risk. First and foremost, the relationship must be established with national security in mind. A cautious and progressive approach that commences with a partnership in mission areas and functions that are not military or defense related is appropriate. Environmental missions and/or space science exploration missions are two examples of areas that the U.S. and China can open relations that are not related to defense. Additionally, policy and legislation that prohibits U.S. – China bilateral engagements must be eliminated. Any legislation banning cooperation is contradictory to overarching, senior-level policy that stresses the importance of cooperation and partnership building.

A very important component of a U.S. – China partnership is that the partnership should not be contingent upon other aspects of U.S. - China relations. Specifically, if tensions were to arise over a South China Seas issue, this should remain separate and transparent to the partnership in space. Relations between the U.S. and Russia provide a good example of an international relationship that maintains transparency in one area, while facing issues in another. Tensions are extremely high in Eastern Europe over Russia's aggressive actions toward the Ukraine. Despite the strain that Russia's actions are placing on the relationship with the U.S., the space partnership with Russia remains. The International Space Station (ISS) is one of the rare areas of US - Russian cooperation that has not been hit by the Ukraine crisis. In the latest show of this commitment, two space veterans -- American Scott Kelly and Russian Mikhail

Kornienko launched into space for a year on 27 March 2015 from Kazakhstan.[41] A fitting quote from Russian space expert Vadim Lukashevich summarizes the relationship, "Even though we are butting heads on Earth, up on the ISS we can t work without them and they can t work without us."[42]

Conclusion

The advantages of a cooperative space partnership with China far outweigh the associated risks. The benefits of partnering with China are quite clear and include reduced costs, improved efficiencies with many space technologies, and most importantly a space environment with reduced competition and congestion. A failure to partner will expedite the competition and congestion in space and ultimately lead to an environment that is useless. This is a grave risk to our nation that so heavily relies on the capabilities and enablers from space. An expanded partnership also has tremendous potential to minimize redundancies of capabilities in space by sharing non-defense related technology and space systems. This will not only reduce the congestion and competition in space, but it will reduce spending during a time of severe fiscal constraint. Policy change towards an expanded space partnership with China is certainly a challenge. There are risks associated with information and technology loss as well as the risk of sharing information and cooperating with a potential future adversary. These risks can be mitigated through a very cautious and deliberate approach to information and technology sharing that begins with non-defense related technologies. Additionally, the overall risk of a space partnership should be measured against the growing risk that space is on a path of becoming so contested, competitive and congested that it will become useless in the future.

Endnotes

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