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EXECUTIVE SUMMARY

This report was catalyzed by a conference convened in June 2011 in Prague, entitled "Space Security through the Transatlantic Partnership," co-sponsored by the Prague Security Studies Institute (PSSI) and the European Space Policy Institute (ESPI). Over a hundred distinguished participants and speakers were brought together for this event, including current and former senior space policy officers from Europe, the United States and Japan. It was the first such trilateral gathering on space security of its kind hosted by non-governmental organizations. This report represents a follow-on to these proceedings, in the interest of preserving the positive momentum generated by the conference in a number of areas, including the principal focus of this report, the underdeveloped defensive space control dimension of allied space security.

Despite the attention of the U.S. government to the threat posed to critical space assets by the potential actions of other space-faring nations and rogue actors, this same priority treatment is largely not reflected in the senior-level security dialogue and military planning that underpins the collaborative security relationships among the United States, Europe and Japan.

The cause for this seeming disconnect is rooted in a shared cultural and political reticence within Europe and Japan to acknowledge that the weaponization of space is not only inevitable, but is well underway. There may also be the feeling on the part of some countries that less discussion of this reality deters other space-faring nations from breaking behavioral norms built around space as a peaceful domain. The centrality of space assets in modern war-fighting, however, has not been lost on – or ignored by – rising powers or smaller states interested in relatively low-cost, asymmetric ways of leveling the playing field in a potential conflict. In this new environment, any defense planning, including collaborative defense planning among allies, is fundamentally incomplete unless it incorporates – and plans for – scenarios that involve the targeting or disruption of national assets in outer space.

There are a variety of ways in which an adversary can target a satellite, including jamming, spoofing, blinding, high-powered microwave attack, direct ascent anti-satellite weapons (ASATs), co-orbital ASATs, cyber attacks and others. China and Russia are the leading countries, outside of the U.S., in the development and deployment of these capabilities. There are a number of documented cases of Chinese tests involving most – if not all – of these offensive space control methods and techniques. China’s aggressive funding and testing of these technologies, in addition to their proliferation of space-related capabilities to foreign partners, demonstrates the present-day reality that military planners worldwide regard space assets as targets in a conflict or even pre-crisis scenarios.

The National Security Space Strategy (NSSS) published by the Obama Administration in January 2011 forthrightly acknowledges the relevance of this contested operating environment, not only to

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1 As per Air Force Doctrine Document 3-14, entitled "Space Operations," published on November 27, 2006 and last updated July 28, 2011, the definition for the terms "space control" and "counterspace," used interchangeably herein, is "combat, combat support, and combat service support operations to ensure freedom of action in space...and, when directed, deny an adversary freedom of action in space. The space control mission area includes: surveillance of space; protection of US and friendly space systems; prevention of an adversary’s ability to use space systems and services for purposes hostile to US national security interests; negation of space systems and services used for purposes hostile to US national security interests; and directly supporting battle management, command, control, communications, and intelligence."
the security posture of the United States, but also to U.S. relations with key allies and partners. In addition, the National Space Policy issued in June 2010 instructed the Secretary of Defense and Director of National Intelligence to “assure critical national security space-enabled missions” through options, such as “leveraging allied, foreign, and/or commercial space and nonspace capabilities to help perform the mission” and augmenting “U.S. capabilities by leveraging [the] existing and planned space capabilities of allies and space partners.”

As it stands, however, the primary venue for advanced collaboration on the space control mission among allies has been the Schriever Wargame, coordinated by the United States annually or bi-annually. Participation in these exercises has been, in part, based on membership in the so-called “Five Eyes” (i.e., the United States, the United Kingdom, Canada, Australia and New Zealand). The Schriever Wargame consists of a series of exercises that starts with an attack on critical space assets and/or cyber infrastructure. The “Five Eyes” is a partnership for sharing signals and other intelligence that dates back to 1946 and is based on the long-time confidence of the U.S. in sharing highly sensitive intelligence with these foreign partners. Today’s counterspace threat environment, however, and the role of space in national and multinational defense, should also be determinants concerning which allies the United States brings into this privileged fold. Rather than addressing the question head-on in terms of which foreign partners are most likely to be implicated in a conflict scenario in this domain or which countries have the most needed capabilities, the U.S. is seemingly “backing in” to which countries participate in critical contingency planning, with membership in this group seemingly a key consideration.

Japan and European allies also shoulder significant responsibility for the lack of sufficient dialogue and planning on this issue to date. Political and cultural obstacles to any policy initiatives that could point to the weaponization of space has stymied proper planning in the face of growing counterspace threats. Any progress that European partners have made in expanding the comfort zones of their politicians and technical experts on this issue has been outpaced by the growth in importance of space to national defense and the offensive space control investments of potential adversaries.

Nevertheless, some significant progress is being made, for example in the invitation of select NATO allies for the first time to participate in the International Game portion of the 2012 Schriever Wargame held in May 2012 at Nellis Air Force Base in Nevada. In addition, Japan passed the historic Basic Space Law in 2008 and the Basic Plan for Space Policy in 2009, which set in motion critical reform measures that continue to this day. As recently as late June 2012, the Upper House of Japan’s Diet passed an important piece of legislation that centralizes control of the planning and budgeting of the country’s government space program within the Prime Minister’s Cabinet Office and creates the Space Strategy Office to execute this new mandate. This new office brings much needed “top-down” leadership to ensuring that the space-based capabilities of Japan provide dual-use benefit for the security community as well as proposing new and creative ways of making national defense a priority consideration in the structure and investment decisions of the Japanese space community going forward. Importantly, this law also removed an article from a previous law that had heretofore restricted the Japanese Aerospace Exploration Agency (JAXA), the government’s primary repository of technical space expertise, from pursuing dual-use space programs.

For its part, Europe has also joined the “space security” fray over the past few years in several ways: 1) it has taken the lead in drafting an International Code of Conduct for Outer Space Activities, which

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is dedicated to institutionalizing responsible behavioral norms in space, although this initiative has been afflicted with the same tendency of defining the problem principally as a space sustainability issue, rather than a security one; 3) it has developed the Global Monitoring for Environmental and Security (GMES) system consisting of land, marine and atmosphere monitoring services that include earth observation satellites; 4) an ambition to transform the European Space Agency (ESA) into a comprehensive civil and security space agency; and 5) it has realized in the aftermath of a failed partnership with China on Europe’s signature space investment, the Galileo satellite navigation system, that greater sensitivity is required concerning the reality of other space-faring nations seeking to gain an "upper hand" in space. This failed Europe-China space partnering opportunity was marked most notably by Europe’s dismay at China designating some of the same frequencies for its independent Beidou-2 satellite navigation system as those assigned to Galileo, notably those used by the Galileo Publicly Regulated Service (PRS).³

The primary obstacles to be overcome in establishing the proper dialogue and planning on space security – especially defensive space control – among the United States, Europe and Japan are summarized below.

1. The U.S. government appears to have, by default, taken nearly total responsibility for leading and executing a strategy to defend its national space-related assets (including ground stations) and those of its allies due to the lack of allied investment and political will and/or a cultural aversion to the so-called "weaponization of space."

2. Counterspace planning among allies, to date, has been limited to a group of countries that is based, in part, on membership in the "Five Eyes." It has not included as formal members key allies that are most likely to be implicated in a conflict involving threats to space-based assets and ground stations for reasons related to the strategic value of those assets and their geographic location (e.g., Japan, France, Germany, India, South Korea, etc.)

3. European space actors continue to shy away from directly addressing counterspace threats as a core space security concern, at least in multilateral settings. The Code of Conduct, which is the primary focus of European space diplomacy, touches on the issue, but is designed to serve as a preemptive measure by seeking to establish "rules of the road" and "best practices." It is not crafted to offer sufficient guidance regarding scenarios where those rules are violated. Indeed, little such planning or specific verification and enforcement measures were unearthed in the course of researching this report.

4. Space assets are still sufficiently coveted by individual European states that their availability for contribution to NATO is largely absent, hobbling practical collaboration on defending against counterspace threats, at least in the near term. Establishing ways in which the alliance might respond to a purposeful "incident" in space, however, remains highly desirable. NATO’s Allied Command Transformation (ACT), located in Norfolk, Virginia, has published forward-looking documents that describe the need to maintain unfettered access to shared domains, including "outer space," and urges further study of what role NATO should play in this arena.⁴

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5. Although the Japanese government has made considerable progress over the past few years in making its space infrastructure available to service national defense and breaking key bureaucratic bottlenecks to facilitate this mission, these reforms are still in process. They face potential “turf” battles among Ministries, JAXA and the Cabinet Office and a fairly steep learning curve with regard to educating and empowering security-minded agencies of the Japanese government to be more proactive in this area. Japan is also confronting rigid budget limitations with respect to contributing to meaningful, allied space security initiatives, including the space control mission.

6. Given the importance of safeguarding highly classified information regarding space technology, assets, signals and other intelligence-gathering methods, the U.S. security community remains somewhat apprehensive over Japan’s ability to keep secrets. This apprehension stems from past instances of Japanese officials mishandling classified information, including leaks pertaining to the joint U.S.-Japan AEGIS program.

7. The U.S. has not engaged in sufficient interagency coordination on defensive counterspace, despite the rapidly growing dimensions of the threat. There are numerous Department offices and nodes of relevant activity, including within the combatant commands, but they are not adequately centralized at the White House for real-time, top-down decision-making. Interviews with senior foreign space officials made clear that Washington is, at times, sending mixed signals, as these representatives are hearing different policy interpretations depending on the U.S. agency being consulted.

8. There appears to be an “education deficit” among allies concerning the rapid growth of, and in some cases, even use of, offensive space control capabilities by countries such as China, Iran and North Korea as well as non-state actors. The ominous changes in the space control threat environment are clearly outpacing allied recognition of, and planning for, these new contingencies, with the notable exception of the United States.

Based on an array of interviews with key officials in the space security establishments of the Japanese, European and U.S. governments as well as non-governmental space policy experts, the following are recommended next steps for addressing these shortcomings.

1. The U.S. security community, likely led by the Department of Defense and coordinated by the National Security Council staff, should continue to demonstrate leadership in the face of lingering political and cultural aversions to counterspace on the part of Europe, Japan and other allies and push forward an agenda of allied policy measures, investments and information sharing/safeguards and other elements needed for true collaborative defense against common counterspace threats.

2. While U.S. leadership in outlining prudent next steps for our allies is the most realistic course for overcoming allied shortfalls in defensive space control, it can only be effective if the U.S., itself, better defines the “chain of command” in its space security establishment and speaks to partners with “one voice.” The President should task either the Department of Defense or the National Security Council with taking the lead in creating a global architecture for defending against counterspace threats from potential adversaries and communicating with allies on the most effective means of defense burden-sharing.

3. The Pentagon should actively press NATO to define, in more specific terms, the role of defensive space control within its alliance mandate.
4. Japan should task its newly created Space Strategy Office to pursue, as a key objective, joint military planning and preparedness “games” with the United States that explicitly involve attacks on space-related assets (probably catalyzed by heightened terrestrial tensions or even conflict in the region). This would likely need to be coordinated within the Security Consultative Committee, informally known as the “2+2 Ministerial,” involving the U.S. Secretaries of Defense and State and the Ministers of Foreign Affairs and Defense as well as the Cabinet Intelligence Office of Japan. Significant progress, however, would be required in the bilateral dialogue before this goal is realized.

5. The U.S. should launch an effort to create a trilateral security framework to facilitate discussion among these key allies of issues, such as the space control mission, that benefit mightily from spanning the Atlantic and Pacific theaters. Such a framework would also provide better political cover for the nations involved by demonstrating that the counterspace dimensions of space security have global relevance, rather than serving merely theater-specific purposes that can be more easily perceived as targeting individual countries (e.g., China).

6. The U.S. should continue to open up participation in the Schriever Wargame – or create a complimentary, additional framework (at lower classification levels) – to reflect better those countries and regions that have space-based assets that are most likely to be put at risk by a prospective adversary and require alliance responses (e.g., Asia and the Middle East). Expanded wargames in this area might also better identify preplanning needs concerning other aspects of space crisis management, such as diplomacy, the involvement of commercial actors and the broader intelligence community.

7. The rapid development and deployment of counterspace capabilities by China, in particular, should be more frequently on the agenda of senior-level, bilateral and multilateral security discussions, both classified and unclassified, of the United States worldwide.

There is little question that today’s most likely zones of terrestrial conflict would, more often than not, implicate space assets, if only to disrupt surveillance, navigation, communications and other capabilities during periods of heightened tensions or actual kinetic engagement. Accordingly, the broader security communities of alliance members, including the combatant commands and their equivalents in allied nations, have no choice but to “game-out” the most likely uses of counterspace capabilities by space-faring adversaries and the most effective, real-time allied responses. In this regard, it is useful to keep in mind that space control tools are already in use and this trend will only grow. (See Appendix 2.)

Should an incident occur, there would be little to no time for dress rehearsals or planning/policy debates. Past wargames have made clear the potential for space conflict to escalate rapidly and impose severe time pressures on decision-makers. If the U.S. and our allies are not in front of these scenarios, they will definitely be playing catch-up in a perilous environment with potentially immense stakes. It is hoped that this report will serve as a useful early warning device with respect to the progress urgently required to maintain space as a secure, stable and sustainable domain.
INTRODUCTION

The term “space security” is defined for the purposes of this report as the generally shared aspiration among space-faring nations and independent actors to preserve outer space as a secure and sustainable environment for civilian, commercial and military space activities. The principal objective underpinning space security initiatives is to better protect space-related assets from natural and man-made risks and threats. Experts participating in the international dialogue on space security typically group together a range of concerns under this umbrella, including orbital debris, unintended collisions, natural and intentional radio frequency interference, counterspace activities, Space Situational Awareness (SSA), Transparency and Confidence Building Measures (TCBMs) and overall space crisis management.

Among allies, the counterspace capabilities of certain space-faring nations stand out as perhaps the most challenging and least developed of these areas for productive discussion. The definition of the terms “space control” and “counterspace,” which are used interchangeably herein, is consistent with that assigned to it by the U.S. Air Force, and generally accepted internationally, as “combat, combat support, and combat service support operations to ensure freedom of action in space...and, when directed, deny an adversary freedom of action in space. The space control mission area includes: surveillance of space; protection of U.S. and friendly space systems; prevention of an adversary’s ability to use space systems and services for purposes hostile to U.S. national security interests; negation of space systems and services used for purposes hostile to U.S. national security interests; and directly supporting battle management, command, control, communications, and intelligence.”

The implications of increasingly sophisticated space control systems, both ground- and space-based, are somewhat elusive even for U.S. security professionals. Specifically, the vulnerability of existing space assets and the priority attention that defending these assets deserves from senior U.S. security policymakers and officials still appears to be inadequately appreciated. For Japan and Europe, the challenge is more complicated still. There remains a profound political and cultural aversion to conversations that in any way intimate the gradual “weaponization” of space or even the well-established relevance of space-based assets in the war-fighting scenarios of allies and potential adversaries. As a result, most U.S. allies have generally “kicked the can down the road” on serious contingency planning to defend against counterspace threats in order to ensure some level of productive dialogue with potential adversaries on the less politically-toxic space security challenges, such as orbital debris remediation, behavioral norms and space sustainability.

This report seeks to enrich the exchanges of the space-faring community with regard to this underdeveloped area within the space security portfolio and its relevance to the broader defense and strategic dialogue among the U.S., Europe, Japan and beyond. In so doing, we hope to establish the importance of our allies joining the U.S. in being equipped to identify and assess scenarios where unfettered access to, and use of, space could be compromised, not by an unintentional collision or radio frequency interference, but as the result of a pre-planned, willful act by a space-faring nation. This report will also seek to strengthen the case for greater deterrence and pre-crisis planning among allies and dispel the political “taboo” associated with this subject, which, rather than bolstering the international security environment, now risks endangering it.

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The findings and recommendations herein are based on extensive primary and secondary research, including numerous personal interviews conducted with senior-level space policy practitioners within the respective governments of the United States, European nations and Japan as well as distinguished space policy experts outside of government at prominent universities and non-profit organizations. With few exceptions these individuals requested anonymity regarding their contributions.
REVIEW OF PRINCIPAL THREATS TO SPACE SECURITY

Although this report focuses primarily on improving allied collaboration in confronting intentional, willful challenges to space-related assets, an understanding of the variety of threats to the security and sustainability of such assets is relevant, given the holistic approach to space security that is the norm among U.S. allies in particular. These challenges, whether naturally occurring or intentional, threaten the uninterrupted conduct of fundamental aspects of daily life that are now facilitated through space systems. Below is a brief overview of the most prominent threats that are typically discussed in the context of "space security."

SPACE DEBRIS
Space debris is comprised of naturally occurring objects that are small bits of asteroidal or cometary material called meteoroids or micrometeoroids as well as man-made objects that are the remnants of past satellites and their launch vehicles. NASA identifies 22,000 pieces of debris of 10 centimeters or larger that are currently known to be orbiting Earth. There are also potentially billions of smaller – sometimes much smaller – particles of space debris that are too tiny to track and catalogue, but that also pose a threat. Significant resources are dedicated to tracking such space debris and avoiding accidental collisions that can damage or destroy satellites or other space assets and/or space exploration mission. The most comprehensive provider of data on space debris is the Space Surveillance Network (SSN) fielded by the U.S. Strategic Command’s (USSTRATCOM) Joint Space Operations Center (JSpOC). The SSN incorporates data from 29 space surveillance sensors located around the world. Other sources of valuable data are also available and work is ongoing to integrate these private sector and international sources into a more comprehensive data pool available to satellite operators and space-faring nations.

ORBITAL COLLISIONS BETWEEN SATELLITES
The only known collision between satellites was in February 2009 when an operational Iridium 33 satellite, which was used for commercial communications, collided with an inactive Russian communications satellite named Cosmos 2251. The two satellites collided over Siberia, which was reportedly only the fourth known collision between two cataloged objects. Some 1,000 operational satellites are followed by the SSN. Despite the scarcity of actual collisions to date, an increasingly congested space environment is making this threat more pronounced every year. The 2009 collision demonstrated the need for Space Situational Awareness (SSA) capabilities to be adequately resourced and that enhancing coordination between the commercial and government sectors – and among nations – is given proper priority.

KINETIC ENERGY ANTI-SATELLITE (ASAT) WEAPONS
Kinetic energy attacks are attempts to damage or destroy a satellite by striking it with a missile, interceptor, another satellite or some other object launched from an interceptor.

Ground-based, direct-ascent attacks are the most tested and cost-effective kinetic energy attacks currently available, with low earth orbit (LEO) satellites generally considered within range of medium-range missiles. In a direct ascent attack, a missile releases an interceptor after leaving the Earth's atmosphere that uses “homing” capabilities (i.e., sensors and thrusters) to maneuver itself for a collision with the targeted satellite. Geosynchronous satellites pose a greater challenge for direct ascent attacks due to their significantly higher orbits. Space-based kinetic energy attacks are also referred to as co-orbital ASATs and involve the launch of maneuverable satellites that position themselves for either a high-speed collision with a targeted satellite or some other less violent intercept. Although it would require more sophistication, power and maneuverability, co-orbital ASATs could conceivably be deployed against geosynchronous satellites at higher orbit. Micro-satellites are sometimes regarded as having special relevance as co-orbital, space-based ASATs, due to the possibility of their being launched and maneuvered with greater ease and secrecy.

**DIRECTED ENERGY WEAPONS: LASER AND MICROWAVE ATTACKS**

Directed energy weapons take the form of laser and high-powered microwave attacks. Laser attacks can be carried out using continuous wave (CW) lasers, which produce a steady stream of energy at usually lower levels of intensity, or pulsed lasers, which produce peak power levels over a shorter period of time. Attacks can disrupt satellite components, such as sensors and imaging lenses when directed to target those components specifically, or the broader integrity of a satellite by disrupting its thermal balance or degrading it structurally by targeting, for example, a satellite’s pressurized hulls or solar panels. LEO satellites are most vulnerable, while geosynchronous satellites are generally not in range. Protecting against laser attacks requires hardening surfaces, deploying shields or creating system redundancies.

Targeting the sensors onboard a satellite with lasers can be accomplished through techniques known as dazzling and blinding. Both of these require the attacker to be within the satellite sensor’s field of vision, which, in the case of imaging satellites, can be quite narrow. Dazzling involves temporarily interfering with a satellite sensor’s ability to conduct its mission, including, for example, its imaging capabilities, which are fundamental to theater awareness, intelligence collection and “informationalized” warfare. Dazzling occurs when a laser floods an optical sensor with light that is brighter than what it is trying to picture, temporarily impairing the sensor’s functions. The impact of the dazzling attempt on the sensor’s ability to see the location from which the laser is emanating depends on the power of the laser. A higher powered laser is able to interfere with the imaging functions of a satellite over a broader area. A number of obstacles, however, confront the attacker, such as a satellite having multiple sensors, multiple filters, built-in defenses, etc. Blinding involves similar mechanics to dazzling, but with the objective of permanently disabling the detector components of the satellite’s optical system, likely through the use of a higher power laser that would typically require a shorter period of time to accomplish that goal.

While dazzling and blinding attacks are limited to geographic areas that are in the targeted sensor’s field of view, a laser attack designed merely to damage the thermal integrity of the satellite or, with a particularly intense beam, damage the satellite structurally, can be launched.

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from anywhere within the line of sight of that satellite. Compromising satellite components requires a powerful laser, mirror and sophisticated adaptive optics. Unshielded satellites in LEO can be impaired with ground-based megawatt-class lasers in just a few seconds, while kilowatt-class lasers could also cause damage if afforded a longer period of time and targeting a satellite’s more vulnerable component parts.

Another directed energy ASAT weapon is the use of high-powered microwaves (HPM) to impair satellite functions. HPM attacks can occur through antennae (“front-door”) or seams in the satellite casing (“back-door”). Ground-based attacks would require high intensity power and a large antenna to focus the beam due to the distance and atmospheric interference that can limit the transmission of the beam. A “front-door” attack is accomplished through the HPM coupling with the antenna. An attack would need to be mounted within the transmission range of the satellite and can accomplish its task with only a brief, high-intensity attack. The attacker would need to know the frequency of the satellite, which, for commercial satellites, is attainable, in order to launch an attack within the transmission range. Satellites are usually designed to pick up faint signals and overwhelming them with HPM can damage them permanently if they are not properly protected.

"Back-door" attacks impair the electrical systems of satellites through small seams in the satellite casing or gaps around electrical connections and need originate only within line of sight of the targeted satellite (i.e., it does not need to originate from within the satellite’s transmission range). Unlike “front-door” attacks, these effects are uncertain and can require a wider range of frequencies to affect any harm at all. The power levels associated with such an attack would also need to be much higher to be successful.10

RADIO FREQUENCY INTERFERENCE

Communication systems for satellites consist of a receiver, transmitter and radio antennae. Transmissions are usually encrypted and encoded. One of the key functions of satellites that generally requires only a small part of the assigned bandwidth involves important telemetry, tracking and command information, known as TT&C. Radio frequency interference can undermine these key functions and compromise a satellite’s altitude control system and propulsion system leading to deterioration of orbit, loss of core mission capability or complete loss of communication. These core capabilities can be undermined through radio frequency interference, both intentional and unintentional.

Unintentional radio frequency interference can originate from faulty equipment, the reduction of orbital spacing between satellites and the unauthorized use of satellite space segments by carriers. Intelsat’s Chief Technical Officer, Thierry Guillemin, noted “[i]n our experience, episodes of signals from unauthorized carriers and of cross-polarization make up 70 percent to 75 percent of radio frequency interference cases plaguing satellite operations...to this number, you should add a 15 percent to 20 percent of cases caused by adjacent satellite interference.”11

Intentional forms of radio frequency interference include jamming and spoofing, which are different ways to disrupt the gathering, disseminating, calculating or communication of data between the satellite and ground stations. Jamming is conducted by either drowning out the signals emanating from the ground-station or satellite (i.e., the uplink or the downlink). Jamming the

downlink would involve preventing a transmission from reaching the ground station and requires
the jammer to be placed in the vicinity of the ground station. Jamming the downlink is generally
seen as easier than jamming the uplink, as it does not require great precision to effectively jam
the signal. There are several methods to countering efforts to jam the downlink, including simply
increasing the satellite signal or encoding it, making the receivers more directional (i.e., to help
distinguish between signals) and having the satellite power concentrate on a smaller frequency
band, causing the jammer to have to expand the frequencies they are targeting. Jammers can
also be located through their signals and shut down by force, as was the case when U.S. forces
successfully targeted Iraqi jammers in 2003. A more sophisticated form of jamming could be
constructed through the use of LEO satellites to jam satellites in high earth orbit (HEO), although
this would require a network of satellites to accomplish.\textsuperscript{12}

Jamming the uplink (i.e., jamming the receivers on satellites) involves a greater investment of
resources. Satellite uplink receivers are typically better protected than ground stations since
they often encode and encrypt signals. High-powered jammers are required to break through this
to muddle the signal with more noise than actual signal. The easiest satellites to jam are known
as "bent pipes," which simply retransmit signals, not process them. Jamming the uplink for
commercial and communications satellites is easier than military satellites due to their tendency
to receive a broad range of signals for multitudes of users from a large geographic area, making
it easier to jam an uplink signal in such a scenario when the jammer is located in another
country. As commercial and communications satellites are used heavily by the U.S. military (as
well as the militaries of other countries), this vulnerability is relevant to the security community
and allied collaboration. Iranians based in Cuba, for example, are known to have jammed the
uplink signal of transmissions from the U.S. that were broadcast through Telstar 12 satellite
to Iran, most likely to interdict \textit{Voice of America} programming. A Falun Gong group based in
Taiwan is also believed to have jammed the uplink of a \textit{China Central Television} broadcast of the
2003 Shenzhou V spaceflight, prompting China to incorporate anti-jamming equipment into their
communication satellites.\textsuperscript{13}

Indeed, the incidence of intentional jamming has increased in recent years for accomplishing
military, political and social objectives. State-sponsored jamming becomes increasingly prevalent,
there is likely to be increased interest internationally in scripting appropriate responses to these
kinds of actions. At present, this is an underdeveloped area of security policy as well as economic
policy and diplomacy.

Spoofing, although similar to jamming, is more sophisticated. It involves mimicking the original
or intended signal so that the user receives a different "spoofed" signal in place of the real one,
typically in order to take control of the targeted satellite. As with jamming, spoofing requires that
the signal be in the vicinity of the ground station or source of the original signal. One can spoof
either the uplink or the downlink. Spoofing involves sending a false signal to the ground receiver
and would require the false signal to originate either nearby or in line of sight of the receiver.
Countering spoofing requires the signal to be encrypted before it is sent and unscrambled after

\textsuperscript{12} "The Physics of Space Security: A Reference Manual." David Wright, Laura Grego, Lisbeth Gronlund. American Academy of Arts and
\textsuperscript{13} "The Physics of Space Security: A Reference Manual." David Wright, Laura Grego, Lisbeth Gronlund. American Academy of Arts and
reception, which typically makes more sense in military applications due to the added cost and limits on the amount of data that can be sent and received in this fashion.16

**CYBER-ATTACKS AGAINST SATELLITES AND/OR GROUND STATIONS**

Cyber attacks against satellites and ground stations are also a growing problem and stand out as a key vulnerability that can be added to the current array of political and budgetary challenges facing both cybersecurity and space security as new claimants on the agenda of policy makers and the security community writ large. Cyber attacks permit anonymity and prove lower cost with regard to spying, spoofing or otherwise incapacitating an adversary’s satellites. There are already a number of known examples of cyber attacks against satellites resulting in loss of control. (See Appendix 2.)

CHINA AS A COUNTERSPACE CASE STUDY

The counterspace methods and techniques described above are not conceptual. Many, if not all, of these capabilities have been developed and tested by nations as potentially useful tools in war-fighting scenarios. From the perspective of the United States and alliance partners, there are two countries that have invested in offensive space control programs sufficiently to require special attention, China and Russia. The offensive space control capabilities of other countries, both space-faring and those aspiring to this status, is also improving. In certain cases, this is due to the sharing of dual-use technology and expertise by China and Russia, either as a function of military partnerships or as incentives to secure broader economic relationships.

The purpose of this section, however, is to provide a case study examining China’s pursuit of offensive space control capabilities as a way of underscoring that these types of activities are real, growing and already playing prominently in the security arena with clear implications for the U.S. and its allies and their collaborative defense relationships.

Below is a brief overview of what is known publicly of China’s offensive space control activities and the military lens through which Beijing views its space program more broadly.

CHINA’S SPACE OUTLOOK

As China modernizes its military, it is well understood that space-related capabilities are one of the highest priorities for the Peoples Liberation Army (PLA). In a number of venues, the PLA has laid out its central, long-term objective to field an “informationalized” military and to be able to win an “informationalized” war. Much like the rest of the world, PLA analysts have taken note of the accomplishments of U.S. and allied military forces over the past three of four decades and concluded in public documents that “battlefield monitor and control, information communications, navigation and position guidance all rely on satellites and other sensors.” They have observed, “space is the commanding point for the information battlefield.” Capable space-based assets are essential for advanced surveillance, reconnaissance, communications, navigation and other capabilities that are fundamental to the PLA’s priority efforts to project military force over a much greater area than is presently the case. Accordingly, the PLA is presently pursuing these capabilities with vigor.

The PLA’s aspirations, however, extend beyond enhancing their competitive position in space. It has invested heavily in the development of weapons systems that aim to undermine the competitive capabilities of others. The same PLA analysis referenced above also concluded that “destroying or capturing satellites and other sensors...will deprive an opponent of initiative on the battlefield and [make it difficult] for them to bring their precision-guided weapons into full play.” Although China’s pursuit of offensive space control was initially intended to provide a so-called “assassin’s mace” strategy, that deploys asymmetric warfare tactics to level the playing field against a superior adversary, it would be underappreciating China’s investments in this area over the past several years to view their

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commitment to this field of battle solely in those terms. As China’s military modernization progresses, space warfare and its role in achieving anti-access/area-denial objectives will play prominently, regardless of the PLA’s relative strength vis-à-vis its adversaries.

This view is also shared by the U.S. Departments of State and Defense, which, in a joint report entitled “Risk Assessment of United States Space Export Control Policy,” published in April 2012, concluded, “as China advances in operational space capabilities, it is actively focusing on how to destroy, disrupt, or deny U.S. access to our own space assets.” In other words, the fielding of a reliable offensive space control architecture has been incorporated as an essential component of Chinese military preparedness.

This reality should put into stark relief the lack of adequate planning and dialogue among allies with respect to how to respond collaboratively to – and defend against – such actions, if they are ever used against a partner government.

**CHINA’S COUNTERSPACE CAPABILITIES**

China’s offensive space control capabilities include kinetic energy ASATs as well as directed energy and cyber ASATs. Each of these strategies has been successfully tested, with non-kinetic techniques generally regarded as more cost-effective and likely to be deployed. Below is a brief review of China’s activities and/or history across these various techniques/capabilities.

**Direct Ascent Anti-Satellite Weapons**

One of the highest profile offensive space control capabilities being developed by the PLA is its direct ascent anti-satellite (ASAT) program, which was put on public display in January 2007. The PLA carried out a controversial test that used a ballistic missile to destroy a disabled Chinese satellite in low-earth orbit, creating some 40,000 pieces of space debris and earning the instant opprobrium of the international community. The missile was launched from the Xichang Space Center in Sichuan province and the targeted satellite was the Feng Yun 1C, an inactive weather satellite.

Chinese research and development activities on this capability are well-known and continuing.

**Space Situational Awareness**

China’s ability to effectively interdict the satellite communications of a perceived adversary depend on its level of success in tracking these objects through an indigenous Space Situational Awareness capability. China has reportedly been developing the architecture for such a system for years. The aforementioned U.S. government report concluded that improvements in this area are “a prerequisite for effective, precise counter-space operations.” One Chinese agency charged with this task is the Chinese Academy of Sciences’ (CAS) Space Target and Debris Observation and Research Center, which has a public mandate to track small debris that might collide with China’s manned space vehicles. The China National Space Administration has a long-term action plan for 2006 to 2020, adopted in 2003, that was supposed to field a “space-based surveillance system for tracking debris, satellites, and other objects in space.” Cheng and Stokes observe that the “PLA and civilian counterparts also have been...”
enhancing national satellite laser range finding capabilities, and investing in radar systems for satellite surveillance and tracking," investments that have clear space control implications.\textsuperscript{21}

**Satellite Jamming and Spoofing**

China has reportedly tested its ability to conduct electronic signal jamming against satellites, demonstrating its ability to successfully use land-based transmitters to interrupt and interfere with the flow of signal communications between satellites and ground stations.\textsuperscript{22} The U.S.-China Economic and Security Review Commission reports that two U.S. satellites have each experienced at least two separate instances of interference via cyber-attacks that either interfered with, or actively took control of, their functions.

**Blinding and Dazzling**

China has reportedly used lasers to temporarily blind or dazzle U.S. satellites on a number of occasions.\textsuperscript{23} These instances included targeting U.S. reconnaissance satellites.\textsuperscript{24} A European Space Agency official also noted the past targeting of French satellites.\textsuperscript{25}

**Co-Orbital Satellites**

Between June and August 2010, China reportedly conducted two orbital rendezvous maneuvers involving Chinese satellites SJ-06F and SJ-12, during which these satellites allegedly bumped into each other in what many security professionals interpreted as a clear offensive space control exercise.\textsuperscript{26} The development of maneuverable micro-satellites is a technology that China is reportedly focusing research and development resources on intensely. Moreover, this research includes small mobile launch vehicles that allow for expedient and discreet operation. The microsatellites weigh less than 100 kg and, in addition to being deployed with the intent of a possible collision, they can also be used for a broad array of sophisticated remote sensing, electro-optical, radar and reconnaissance applications.

**Ground-Based Systems**

The 2011 Annual Report of the U.S.-China Economic and Security Review Commission cited a book written by PLA Major General Chang Xianqi, entitled "Military Astronautics," which states "destroying the enemy on the ground is the most effective way of seizing space supremacy" and identifies the potential desirability of striking launch systems and command and control facilities via air raids, missile attacks or through the use of special operations forces as part of an effective space control strategy.\textsuperscript{27}

**THE ROLE OF SPACE CONTROL WITHIN BROADER PLA PLANNING**

The 2007 ASAT test was instructive in exposing the level of attention these programs and initiatives attract within the broader workings of the PLA. Kevin Pollpeter of the Jamestown Foundation took note of the slew of promotions that took place later that year of career space professionals to senior positions within China’s broader weapons development bureaucracy. Despite the international condemnation that followed that test and the diplomatic "damage control" that was required of civilian leadership in Beijing, who were seemingly caught off guard by it, PLA leadership promoted space

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\textsuperscript{23} “Spooks in Orbit; the Military Uses of Space.” The Economist. July 2, 2011.


professionals to the head position at the Commission of Science, Technology and Industry for National Defense (COSTIND) and four of the top eight slots at the PLA’s powerful General Armaments Division (GAD). Pollpeter also noted the following significant personnel moves:

“On August 30, Zhang Qingwei, General Manager of the China Aerospace Science and Technology Corporation (CASC), was promoted to the post of minister of the COSTIND. Zhang, 46, is one of the youngest ministers to have ever been appointed in the People’s Republic of China. In 2006, another career space insider, Huang Zuoxing, was promoted to the position of deputy political commissar of the GAD. Huang’s promotion was preceded in 2002 by the appointment of the former deputy political commissar of the Taiyuan Satellite Launch Center, Chi Wanchun, to the position of political commissar of the GAD. Two other deputy commanders of the GAD also have space careers. Zhang Jianqi, appointed to the GAD in 2004, has served most of his career at China’s launch facilities and Zhu Fazhong, appointed to the GAD in 2002, appears to have spent the majority of his career in the missile and radar fields. Zhang Qingwei, Chi Wanchun, Zhang Jianqi, and Zhu Fazhong are also members of the important Central Committee of the Chinese Communist Party.”

Pollpeter further noted,

“The promotion of career space professionals to positions of prominence in China’s military industrial complex may signal the increasing influence of the program in Chinese decision-making on weapons development. Such influence could help explain China’s decision to develop counterspace capabilities and the increasing attention that is being paid to the development of space-based C4ISR assets and China’s space program overall.”

The central coordination of counterspace activities within the PLA remains somewhat unclear. There have been discussions about the utility of creating an independent “space command” within the PLA, but this does not appear to have occurred. Instead, the General Armaments Division’s China Launch and Data Control department, which oversees the country’s primary launching facilities and SSA capabilities, appears to have the lead. Indeed, Cheng and Stokes have described the GAD as the “executive authority for space.” That said, the General Staff Department is technically in charge of the information that is collected from the satellites, while the PLA Air Force and the Second Artillery have also laid claim publicly to the space domain as their area of competency. These overlapping claims to the command hierarchy of the space control mission and to the PLA overall add layers of complexity to an already non-transparent bureaucracy.

Ultimately, however, the GAD is regarded as the agency that provides the vision for China’s space program and its operational requirements. This responsibility is not limited to military programs. The PLA’s oversight function inevitably paints a large swath of the country’s overall space activities with a military brush. GAD, through several departments within it, is reportedly responsible for “stabilizing defense and space acquisition and policies, managing China’s space program, developing technical solutions to satisfy operational requirements, and overseeing defense industrial research, development and manufacturing.”

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It should not be surprising, therefore, that PLA leaders look for dual-use applications for nearly all space systems under their charge, including the development of new capabilities in the area of imagery, reconnaissance, navigation and earth resource systems.

**CHINA’S SPACE SECURITY DIPLOMACY**

In 2008, China and Russia proposed the “Treaty on Preventing the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects” (known as the PPWT) before the United Nations’ Conference on Disarmament (CD). This draft agreement sought to ban the placement of weapons in space, but allowed for the deployment of ground-, sea- and air-based antisatellite systems. It was seen by the U.S. as an attempt to curtail disproportionately the military space applications of the United States and was also determined to be inherently unverifiable. Moreover, its sponsorship by a nation, China, that, only the year before, attracted international condemnation for shattering a low-earth orbit satellite with a direct ascent ballistic missile while pursuing a range of other counterspace initiatives, seemed to underscore the disingenuous nature of China’s support for pacifying outer space. It likewise underscored the risk associated with signing on to such agreements with partners that have poor track records on being communicative, transparent and responsible.

The net result of the promulgation of international agreements seeking to curb space-based weapons in this manner would have a more substantive impact on technologically advanced countries, but not necessarily on those that pose the greatest threat to space-based systems. For example, although space-based missile defense and co-orbital counterspace weapons might be snared by such agreements as constituting the weaponization of space, laser-based blinding, jamming, cyberattacks and even anti-satellite missiles would not be targeted by the agreement’s provisions.

As pointed out in a 2009 study published by the Institute for Foreign Policy Analysis, the Annual Report to Congress entitled, “Military and Security Developments Involving the People’s Republic of China” laid out the Chinese concept of “three warfares” or “san zhong zhanfa.” These include the combination of psychological warfare, media warfare and legal warfare that can shape the strategic landscape vis-à-vis adversaries.30

As stated in that report:

“Legal Warfare uses international and domestic law to claim the legal high ground or assert Chinese interests. It can be employed to hamstring an adversary’s operational freedom and shape the operational space. Legal warfare is also intended to build international support and manage possible political repercussions of China’s military actions.”

The “three warfare” approach is reportedly part of the training and exercises of the PLA and presumably contributes to China’s motivation to urge global support for treaties that restrict military activity in space, despite its own evident interest, and robust investment, in this activity.

**PROLIFERATING SPACE TECHNOLOGY**

Another area of developing concern is Chinese proliferation of militarily-relevant space capabilities. According to February 2012 testimony from the Director of the Defense Intelligence Agency, Gen.

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Ronald Burgess, Chinese state-owned enterprises “continue to proliferate space and counterspace related capabilities” that have military applications. Burgess noted:

“One example is Chinese development of the Beidou position, navigation and timing system, which the Chinese plan to have available for regional users by 2012 and internationally by 2020. This system will enable subscribers outside of China to purchase receivers and services that give civilian and military applications greater redundancy and independence in a conflict scenario that employs space assets.”

There are already reports over the past year bearing this concern out, notably China including access to their Beidou system as part of “package deals” when negotiating access to the natural resources and markets of developing countries. This may not always implicate offensive space control technologies directly, but does speak to China’s role in improving the broader capabilities of other nations to leverage space for potentially military purposes.

The aforementioned report by the U.S. State and Defense Departments observed, “many of these arrangements are with countries that are not supportive or are openly opposed to U.S. foreign policy objectives.” The report identified China’s entry into the world market in the export of satellites and infrastructure to nations throughout South America, Africa, the Middle East, and Asia as part of a concerted strategy to develop niche areas for export that do not compete with Russian or western suppliers. For example, China has pursued systems for export that include GPS and GLONASS-equipped multiple rocket launcher systems and short-range ballistic missiles. Consistent with broader Chinese economic and resource acquisition strategies, China also offers attractive (read subsidized) financing and technology transfer options to entice prospective foreign partners.

Moreover, there is also a direct economic benefit for the PLA marketing its space capabilities to foreign countries, as its satellite sales and launch business has become a source of considerable revenue. It is possible that Chinese space imagery will become available to foreign customers, which could advance the capabilities of foreign militaries to consider the development of “assassin’s mace” strategies of their own, even if limited to jamming, spoofing or cyber operations (i.e., the less expensive and technically-challenging approach to the space control mission).

**RISK, UNCERTAINTY AND NON-TRANSPARENCY IN CHINA’S COUNTERSPACE POSTURE**

The dual-use dimensions of China’s space program and the oversight role played by the PLA in all of China’s space-related endeavors creates an atmosphere of uncertainty throughout their space programs and foreign relationships that, over time, has raised security concerns even in those areas where China’s partners solely focused on acquiring economic or scientific benefits.

For example, Western security experts, including in Europe, now take note of the strategic significance of China’s indigenous constellation of navigation satellites (termed COMPASS or Beidou-2) being assigned by the PLA the same downlink frequencies as the EU’s Galileo Global Navigation System (a program that was formerly a collaborative effort with China). A recent study of this issue by technical experts noted, “Using signal structures similar to other [global navigation satellite systems]
and sharing frequencies near to or overlapping those of Galileo, the Galileo and Compass signals overlay becomes a matter of great concern for the system providers and user community.\textsuperscript{33}

Multiple meetings between the Europe and China have generally failed to resolve the issues raised by this overlap. The disconnect is fueled by China not considering Galileo to consist of established “legacy” systems, as it does GPS and Russia’s GLONASS, under the terms of the International Telecommunications Union (ITU), which seeks to administer these types of disputes. Moreover, the pace of China’s space program makes it possible that the operational capability of Compass may exceed or preempt Galileo, with a number of technical and commercial implications. The security concern relates, not only to the possibility of harmful interference occurring as a result of the frequency overlap, but also to the constraints that overlapping frequencies cause on the satellite user’s ability to control the service provided to specific users, potentially including military applications. Indeed, there is speculation that the signal overlay has the potential to deny access to key Galileo frequencies in times of emergency.\textsuperscript{34} Accordingly, Europe has consistently opposed China’s efforts to move forward with these overlays.

As the entirety of China’s space program is administered by the PLA, there are clear security implications and space control mission concerns with regard to China’s decision thus far not to compromise on this decision. No doubt, this should be of critical importance to the defense planning that presently occurs among the U.S. and European allies as well as Japan. Moreover, the U.S. government is reportedly investigating whether the same might be true with respect to Beidou-2 downlink frequencies and those of its Global Positioning System satellite (GPS) receivers.\textsuperscript{35} The lack of transparency and confidence in China’s intentions has crossed a threshold where these types of investigations now encounter far less resistance.

Despite China’s history of championing increased governance and multilateral agreements with regard to the “weaponization of space,” China’s past and present behavior in this area has been more culpable than any other nation for the decline in confidence that space can be an environment free of imprudent, irresponsible or malevolent acts. China’s 2007 ASAT test and the resulting 40,000 pieces of orbital debris will need to be reckoned with by all space-faring nations for the indefinite future. This was emphasized by the “avoidance” maneuvers required of the International Space Station in January 2012 to prevent a collision with debris that emanated from that incident.

Most significantly, the fact that this provocative act by the PLA may not have been initiated, or even condoned, by “civilian” leadership should be of little consolation to the international community. Rather, it highlights the growing disconnect that appears to exist between the PLA and those who are ostensibly in charge in Beijing. It has been speculated that the Hainan incident in 2001, when the Chinese forced down a U.S. EP-3 aircraft patrolling near its waters, the test flight of the secretive J-20 stealth fighter by the Chinese Air Force during a formal session between U.S. Secretary of Defense Robert Gates and Chinese President Hu Jintao and even the 2010 rare earths embargo following the arrest by Japan of a Chinese trawler captain were all orchestrated by the PLA without proper internal coordination with civilian leaders.


\textsuperscript{34} “Expert Advice: The Strategic Significance of Compass.” Scott Pace. GPS World. December 1, 2010.

This trend of an ascendant PLA within the Chinese leadership structure is troubling and should supercharge ongoing efforts to cooperate on defensive space control. Indeed, defense planning requirements ought to incorporate the assumption that this disconnect periodically exists and, by many accounts, is getting worse. That this divided leadership extends to military space issues ought to be relevant to military planners and joint allied preparedness at a fairly granular level, which is currently not the case.

**BOTTOM LINE**

The U.S. has appropriately objected to China’s lack of disclosure, transparency and willingness to engage openly with other nations on its largely offensive military build-up, including vis-à-vis space. The U.S. security community writ large should object to the political difficulty that still exists among allies to acknowledge what is publicly known of China’s counterspace investments and military planning – as well as similar planning conducted by others – and move forward with a collaborative understanding that space has already become a domain of potential conflict. To the extent that our Japanese and European allies already understand these threats, they often do not do so comfortably enough to engage in the kind of allied operational planning for highly plausible space conflict scenarios that are urgently required, although this is changing.
The Space Security Policies of the U.S., Europe and Japan

It should be regarded as an opportunity that the space policy agendas of the U.S., Europe and Japan are each presently evolving into new configurations. With new space policy ground being broken in various quarters, the timing may be right to urge the respective government agencies overseeing space assets to reorder the priority accorded space security, particularly defensive space control. This is especially needed with respect to allied cooperation to ensure that, when common threats are taken into account, new policies, military doctrines as well as investments that compliment, rather than duplicate, those of other allies.

The fact that the U.S., Europe and Japan are still in the early stages of responding even to the need for strengthened sharing of SSA capabilities is evidence that allied cooperation on the defense-related aspects of space security has not progressed sufficiently. This might be seen as an indicator of the extent to which each of the U.S., Europe and Japan have traditionally sought to ensure that their internal architecture is well-developed prior to serious bilateral or multilateral outreach. There is abundant room for improvement with regard to having a prudent level of interoperability or, at least, complimentary space security capabilities among allies. Per the case study above, such collaboration should not be viewed as premature or at risk of being “the tail wagging the dog” in the direction of the weaponization of space. Any such collaboration at this stage should rightly be viewed as reactive and defensive, rather than proactive and offensive.

The reality of current discussions on this topic among allied capitals is that they are only in a relatively nascent stage. This makes the coming few years especially important. The following basic shortfalls in current collaboration underscore the types of problems that need to be remedied.

» There is not today a common understanding among allies on what constitutes an “incident” or conflict in space or the proportionate responses that may be necessary in the event such an “incident” occurs.

» Counterspace threats and state actor challenges to space assets are underdeveloped in the security policy planning of Japan and most European states and multilateral institutions.

» It is not clear that the U.S. sharing of SSA capabilities with Europe and Japan includes a specific mission of having SSA contribute to counterspace preparedness and contingency planning. Private sector initiatives, such as the Space Data Association, are also inadequately leveraged by state actors – individually or collaboratively – to improve existing threat detection capabilities and counterspace contingency planning.

» There is need for a better understanding of the connective tissue among SSA, Transparency and Confidence Building Measures (TCBMs) and crisis management. In other words, there is an important gap within the international community and among allies in scoping out scenarios whereby a crisis emerges even under the umbrella of multilateral mechanisms, such as SSA agreements and TCBMs (e.g., an International Code of Conduct).
To begin addressing these types of deficiencies, a useful objective would be to reduce – and, over time, eliminate – long-standing barriers to the type of bilateral, trilateral and multilateral cooperation that is required to implement a truly integrated, collaborative space security architecture that is mutually reinforcing, rather than competitive.

The U.S. and its space-faring allies have delayed meaningful collaboration with regard to defending against threats to space control for a host of reasons. The relative vacuum has been filled by an atmosphere of competition, indigenous development and non-transparency that has further stunted recognition of the vital nature of a global space security architecture among “willing” space-faring nations that are otherwise well-integrated in terms of terrestrial defense assets and planning.

The lack of adequate allied coordination, thus far, stems primarily from:

1. international competition over space-related technology that prioritizes national or regional independence and “doing it better” over “doing it together”; and

2. the political aversion to any charge that such cooperation might constitute a move toward the “weaponization of space” or otherwise soil the idealistic vision of keeping space a common frontier free of terrestrial conflicts or flash points.

Success in breaking free of these constraints will depend on hardheaded political leadership, an emphasis on shared interests, realistic milestones and enhanced trust in the disposition and handling of sensitive data. It is also beneficial that there are a number of space security challenges caused by non-intentional factors, such as commercial congestion, space weather, natural space debris, etc., that, at minimum, put forth highly defensible reasons why governments should care about space security even in the absence of an adequate appreciation for the counterspace threat or the political will to confront it. Accordingly, the advancement of the counterspace policy portfolio is not necessarily dependent on all parties sharing the same perspective on – or assessment of – the threat environment.

The reality that redundancy and protective measures for space-related assets (including ground stations) are necessary is generally accepted by all space-faring nations and provides a useful starting point for policy-makers and security professionals within allied governments that appreciate the counterspace threat, to begin more substantive discussion of this aspect of space security. A senior European official, for example, acknowledged to the authors that, from his perspective, there is a lack of any threat scenario planning within Europe as a whole with regard to the potential counterspace predations of other state actors (although individual countries, like France and the UK, may well have such planning underway). This type of acknowledgement provides some encouragement that current, systemic lapses are gaining attention and attracting fresh, critical thinking. At the same time, such acknowledgements of the deficiencies in collaborative planning and communication can be dangerous as they embolden actors relying on offensive space control capabilities to exploit these strategic vulnerabilities for their respective regional power-projection capabilities.

In the aforementioned 2009 report by the Institute for Foreign Policy Analysis, it was observed that there is a “need for a space deterrence component of national security strategy for which the United States should develop a declaratory policy addressing what actions the United States would take if a nation attacks our space assets.”

The fact that this still does not exist to guide U.S. military

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doctrine, let alone joint strategy and planning with key allies, is problematic in a security environment where space-based assets play so prominently.

There is still significant ambiguity as to what assets the U.S., Europe and Japan might consider of national security relevance and, in turn, how to deter and defend against behavior threatening the integrity of those assets. Many military functions, for example, employ commercially operated and privately-owned satellites and other pieces of infrastructure for communications, imaging, navigation, new launch and other capabilities. This is true for the United States as well as Europe and Japan. It is especially perilous for those U.S. allies which lack the ability to defend their space assets, or respond in-kind to any attack, to postpone further the kind of investment, information and intelligence exchanges in coordination with the U.S. that is necessary to demonstrate to potential adversaries that agreed responses to counterspace attacks exist alongside clear “red lines” regarding such behavior.

U.S. SPACE SECURITY POSTURE

The Obama Administration and the U.S. Congress are grappling with a number of challenging issues related to the future of manned space flight, the role of the private sector in civil space endeavors and the proper level of fiscal investment to pursue various agendas. Although there are a number of outstanding questions, President Obama set forth several reinforcing objectives relevant to space security in his 2010 U.S. National Space Policy (NSP). The appreciation for space assets as a component of U.S. defense planning, including the need to defend these assets against the space control capabilities of potential adversaries, is not in doubt. The policy document states,

“The United States will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them.”

This document also instructs that the Secretary of Defense and Director of National Intelligence, in consultation with other agencies and departments, take on the following excerpted tasks to underscore the attentiveness of the U.S. to the space control mission, including more robust allied coordination in the arena. Agency heads shall:

“Develop and implement plans, procedures, techniques, and capabilities necessary to assure critical national security space-enabled missions. Options for mission assurance may include rapid restoration of space assets and leveraging allied, foreign, and/or commercial space and nonspace capabilities to help perform the mission;”

“Develop capabilities, plans, and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack U.S. or allied space systems;” and

“Improve, develop, and demonstrate, in cooperation with relevant departments and agencies and commercial and foreign entities, the ability to rapidly detect, warn, characterize, and attribute natural and man-made disturbances to space systems of U.S. interest.”

With respect, specifically, to international cooperation, the Secretary of State is called upon to:

“Demonstrate U.S. leadership in space-related fora and activities to: reassure allies of U.S. commitments to collective self-defense; identify areas of mutual interest and benefit; and promote U.S. commercial space regulations and encourage interoperability with these regulations;”

“Promote appropriate cost- and risk-sharing among participating nations in international partnerships;” and

“Augment U.S. capabilities by leveraging existing and planned space capabilities of allies and space partners.”

Although the U.S. government has an established track record concerning the relevance of space assets to broader security and military goals (including with regard to fielded capabilities to defend against offensive space control initiatives and or respond in-kind), there are three areas related to the above policy objectives that could be significantly improved upon:

1. The interagency reporting structure for properly coordinating the growing security dimensions of space policy appears to be somewhat disorganized, especially with regard to providing uniform views to U.S. allies.

It has been observed by foreign partners – including officials interviewed in the course of preparing this report – that, with respect to space security, the U.S. is not consistently speaking with "one voice." There are a number of agencies and parties within the U.S. government that have a vested interest in this policy portfolio. When seeking to unearth an overarching assessment of U.S. needs and objectives, one is likely to receive a somewhat different answer from different Departments and agencies, whether the inquiring party is a foreign ally or a senior U.S. official. Different agencies of government are pursuing their own respective projects and, accordingly, their own procurement plans. Because space responsibilities are dispersed across agencies, such as NASA, the Pentagon, USSTRATCOM and the global combatant commands, there is need for more senior stewardship of the country’s overall space security agenda and for communicating that agenda to partners.

It is not unusual, for example, that the Defense Department will stray into diplomatic conversations with foreign partners that are better suited to State Department involvement (which, to the Pentagon's credit, is often included in such sessions). It is similarly not unusual for NASA to answer questions posed by foreign partners that might better have been posed to the Defense Department. In military circles, USSTRATCOM might be involved in discussions or planning with allies involving war-fighting scenarios and overall preparedness that might better be the shared purview of regional combatant command with specific responsibility for the theater in question. This coordination challenge could be materially improved by an "embedding" strategy, supervised by the National Security Council (NSC) of some specially designated node within the Pentagon, of placing representatives of government agencies or commands into one another for a significant period of time, so that a more unified and comprehensive space security policy emerges on the other end.

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It is apparent to a number of experts interviewed for this report that there are too few people assigned responsibility for implementing the NSP, particularly at the State Department. Moreover, the uncertainty associated with only a few people having a definitive understanding on what responsibilities lie where and the lack of authorized officials to ensure that agencies do not overstep their boundaries or cause “lane confusion” should be corrected via stronger White House leadership. The NSC would be ideally positioned to bring executive oversight to the agencies involved as well as overseeing the conversations with allied partners that are often perplexed over who they might best meet with for specific collaborative discussions on such issues as defensive space control. The problem today appears to be that NSC has not been sufficiently mandated to take on this role or assertive in its implementation. If the NSC is deemed to be ill-equipped for this mission, the designation of a special node within the Pentagon that is charged with this role or the resurrection of a White House National Space Council to implement policy might be other solutions.

2. **The Defense Department has not integrated effectively the personnel that are most versed in the technical and scientific realities of managing space assets with the combatant commands that hold primary responsibility for war-fighting and military preparedness.**

As referenced above, another critical deficiency within the U.S. space security posture is the seeming disconnect between the space community and the war-fighters and planners. There are reportedly shortcomings in the integration of U.S. technical and scientific space experts with the combatant commands that are most likely to be tasked with using and defending space assets in a conflict scenario – or operating in their absence, if required. Even within the Pentagon, USSTRATCOM has little incentive, motivation or negative consequences associated with failing to more effectively leverage commercial and international space capabilities.

There is also insufficient integration of personnel to ensure that those planners and war-fighters most capable in the operational dimensions of conflict have an opportunity to learn from – and provide feedback to – officials whose responsibilities include securing space assets. These officials are too few, their responsibilities are too fragmented and they have little incentive to change. At present, experts at USSTRATCOM generally address space security needs outside of specific conflict scenarios that are the purview of the regional combatant commands.

Based on conversations with space security experts, it is sometimes the case that, even in military settings, officials operate on the assumption that space assets will simply be available when needed and that it is the responsibility of technical experts to make sure this is the case. One space security expert with the U.S. Department of Defense offered the critique that it is typical for military planners to prioritize achieving greater capability in space over ensuring the resiliency, redundancy and protection of existing space assets when seeking to buttress U.S. war-fighting preparedness.
3. The implementation of the NSP’s directives with regard to allied or international cooperation does not appear to be taking place in an adequately systemic manner due, in part, to the prioritization accorded by the State Department to diplomatic discussions involving the Code of Conduct and the pursuit of other multilateral initiatives and agreements (e.g., Long-Term Sustainability of Space Activities, UN Group of Government Experts, etc.)

Despite the many references to incorporating allies into the U.S. space security posture, it appears that the reality of the existing dialogue with close allies, such as Japan and Europe, has often not lived up to those objectives. As noted above, the NSP calls for developing options for leveraging allied space capabilities to enhance system resiliency, promoting cost- and risk-sharing among international partners and augmenting U.S. capabilities by leveraging the present and future space capabilities of allies.

These policy statements give the impression to some – perhaps including those on Capitol Hill and elsewhere – that they are being faithfully implemented, which experts consulted in the course of this report generally agree is sometimes not the case.

It is, however, reassuring and helpful that more robust collaboration with allies on defending against the counterspace deployments and planning of potential adversaries is already embodied in U.S. space policy. It lays the bureaucratic groundwork for pursuing this agenda with greater assertiveness and determination in the period ahead.

GLOBAL POSITIONING SYSTEM (GPS)

A brief review of the role of GPS within the U.S. space posture may be worthwhile, alongside a similar review of the flagship satellite systems of Japan and Europe, to provide some background on the structure of these satellite systems and their critical purposes.

GPS is exclusively a U.S. owned and operated satellite positioning, navigation and timing system consisting of space, control and user segments. The space and control components are developed, maintained and operated by the 2nd Space Operations Squadron of the U.S. Air Force, located at Schriever Air Force Base in Colorado. The Air Force is tasked with ensuring the availability of at least 24 out of approximately 31 operational GPS satellites 95 percent of the time. There are reportedly 3 to 4 decommissioned satellites, termed “residuals,” that are available for reactivation, if needed. The orbital arrangement aims to have at least four satellites in view from any singular point on the planet at all times. In June 2011, an important expansion was completed so that three of the extra satellites became part of the baseline constellation, improving coverage over much of the globe.

Although the operational side of GPS is managed through the Department of Defense, long term planning and guidance for the system is provided by the National Executive Committee for Space-Based Positioning, Navigation and Timing (PNT), which is a joint civil/military body created by presidential directive. Its predecessor, which laid the foundation for joint civil/military control of GPS, was the Interagency GPS Executive Board created by President Clinton in 1996. The National Executive Committee is joint chaired by the Deputy Secretaries of Defense and Transportation, with broader membership consisting of top leaders from the Departments of State, Interior, Agriculture, Commerce, Homeland Security, the Joint Chiefs of Staff and NASA.

This broader constituency reflects the large variety of ways that GPS impacts daily life across civil and commercial applications. GPS data is available to the public and was freed from deliberate government degradation in 2000, which had previously been deemed a security requirement to ensure an edge for the U.S.
military in precision PNT capability. GPS data has become fundamental to broad swaths of the private sector in the U.S. and internationally.

EUROPEAN SPACE SECURITY POSTURE
In July 2008, the European Parliament voted 502 to 83 in favor of its global navigation satellite system (GNSS), GALILEO, being made available for military use – a dual-use application of an ostensibly civilian and commercial investment. In 2007, the EU and the European Space Agency (ESA) member states, totaling 29 countries, endorsed unanimously the European Space Policy, demonstrating support for a comprehensive, common way forward. In addition, the Fifth Space Council named “space security” among its four priority areas. The Fifth Space Council is a periodic meeting of the ESA Ministerial Council (the governing body of ESA) and the EU Council (also represented at the Ministerial level) to make decisions on European space policy.

In terms of operationalizing space security, it is apparent to most observers that U.S. allies in Europe are better positioned at the individual member state level to offer actual capability as well as value-added with regard to counterspace contingency planning. Politically, there are also fewer obstacles to making security-oriented decisions with regard to cooperation in militarily-sensitive space situations. Nevertheless, cultural, political and budgetary obstacles remain to providing more frequent groundbreaking contributions in this area and Galileo stands out as Europe’s most impressive and ambitious space program at the multilateral or member state level.

GALILEO
Galileo is the global satellite navigation system under joint development by the European Union (EU) and the European Space Agency (ESA). In contrast to GPS, the Galileo system resides entirely under civilian control. The system was designed to be interoperable with GPS as well as Russia’s Glonass program. It has thus far launched two experimental satellites (the GIOVE-A and -B in 2005 and 2008, respectively) as well as the first two of four satellites that comprise the "In-Orbit Validation" (IOV) phase of the system, which were launched on October 21, 2011. The two remaining satellites are reportedly scheduled for launch in 2012.

Initial Operational Capability (IOC) is scheduled for mid-decade, when three services are scheduled to be available: a freely available service for anyone with a compatible receiver (similar to GPS); an encrypted signal that is available to law enforcement and government agencies; and a Search and Rescue (SAR) function unique to Galileo that allows a user to alert authorities of emergency situations and to receive confirmation that the signal was received. It is worth noting, particularly in the context of this report, that early technology for the SAR function was originally to be provided by China before technical and political disagreements reportedly led to the pursuit of alternative sourcing. In fact, the first two satellites were equipped with placeholder, empty SAR payloads as a result.

Full Operational Capability (FOC) is scheduled to occur by the end of the decade. The vision for the completed Galileo system is 30 satellites, comprising 27 operational and 3 in reserve, placed in three medium earth orbits (MEO). The Galileo system is said to provide locational data down to one meter and smaller (as compared to the "several meter" level of precision currently provided by GPS).

Observers have offered different opinions as to whether space security collaboration with Europe should run through NATO or not. With most space assets still owned by individual member states that remain reluctant to “contribute” such assets to NATO, some view the organization as ill-equipped, at
least at this juncture, vis-à-vis required resources to be a serious partner or venue through which to plan collaboratively on potential space control incidents.

Others, however, point to NATO’s Allied Command Transformation (ACT) located in Norfolk, Virginia, which, as described on its website, “is NATO’s leading agent for change, driving, facilitating, and advocating continuous improvement of Alliance capabilities to maintain and enhance the military relevance and effectiveness of the Alliance.” In April 2011, NATO ACT published a report entitled, “Assured Access to the Global Commons,” which was designed to stimulate attention within NATO to the need to maintain unfettered access to shared domains, identified by this report as including maritime, international airspace, cyber space and outer space. The interest in preserving access to these domains serves broad economic and security interests. Indeed, this report held out the possibility of this program continuing through the Multi-National Experiment 7 (MNE-7) taking place over the course of 2011 and 2012 that is evaluating these four domains. The hope is that the NATO ACT report and MNE-7 exercise would help define the potential roles and responsibilities of member states in assuring access to these areas for economic and national security purposes and establish a more defined role for NATO to advance allied collaboration on a range of issues, including this dimension of space security.

Otherwise, the current European position on space security is dominated by discussion, debate and diplomacy over the EU’s proposed International Code of Conduct for Outer Space Activities. This Code has also dominated the international space security diplomatic agenda more broadly for the past few years. The U.S. considered the proposal and announced in January 2012 that it could not support the current draft, but would work further with the EU and other nations to develop an internationally-acceptable agreement. In the intervening period, the EU, on May 29, 2012, passed again its original version of the Code with some amendments that were made in 2010.

There has been significant debate regarding the Code over the past few years, with those opposed to the plan highlighting the lack of adequate verification, compliance and enforcement provisions of the agreement and the flexibility and exceptions it appears to grant to signatories for actions that are deemed to be in their respective national interests. It is feared that the Code will tie the hands of responsible governments and open the door for irresponsible regimes to gain an upper hand through cheating or adopting a liberal, self-serving interpretation of the agreement. The U.S. security community is also concerned that the Code could unwittingly inhibit its ballistic missile defense planning, providing an opening for potential adversaries to challenge certain future U.S. deployments. Moreover, the agreement is principally designed to create a sustainable space environment, with less emphasis on the counterspace programs of irresponsible space-faring nations. It does not appear to be, however, the precursor to actual planning among some “coalition of the willing” concerning how to defend against – and respond to – potential counterspace attacks. In other words, no “connective tissue” has yet been identified for how to marry such an overarching Transparency and Confidence Building Measure with proper space crisis management. There has not been sufficient discussion of – or solutions provided for – what member states might do, in reasonably precise terms, in the event that these rules of the road are violated.

In fact, discussions of the Code of Conduct by EU members within bilateral sessions and multilateral conferences have demonstrated that the definition of space security in European settings consistently

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gravitates back toward the challenges posed by incidental or naturally-occurring phenomena, which are far less challenging issues to grapple with politically. Movement away from these issues as the central agenda items on space security continues to prove difficult, underscoring the pushback over having productive discussions between the U.S. and the EU on the man-made challenges to a secure space environment.

**JAPANESE SPACE SECURITY POSTURE**

For its part, Japan has recently emerged from a long period where its government space program was, by law, severely restricted in terms of its ability to serve the country’s security interests. In 2008, the Japanese Diet enacted the historic Basic Space Law that created the legal framework for Japan to adopt a national space strategy that is unbound by a previous legislative requirement that all space activities be exclusively for peaceful purposes.

The bill enabled the national space policy to reinforce the country’s security requirements, albeit through “non-aggressiveness,” as well as enhance space research and development and nurture more effectively Japan’s domestic space industry. This law was followed up with the Basic Plan for Space Policy, which was adopted in 2009. One of the most significant contributions of the Basic Space Law was the establishment of the Strategic Headquarters for Space Policy, which is formally chaired by the Prime Minister, and has served the purpose at this early stage of studying how the Basic Space Law and the Basic Plan for Space Policy might best be shaped and managed. In part, the motivation for these and other reforms has been the real-time efforts and investments of the Japanese government in its flagship space project, the fielding of the Quasi Zenith Satellite System (described below).

**QUASI ZENITH SATELLITE SYSTEM (QZSS)**

QZSS is a Japanese government administered program to field a 3-satellite constellation that is positioned in figure eight-shaped orbits that pass through the “near zenith” over Japan. Three satellites are required to always have one in this “zenith” position. The primary purpose of QZSS is to complement existing GPS coverage of Japan by boosting and generally enhancing the coverage of the country both geographically and in terms of time duration. Indeed, QZSS will share almost the same positioning signals as GPS.

Like Galileo, QZSS aims to provide positioning accuracy at the one-meter and smaller level, which would be an improvement over the current accuracy capabilities of GPS. The first satellite, which was launched on September 11, 2010, called Michibiki, is serving an application verification purpose and is currently providing data that is being evaluated in preparation for the next scheduled launches. The system aims to be operational by 2013.

As part of the most recent space reform measures that facilitate the leveraging of Japanese space policy and assets for military purposes, control of the QZSS budget and program has been taken over by the Cabinet Office, most likely through its newly created Space Strategy Office.

In late-June 2012, the Upper House of the Japanese Diet passed yet another historic piece of legislation that reforms the Japanese space bureaucracy still further. The newest legislation creates a Space Strategy Office within the Prime Minister’s Cabinet Office that centralizes control of the planning and budgeting of the country’s government space program. This new office will bring much needed “top-down” leadership to Japan’s space program, including ensuring that the space-based capabilities of Japan provide dual-use benefit for the security community as well as proposing new and creative
ways of making national defense a priority consideration in the structure and investment decisions of the Japanese space community going forward.

Importantly, this law also removed an article from a previous law that had heretofore restricted the Japanese Aerospace Exploration Agency (JAXA), the government’s primary repository of technical space expertise, from pursuing dual-use space projects. In addition, the law took the impressive step of removing control of JAXA from the powerful Ministry of Education, Culture, Sports, Science and Technology (MEXT). The new legislation shifted JAXA’s reporting channels from MEXT to the Cabinet Office and the far more security-minded Ministry of Foreign Affairs (MOFA). MOFA has long held a prominent role on all security-related matters for the country, but has, to date, not housed the expertise or the mandate to take on a well-defined leadership position on space security, given the resources and authority delegated to other agencies.

It may prove worthwhile for the Space Strategy Office also to consider a greater role for the Japanese Maritime Self Defense Force (JMSDF) within space security, which was a recommendation of several non-governmental experts consulted in the course of this report. Although, in the U.S., it is the Air Force that has preeminence over the space domain, in Japan, the JMSDF is probably best equipped to serve this function. Reasons include their resource base, expertise and field experience leveraging space-related assets for sea-lane protection and especially the administering of missile defense cooperation with the United States via their AEGIS-equipped destroyers and joint SM-3 missile program. Moreover, JMSDF tends to have primacy in theaters from which the most likely threats – including to space-related assets – are likely to emerge, such as the East China Sea.

Despite optimism over the new legislation, it has only just been passed and now faces an entrenched Japanese bureaucracy and pacifist culture within JAXA that has, to date, stymied the country’s potential on space security from being fully realized. No doubt, some of this dysfunction – like in Europe – is attributable to cultural restraints on the “weaponization of space.” The period ahead will test the ability of the Cabinet Office to insist that the intended security-related benefits of these important reforms are vital to the country.

In addition to the implementation of these reforms, the Japanese space establishment would benefit from some of the same recommendations made with regard to their U.S. counterparts. Similar to the notion of comingling (via embedding) the personnel and expertise of USSTRATCOM with the regional combatant commands (e.g., PACOM, CENTCOM, etc.), there might be some utility in comingling the personnel and expertise of JAXA and MOFA and other security-minded agencies of the Japanese government (e.g., the Ministry of Defense).

There is significant resistance in the Japanese government, however, to this kind of intra-Ministerial cooperation, long identified as another of Japan’s major bureaucratic challenges. This deeply-rooted organizational and cultural challenge will require a concerted effort to realize the type of cross-fertilization inside Japanese government that would upgrade the education and training of Japan’s security policy community with regards to space. To date, the ripple effects of Japan’s interagency turf battles have been felt profoundly in the area of space. The benefits of space apply to many different government functions, ranging from emergency response to natural disasters to weather to land management and other portfolios dispersed across government ministries.

Ironically, Japan also faces other bureaucratic hurdles that mirror some of those of the U.S., including those that have caused Tokyo so much frustration when seeking straightforward answers on what areas might benefit from bilateral collaboration and joint or separate investment on space security, especially defensive space control. The difficulty in the U.S. to "speak with one voice" has complicated
Japan’s efforts to coordinate its space security policy priorities. Japanese officials described to the authors the propensity to get different answers to their questions from NASA, the Defense Department, the State Department and even from the Pacific Command. This phenomenon is exacerbated by the perception among Japanese space professionals that agencies, such as NASA, have responsibilities and functions that, in fact, they do not. This problem, however, has also been present within the Japanese government.

In an ideal scenario, the new Space Strategy Office will take on this issue frontally and provide the more "top-down," centralized authority on matters related to space security that has been sorely lacking. This office is also likely to have the mandate and power to implement the integration of technical space experts with security-minded professionals. The new legislation bodes well for Japan’s commitment and political will to configure, pursue and even fund a space program that is untethered from the kind of bureaucratic “turf” battles that have plagued nodes of the Japanese space program in the past, including JAXA and the Ministry of Defense (the latter of which has struggled with an insufficient budget and rigidity in their priorities for investment and planning).

Despite the new legislation, Japan will still likely encounter challenges concerning how to extract maximum national security value from its space program while not crossing the line of “non-aggression.” Leaders will also seek ways of enhancing their current capabilities in such a way that avoids the uncomfortable question of whether these collaborative actions are being put in place to confront a particular country (read China). Solutions are likely to include defining the role of Japanese space assets as intelligence-oriented or verification and compliance-oriented rather than for potential retaliatory military purposes.

The Ministry of Defense is reportedly already using the Basic Space law to operate its own satellites for select of these purposes, in addition to existing missile defense capabilities. Such contributions are likely to be valuable, even if not representative of a complete, independent solution to the threatening offensive space control investments of other nations, as they should be made in a manner complimentary to the capabilities of their alliance partners. In short, collaboration with the U.S. as well as Europe could provide Japan with a convenient path to mounting an effective defense while avoiding development of specific systems that are viewed as overly confrontational or "aggressive."

Another principal problem identified by outside experts is the issue of Japan’s security consciousness more broadly. Before one can take defensive space control seriously, one has to take broader national security concerns seriously, which is still a major challenge for Japan, culturally and financially. For good or ill, bilateral discussions with the U.S. were provided a boost with the 2007 Chinese ASAT test and persistent North Korean missile and nuclear provocations. These types of incidents seem to have reinforced the notion that the proactive defense of space assets is the only sustainable path forward.

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42 Despite the challenges associated with the Ministry of Defense’s role in space security, they have expressed privately their interest in playing a bigger role in this field going forward. Crisis management and security-minded space TCBMs are specific areas that appear to be attractive starting points due to existing competence in at least the first of these areas.
SPACE SECURITY
COLLABORATION BETWEEN AND AMONG ALLIES

The "gold standard" in the area of space security collaboration and joint preparedness for responding to and managing counterspace threats is currently set by the partnership of states that make up the core of the Schriever Wargame, which is a series of games that has been hosted for the past 10 years by the U.S. Air Force Space Command designed to scope out, and plan for, the role of cyber and space in future conflict. The core participants are, in large part, drawn from the "Five Eyes" (i.e., the signatories of the original "United Kingdom-United States of America Agreement" – or UKUSA – from 1946 that includes the United States, the United Kingdom, Canada, which joined in 1948, Australia and New Zealand, which joined in 1956). This partnership is based largely on intelligence-sharing, with an emphasis on signals intelligence, and is notably absent of Japan and certain key European allies.

More than any other international or multilateral forum, these war games constitute the most advanced form of international crisis planning in the field of space security and responding to deliberate attacks on space assets. This past year, the Schriever Wargame invited 10 observer nations to take part in the exercise, which will likely prove an important step in the direction of considering some practical expansion of this core group in reaction to the growing importance of space in conflict scenarios and the implications it may have on allied collaboration well beyond this elite gathering.

Although there are a number of ways in which the United States, Europe and Japan might cooperate more meaningfully on defensive space control outside of this partnership of nations, the Schriever Wargame does stand out as the "brass ring" for which these allies might reach in order to join this privileged, highly-classified space working group. Indeed, it may be worth exploring with U.S. policy-makers within the security community what processes might be involved for the modest expansion of this forum to include other key partners or whether the creation of a parallel series of less classified exercises might be warranted. For example, we understand that the Schriever Wargame 2012 International Game (SW12 IG), the portion of this year’s game that invited NATO members, was held at a “NATO Secret” level clearance.

With regard to the former, it has been speculated by experts consulted in the course of this report that a second tier membership to the Schriever Wargame would be a useful next step that might, at least initially, have access to only compartmentalized intelligence as part of the exercise. There should also be venues explored to persuade China and Russia at the "red lines" in space-related conduct that would require proportionate allied responses. This type of outreach might also serve a deterrence purpose with regard to the potential escalation of conflict into outer space.

At a more developed stage, it may even be worthwhile to have multiple space-related war games with differing rules based on who is observing or participating in the exercise. The uniqueness of this forum, however, for conducting drills on space crisis management and collaboration among allies when faced with "situations" ought to be further developed. It could be leveraged in tandem with the rising
importance and global relevance of the space theater more broadly and other potential avenues for bilateral and trilateral collaboration explored below.

**U.S.-JAPAN COLLABORATION ON SPACE SECURITY**

According to senior Japanese space officials, almost the entirety of Japan’s international planning with regard to space security is currently with the United States. The key reason, not surprisingly, is the special relationship that has long-existed and the pre-existing framework it provides for security-related conversations. Government officials view such a framework as a prerequisite when evaluating the merits of collaborating with other countries on space security.

To date, the specific venue utilized by the U.S. and Japan has been the Security Consultative Committee, informally known as the "2+2 Ministerial" involving the U.S. Secretaries of Defense and State and the Ministers of Foreign Affairs and Defense from Japan. Within the "2+2 Ministerial" structure, government officials have been generally encouraged of late by the progress made over the relatively short period of time that space has been included as a serious topic of discussion. Specific joint projects are now being discussed, including in the area of SSA.

Notwithstanding this progress, space security remains largely absent from the upper-tier issues on the bilateral strategic agenda, which are presently dominated by the pressing day-to-day challenges of troop deployments, base locations and relocations, the Iranian nuclear crisis, Afghanistan funding, maritime intrusions, missile defense and other important topics. In short, the dialogue on space security has not yet earned a permanent seat at the "top tier table." Elevating the importance of space security within the bilateral security relationship should be a priority in the period ahead.

Of course the realm of the possible in such discussions has only recently been expanded in the wake of Japan’s adoption of the Basic Space law, Basic Plan for Space Policy and, most recently at this writing, the broader space reform bill of June 2012. Japanese security professionals appear to have a new appreciation for the value of their hard-fought momentum on this subject and the need to ensure that space-related investments and activities are secure and available for military and intelligence purposes.

Certain Japanese policy-makers similarly understand the opportunity that this new environment presents for increased space-related defense collaboration among allies. A Japanese government official expressed privately that the "next rare earths crisis" could well involve China’s challenge to certain of Tokyo’s space assets and originate in the malevolent use of its Beidou satellite network. This was a meaningful statement, given the gravity of the rare earths embargo (i.e., an actual stab by China at the industrial heart of Japan) and the indelible impressions it has left on the Japanese security community, especially concerning the speed and uncoordinated nature of Beijing’s escalatory responses to the detention of a guilty Chinese trawler captain.

In that case, China imposed strict export quotas implicating its supply of rare earths elements to Japan in response to Japan detaining a Chinese trawler captain for his deliberate ramming of a Japanese government patrol boat in the East China Sea in the fall of 2009. Space security professionals took note of the disproportionate response, the high velocity of China’s escalation of the conflict and Beijing’s willingness at an early stage of the standoff to target nodes of critical importance to the Japanese economy. Just as Tokyo sought bilateral and multilateral support during its configuration of a response to the rare earths crisis, it is likely that Tokyo would also seek guidance and support from the U.S. in any challenge that emerges from China with regard to Japan’s growing space infrastructure,
which aims to include three regionally-dedicated satellites that will enhance the coverage currently provided this area by GPS.

The inclusion of space security within the "2+2 Ministerial" is evidence that such a scenario is viewed as realistic enough to warrant some level of security-minded consideration. Interestingly, the Obama Administration’s NSP included a section that called upon departments and agencies within the U.S. government to identify areas for international cooperation and offered as a possible example the "use of space for maritime domain awareness." As indicated above, this would be a logistical and defensible area where Japan could assert itself. This might be accomplished by forging a tighter space security relationship with the U.S., and possibly Europe, that leverages the existing experience of the JMSDF with missile defense, the use of space assets and maritime domain awareness itself and take full advantage of the door opened in this area by this important Presidential policy document.

The potential relevance of the Schriever Wargame to the bilateral U.S.-Japan relationship should also not be overlooked and stands out as a natural ultimate objective for Japanese security professionals charged with bringing the U.S. and Japan closer together in this portfolio. A nearer-term objective might be the development of an additional, complimentary, bilateral war game exercise on counterspace that could be coordinated via the "2+2 Ministerial" framework. No doubt there are fundamental hurdles for Japan to overcome for the U.S. to consider inviting Tokyo – and other prospective members – into these types of highly-sensitive exercises.

Based on conversations with space security experts, there are a number of performance milestones that Tokyo should expect will be required to earn its way into such a joint initiative. These include:

1. an improved bilateral dialogue with the Australians on space security, consistent also with similar discussions being held with the United States;

2. demonstrating consistent competence in coordinating and collaborating on component parts of a robust space security infrastructure, such as the dedication of resources to advanced SSA as a well-developed Japanese capability and differentiator; and

3. bringing some closure to the nagging mistrust that exists between the U.S. and Japan with regard to Japan’s ability to keep secrets and avoid leaks of classified information.

While, often times, the burden seems to be on U.S. allies to commit the resources and political will to foster an appropriate appreciation for space security as a core element of defense collaboration, there are areas where it may be the U.S. side that is impeding progress. One hurdle of vital importance is the area of export controls, which, in select cases, may be overly restrictive, thereby inhibiting Washington’s ability to share space-related technology with key allies.

The report authored by the State and Defense Departments entitled “Risk Assessment of United States Space Export Control Policy” concluded that “Certain [NATO] allies and other close partners are among the top-tier satellite and space-faring nations...[and] have space-related design, manufacturing, and operational capabilities closest to that of the United States, and it is unlikely that exports of U.S.-origin satellites and related items, including technology, to these countries would result in harm to U.S. national security objectives. Moreover there is a likelihood that any improvement in their military
capabilities would serve to enhance and strengthen our strategic partnership, and the Departments judge that these potential benefits outweigh the low risks associated with export.”

Current munitions export control laws require approvals for satellite-related technology that the U.S. is likely to approve for reasons that are clear given the bilateral security relationship already in place. In 2011, the Department of Defense reviewed 1,935 licenses involving U.S. munitions list-controlled satellite-related parts and components that were destined for 36 countries identified as “Strategic Partners” for commerce control list export control purposes. The Department of Defense approved 99.7 percent of these licenses. Were such parts to be administered by the commerce control list, rather than the U.S. munitions list, many of these exports would be permissible without a license.

U.S.-EUROPE COLLABORATION ON SPACE SECURITY

While the U.S. possesses a robust space security policy that memorializes the fact that its European allies “remain the cornerstone” of its efforts to maintain a secure space environment from the predations of bad actors, the same cannot be said for Europe, which continues to concentrate its attention on unintentional space threats. The U.S. National Security Space Strategy (NSSS) of May 2010 addresses space directly, stating “to promote security and stability in space, we will pursue activities consistent with the inherent right of self-defense, deeper cooperation with allies and friends, and work with all nations towards the responsible and peaceful use of space…” For its part, the EU acknowledges that space security is a global concern and that cooperation in this field with the U.S. represents a vital building block of its overall space strategy.

With the proliferation of space-faring nations, however, U.S. space primacy will likely be stretched, thereby increasing its reliance on allied burden-sharing in this theater. The three words selected by the U.S. to capture this more complex space environment in its NSSS are “congested, contested and competitive.” Not surprisingly, there are a plethora of cooperative ventures underway between the two sides concerning civil space cooperation, particularly since 2006, overseen by the European Commission (EC), ESA and the U.S. Department of State.

Again, the same cannot be said about the defense side of the space equation, which largely remains relegated to U.S. bilateral arrangements with individual member states, notably the UK, France and Germany. Most of the experts interviewed for the preparation of this report acknowledged that the EU is increasingly sensitive to this disparity in transatlantic treatment of international threats to a secure space environment and, accordingly, Brussels is seeking to play catch-up on this element of space security. NATO is likewise keen to establish a more robust role in space, but it is constrained by its lack of institutional resources, space assets and willingness on the part of member states to expand their modest contributions of sensitive technologies and capabilities.

One brighter note, however, is increasing transatlantic emphasis on SSA, which holds great importance for both the civilian/commercial and military/defense dimensions of Europe’s overall space policy. It also represents a potential “back door” to broader military space cooperation like few other dual-use space activities. In this area, France and Germany are Europe’s leaders in national space surveillance capabilities. The UK is even better positioned through its place at the table of the “Five Eyes.” Although Europe is today largely dependent on the U.S. Joint Space Operations Center (JSpOC), which houses the bounty of data collected by the U.S. Space Surveillance Network and reports to USSTRATCOM, it

has committed to developing an indigenous SSA capability. Such a capability would ultimately provide Europe with the ability, through a large network of sensors, to track objects, receive timely warning of potential collisions, avoid radio frequency interference and provide real-time information about “new developments” in space. The latter includes the ability to detect irresponsible space behavior as well as monitor the actions of potential adversaries. Fortunately, it is safe to assume that an increasingly independent European SSA capability will be generally “interoperable” with that of the U.S. and countries like Japan, providing a multi-layered alliance tracking and surveillance system.

To provide some additional texture on the vital importance of SSA and the successful attraction of European investment in this capability, USSTRATCOM currently tracks approximately 22,000 man-made objects in orbit. About 1,150 of these are active satellites. JSpOC screens over 1,000 active payloads against the U.S. government’s space catalogue daily. Moreover, the U.S. Space Surveillance Network performs roughly 1.4 million sensor takings per week with an average of 190 conjunction warnings and assistance to an average of three satellite maneuvers weekly. This already complex, real-time requirement in support of safe and secure space operations will only grow in the period ahead. The challenge for U.S. leadership is to leverage this uniform requirement into a more comprehensive allied defense against the counterspace threats posed by other space-faring nations. In short, the use of this less controversial, dual-use category of space security could considerably lower the risk of certain countries perceiving themselves as “targeted” and responding in other, unrelated portfolios of relations with countries deemed “provocative” or unfriendly (e.g., trade).

Pursuant to a workshop on the EU’s role in space security and arms control convened in Belgium in June 2011, the Ministerial Council of the European Space Agency authorized an optional SSA Preparatory Program in 2008 with some thirteen ESA members participating. In November 2010, the 7th Space Council acknowledged the need for a Europe-wide level of SSA capability and designated the European Commission and the European Council to propose a governance scheme and data policy. The EU Council Resolutions of 2008 and 2010 described the basic characteristics of this SSA initiative, which, fortunately, includes military applications. Nonetheless, it will depend on the willingness of EU member states to cooperate in creating, along with the U.S., the architecture as well as a governance structure. It envisions integrating existing, as well as new, assets of private, national and intergovernmental entities, together with a network of ground- and space-based sensors, that would provide input data on space surveillance, space weather and near-Earth objects to a set of SSA Service Centers.

The role of the European Defense Agency (EDA) would be primarily to forge a consensus among the defense communities of member states, as well as other European actors, to explore civil-military synergies. EDA has already brought together defense SSA experts to flesh-out the European military SSA requirements, including the need to establish a Recognized Space Picture, apply appropriate data protection and involve key defense actors on the governance of this future capability. Most of this work has been done under the auspices of the so-called Structured Dialogue on Space Security that includes the EC, the European External Action Service, ESA and EDA.

The EDA activities described above are quite encouraging, as it demonstrates that SSA coordination is being expanded to incorporate collaborative defense arrangements against the counterspace

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48 A Recognized Space Picture (RSP) "brings together the positioned data for each space object with other data sources in order to understand, and even predict, events occurring in space," according to the UK’s Royal Air Force.
capabilities of other space-faring nations. It should also upgrade Europe’s dialogue with the U.S. on this vital subject. Moreover, such an expansion of “SSA coordination” can be kept relatively low-key, an important benefit. One of the most encouraging recent developments was the inclusion, for the first time, of seven NATO members in the “Schriever Wargame 2012” (i.e., Denmark, France, Germany, Greece, Italy, the Netherlands and Turkey).  

The Space Innovation and Development Center on behalf of the U.S. Air Force Space Command facilitated this wargame. Also attending were Australia, Canada and the UK (all of which are “Five Eyes” member states). A NATO official observed, “This is a significant development in what was predominately a U.S. event and reflects the need to cooperate and share information to develop future capabilities that benefit NATO collectively.” Indeed the “Smart Defense” initiative launched by NATO at its Chicago Summit in late-May, designed to optimize and leverage defense spending, appears to include equipment acquisitions relevant to defensive space control.

Clearly, this important step is overdue and hopefully represents a harbinger of much more such collaboration to come. A NATO official went on to state, “The U.S. has been encouraging its European allies to invest more in these capabilities and allowing them to participate in the Schriever Wargame provides an opportunity to work together on space-based systems that will be increasingly important to future observations.” A threshold appears to have been crossed by the U.S. Air Force Space Command concerning the trade-off involved in keeping the circle small to protect highly classified information and broadening alliance cooperation and burden-sharing in addressing the space control mission challenge. The objectives of the wargame were also instructive and encouraging:

- Examine options for optimizing space efforts from participating allies and Australia in support of a notional NATO expeditionary operation;
- Identify ways to increase the resilience of space capabilities in a contested environment through expanded international and private-sector cooperation and coordination;
- Determine operational challenges associated with defense of space capabilities employed in support of the operation;
- Examine the operational integration of cyber into defense of the space domain;
- Expand understanding of the operational benefits of broader international participation in combined space operations.

EUROPE-JAPAN COLLABORATION ON SPACE SECURITY

It is clear from researching current European-Japanese space ties that defensive space control is not on the agenda of cooperative initiatives, at least explicitly. The official and commercial framework to develop such collaboration is largely in place, however, including areas that are often identified as being within space security portfolio.
Europe offers several nodes for international cooperation, including the EU, ESA and individual member states. Japan is a major partner for the EU as well as ESA and several member states have forged bilateral, collaborative initiatives with this key Asian counterpart. Several of Japan’s space-related objectives embodied in its 2008 Basic Space Law and the 2009 Basic Plan for Space Policy, which include utilizing space to advance a secure, democratic society, promoting space diplomacy, realizing research and development benefits, creating space industries and protecting the environment, are well aligned with those of Europe. Both sides also recognize the vital importance of SSA and view TCBMs, such as the draft International Code of Conduct, as productive steps forward in establishing widely-recognized behavioral norms for space operations (despite the misgivings of some in the U.S. security community).

Europe’s total annual space budget, however, is substantially larger than that of Japan’s. Europe maintains two large priority projects – the Galileo program and the Global Monitoring for Environment and Security (GMES) system – while Japan’s most ambitious project (particularly with regard to potential security relevance) is its QZSS program. The taskings envisioned for these national projects also overlap considerably. Add to this comparable launcher programs and the message becomes clear: there is abundant room for expanded cooperation as well as substantial cost savings that generally accompany such collaboration. The broad challenge here, that also afflicts the joint development of space security capabilities, is that these key Atlantic and Pacific allies continue to focus almost exclusively on developing indigenous capabilities.

Accordingly, it has been the respective private sector space industries that have stepped into the breach. Specifically, Arianespace and Mitsubishi Heavy Industries (MHI) have forged a mutual back-up agreement for commercial satellite launches. Depending on the broader space exploration agenda of both sides, this kind of industrial cooperation may also be expanded to cover human launch capability, given the long-term, costly nature of this endeavor. Similarly, Mitsubishi Electric Corporation (MELCO) and Astrium, a European consortium in space transportation and satellite systems and services, have successfully pursued a Rendezvous-and-Docking Sensor (RVS) for Europe’s Automated Transfer Vehicle (ATV) and Japan’s HII Transfer Vehicle (HTV). Moreover, European and Japanese companies are also already engaged in various institutional and commercial programs that call for world-class technical quality and management skills.

Indeed, ESA and JAXA share a similar vision of R&D efforts, which has manifested itself in such joint endeavors as BepiColombo, a joint ESA-JAXA mission to Mercury due to launch in 2015. ESA and JAXA may also be exploring new forms of bilateral cooperation with respect to the use of the International Space Station (ISS).

Fortunately, Europe and Japan also share several key policy priorities that involve Earth Observation (EO) and EO-derived information. Climate change, environmental protection and disaster management head this list. To underscore this point, EarthCARE, ESA’s most ambitious and complex Earth Explorer missions, are being pursued as a joint venture with JAXA. The potential security dimensions of EO are well known and this project may be suitable for this kind of cooperation as well. Another cooperative mechanism presently being utilized by both sides is the International Charter on Space and Major Disasters.

Beyond both sides fully supporting the Code of Conduct, another area for future security-minded cooperation would be SSA. Europe is dedicated to developing it’s own comprehensive SSA capability, which presently requires tapping into U.S.-based sharing arrangements. Japan has only two surveillance facilities, (a ground-based optical telescope and a radar telescope) primarily dedicated to monitoring space debris. JAXA presently operates the country’s SSA assets, which also track objects in the
proximity of Japan’s twelve satellites. Japan’s Ministry of Defense, however, operates four advanced radars, called the FPS-5, that also have the capability to detect space objects in the area surrounding Japan. These sophisticated systems could serve as a Japanese contribution to a global, allied SSA system, with benefits for Europe.

To embark on more dedicated and focused space security capabilities applicable to defensive space control, the most appropriate bilateral venue would likely be the EU-Japan Summit and, to a lesser extent, the Europe-Japan Business Roundtable. With the appropriate level of U.S. leadership, these periodic bilateral summits and perhaps other venues could be employed to configure a more tightly coordinated and forward-leaning approach to trilateral space security planning and deployments. In short, the modalities are in place to provide a sufficiently security-minded policy framework between Europe and Japan to effect course corrections favoring more robust counterspace considerations.

**PROSPECTS FOR A COLLABORATIVE, TRILATERAL FRAMEWORK FOR U.S.-EUROPE-JAPAN SPACE SECURITY POLICY**

The most likely near-term solution to bringing together the space security communities of the United States, Europe and Japan is likely limited to an arrangement that keeps the United States as the central coordinating body for an allied defensive space control architecture that is comprised of its bilateral collaboration with Europe and its bilateral collaboration with Japan. There are a number of ways to enhance this coordination role, however, as detailed elsewhere in this report, including in the Recommendations section.

Although officials and experts consulted in the course of this report viewed a more formal trilateral framework as, in theory, a positive idea, there remain significant political and geopolitical trip wires to implementing this kind of framework. An informal trilateral grouping, however, is substantially more achievable. Among the tripwires/sensitivities are the following.

1. There are structural impediments to moving forward with a trilateral approach to space security that stem from the lack of any existing trilateral security framework through which to operate. As addressed above, Japanese officials have specifically identified this as a major obstacle to this concept moving forward. It is seen as somewhat unlikely that such a framework could be put together anew with space security as the primary driver.

2. There is some concern that a trilateral grouping would give the impression that members are targeting a specific country or set of countries that are not included as the focus of their planning exercises, which could, in turn, disrupt or complicate, key international economic, commercial and political relationships or initiatives.

Nevertheless, Japanese government officials have offered that they see two multilateral frameworks for cooperation on space security as more likely (beyond strengthened bilateral discussions in this area). These include:

1. a broader collaborative discussion among the U.S. and other partners in the Asia/Pacific region, which could include Japan;

2. collaboration between the U.S. and Europe via traditional security/military channels simultaneous to a parallel track being pursued between the U.S. and Japan with some cross-fertilization administered by the United States; and
3. a strengthened non-governmental organization (NGO) presence in the field of space security that can convene conferences and bring together senior officials from the U.S., Europe and Japan for informal “side-bar” meetings during the course of the proceedings (e.g., like the one convened by the Prague Security Studies Institute in Prague in June 2011 – see Annex 1).

In terms of the connectivity between Europe and Japan, Japanese officials have reiterated that the most significant space security cooperation between the two occurs within the construct of the Code of Conduct. Future collaboration, at present, appears to be dominated by diplomatic discussions surrounding this agreement.

With regard to the bilateral U.S.-Japan relationship, next steps involve cooperation on specific joint projects, which, in and of themselves, would constitute impressive progress over where things stood just a few years ago. Japan appears to be committed to concentrating its space security efforts on the U.S. in order to demonstrate and/or prove the multiple benefits of such collaboration, before progressing to a more international configuration.

As noted above, an overarching point of concern emanating from the Japanese government with regard to moving forward on counterspace planning (beyond its dialogue with the United States) is how to handle the delicate question: “Is there a common enemy?” Of course, the proverbial 800-pound gorilla in the middle of the room in this respect is China. There is a powerful argument, however, that a trilateral, or some other broader alliance framework on space security is less controversial than bilateral groupings due to the diffuse nature of the geographic area implicated when dealing with a more global partnership. In other words, countries like China and Russia are less equipped to claim having been “targeted” when the nature of the collaboration takes place over a global, rather than regional, footprint. Indeed, it may also be less clear-cut to identify “common adversaries” of the U.S., Europe and Japan than it is to identify those of the U.S. and Japan or the U.S. and Europe.

It may even turn out to be the case that the global coverage and implications of space security make this portfolio a natural driving factor for establishing a Pacific-Atlantic, trilateral alliance framework, rather than waiting for some other more traditional set of concerns to institutionalize a new structure to which space security is later added. All parties consulted agreed that a “Track One-and-a-Half,” NGO-led process underscoring the utility of this sequence of events would be beneficial while current bilateral discussions run their course and lay the groundwork for, at minimum, expanded “informal” space security coordination.
RECOMMENDATIONS FOR ENHANCED SPACE SECURITY COLLABORATION AMONG THE UNITED STATES, EUROPE AND JAPAN

There is much room for improvement with regard to current allied arrangements and coordination in the area of counterrspace and building an alliance-wide understanding of "red lines" in space, how to respond jointly to actors that cross them and how to convey the seriousness of allied planning and capabilities to potential adversaries for the purpose of deterrence. The recommendations described below would advance these objectives.

1. The U.S. security community, likely led by the Secretary of Defense and coordinated by the National Security Council staff, should continue to demonstrate leadership in the face of lingering political and cultural aversions to defensive space control on the part of Europe, Japan and other allies and push forward an agenda of allied policy measures, investments and information sharing/safeguards and other elements needed for true collaborative defense against common counterrspace threats.

Space security is clearly an area where U.S. leadership – particularly that of the U.S. Department of Defense, is a prerequisite for any credible international dialogue, and pre-crisis planning/action among allies. U.S. cultural acceptance of space as a contested domain, along with its advanced infrastructure, expertise, funding prowess, experience and political will, position America as the undisputed leader in identifying space-related threats and responding to them. Accordingly, it is unrealistic to expect adequate progress among allies on this issue absent clear signals and persistent efforts on the part of the Defense Department to encourage these governments to take on specific, complimentary responsibilities in this area and institute policy reforms that would better align their space security establishments with that of the U.S.

2. While U.S. leadership in outlining prudent next steps for our allies is the most realistic course for overcoming allied shortfalls in defensive space control shortfalls, it can only be effective if the U.S., itself, better defines the "chain of command" in its space security establishment and speaks to partners with "one voice." The President should task either the Department of Defense or the National Security Council with taking the lead in creating a global architecture for defending against counterrspace threats from potential adversaries and communicating with allies on the most effective means of defense burden sharing.

It is not only the space security policy establishment of U.S. allies that are in urgent need of course correction. Officials from allied governments have made plain that the U.S. is not "speaking with one voice" concerning its programs, policies and contingency planning. Even in instances where allies have
mustered the political will and financial resources to push ahead with a security-minded space agenda (e.g., Japan), there has been a shortfall of credible, predictable guidance received from the U.S. due to differing perspectives provided by the various space-related nodes of government.

Centralizing the counterspace dimensions of space security at the National Security Council (i.e., establishing a possible new “Space Control Defense Directorate”), a resurrected White House National Space Council or a specifically designated node within the Department of Defense would both convey the importance of the issue area to allies and streamline the “chain of command” on these types of space security decisions. Such a top-down development would also communicate stability and predictability to those allies that are today having a difficult job breaking free of entrenched cultural, political, bureaucratic and financial pushback on this issue within their own countries. In addition, NSC staff should create and chair a new interagency Space Control Working Group.

3. **The Pentagon should actively press NATO, to define, in more specific terms, the role of defensive space control within its alliance mandate.**

Space assets are still sufficiently coveted by individual European states, and even the U.S., that their availability for contribution to NATO undertakings is in short supply, retarding progress toward practical, upgraded collaboration on defending against counterspace threats. Establishing clear guidance with regard to how the alliance might respond to an incident in space, however, remains highly desirable. NATO’s Allied Command Transformation (ACT), located in Norfolk, Virginia, has published forward-looking documents that describe the need to maintain unfettered access to shared domains, including “outer space.”[^52] NATO ACT has offered the possibility of this concept being further developed by the Multi-National Experiment 7 (MNE-7), which was reportedly to become operational during 2011 and 2012, and is designed to evaluate the relevance of space for NATO, among other shared domains or global commons, including international airspace, cyber space and maritime. The baton ought now to be passed to the U.S. to pursue these questions and ultimately forge definitive, near-term answers.

4. **Japan should task its newly created Space Strategy Office to pursue, as a key objective, joint military planning and preparedness “games” with the United States that explicitly involve attacks on space-related assets (probably catalyzed by heightened terrestrial tensions or even conflict in the region). This would likely need to be coordinated within the Security Consultative Committee, informally known as the “2+2 Ministerial,” involving the U.S. Secretaries of Defense and State and the Ministers of Foreign Affairs and Defense as well as the Cabinet Intelligence Office of Japan. Significant progress, however, would be required in the bilateral dialogue before this goal is realized.**

The Schriever Wargame underscores the importance of complex, joint exercises in pre-crisis planning. The involvement of various parts of the allied security community and military is an impetus to necessary course corrections, or acquisition of new capabilities, as well as addressing head-on existing weaknesses in the respective bureaucratic capabilities to respond quickly and effectively. These exercises are designed to operationalize what happens when diplomacy fails or was never given

a chance as well as elevate the existing dialogue on defensive space control to a new, more serious level. Convening such joint exercises with the U.S. should be a primary objective of the new Japanese space security establishment, even if realistic progress in this regard can only occur over a long-term timeframe. It would also help put the existing bilateral security relationship in motion toward an operational joint capability to defend one another from future space-related attacks or “incidents.”

5. The U.S. should launch an effort to create a trilateral security framework to facilitate discussion among these key allies of issues, such as defensive space control, that benefit mightily from spanning the Atlantic and Pacific theaters. Such a framework would also provide better political cover for the nations involved by demonstrating that the counterspace dimensions of space security have global relevance, rather than serving merely theater-specific purposes that can be more easily perceived as targeting individual countries (e.g., China).

European governments as well as Japan often share the concern that new programs and alliance planning in this field could well be perceived as targeting a specific country or countries, thereby complicating diplomatic efforts to keep tensions with powerful neighbors to a minimum. This is especially the case with regard to defensive space control, as underscored by officials consulted in the course of this report expressing anxiety over a trilateral, or any other, explicit security framework, as it would likely give rise to the perception that uninvited countries are viewed as a common foe. In other words, moving from bilateral security relations to a trilateral or multilateral framework might appear to be “exclusive” of certain countries.

This level of sensitivity has been responsible in the past for decisions among allies to offload a substantial portion of their national defense requirements to the United States and for the most likely adversaries to play only marginally (at least at the surface) in the overall security planning of allies.

Examined from a different perspective, however, the configuration of, for example, a trilateral framework would likely strengthen common security while simultaneously diluting or lessening concerns over the reactions of certain countries (e.g., China, Russia, etc.) A U.S.-Europe-Japan security structure would bring together like-minded countries with a global footprint and, accordingly, not imply any specific regional agenda. In other words, the geographic coverage of this partnership may diminish concerns that it advances any theater-specific “containment” or other policy initiatives that could appear unduly provocative.

Japanese government officials have referenced a trilateral venue reflective of a broader set of security issues as a likely prerequisite for trilateral collaboration on the counterspace threat. In the absence of such an official framework, the U.S., Europe and Japan should consider supporting NGO-led gatherings and processes dedicated to this specific trilateral dialogue, led by senior current and former policymakers, academicians, NGO space experts, relevant industry and media representatives and non-space security community representatives.
6. The U.S. should continue to open up participation in the Schriever Wargame – or create a complimentary, additional framework (at lower classification levels) – to reflect better those countries and regions that have space-based assets that are most likely to be put at risk by a prospective adversary and require alliance responses (e.g., the Middle East and Asia). Expanded wargames in this area might also better identify preplanning needs concerning other aspects of space crisis management, such as diplomacy, the involvement of commercial actors and the broader intelligence community.

The primary existing construct for defensive space control planning is a group of countries that is largely drawn from the "Five Eyes." This group does not include several allies that could well be targeted in a terrestrial conflict that spreads to space-related assets. Some expansion or reinvention of the Schriever Wargame to benefit these important allies is warranted, although varying classification levels are likely to be required to accommodate the differing comfort levels of the United States with regard to its partners.

7. The rapid development and deployment of counterspace capabilities by China in particular, should be more frequently on the agenda of senior-level, bilateral and multilateral security discussions, both classified and unclassified, of the United States worldwide.

Again, this is an area where U.S. leadership is key. The allies are generally reluctant, or unwilling, to "name names" when it comes to counterspace threats by other space-faring nations. A U.S.-driven educational undertaking or public diplomacy strategy is urgently needed, as the rapid pace of this emerging threat may not be sufficiently appreciated or acted on by space-faring allies.
CONCLUSION

With the notable exception of the United States, Europe, Japan and other traditional U.S. allies are only in a nascent stage of developing the capabilities and collaborative arrangements required to meet the rapidly emerging threats in the counterspace dimension of the overall space security portfolio. Fortunately, other non-military threats to safe and secure space operations (e.g., debris mitigation and remediation, collision avoidance, SSA, radio frequency interference, etc.) are much further along in being addressed, and in some cases, remedied, via international cooperation. Moreover, there is considerable global activity underway with regard to SSA and space-related TCBMs, both of which are fertile ground for the incorporation of counterspace concerns.

That said, the highly classified space control mission remains understandably compartmentalized and the purview of only the most trusted U.S. allies with regard to intelligence sharing, notably the “Five Eyes.” Herein lies the challenge, primarily for the U.S., as to how best to expand this circle without putting at risk intelligence information, sources and methods. Japan is moving quite aggressively in the direction of being worthy of such membership, even if some limits are ultimately required. It is restructuring its space policy establishment in such a way as to accommodate and streamline dual-use and military space priorities. Europe is likewise awakening to the urgent need for the EU’s External Action Service, ESA, NATO and EDA to step up to the harsh realities embodied, for example, in the China case study included in this report. Nonetheless, the pace of this positive movement in Europe and Japan is not sufficient to stay ahead of the offensive military space programs of certain space-faring nations. Only the U.S. is presently positioned to do that.

There is little question that today’s most likely zones of terrestrial conflict would, more often than not, implicate space assets, if only to disrupt surveillance, navigation, communications and other capabilities during periods of heightened tensions or actual kinetic engagement. Accordingly, the broader security communities of alliance members, including the combatant commands and their equivalents in allied nations, have no choice but to “game-out” the most likely uses of counterspace capabilities by space-faring adversaries and the most effective, real-time allied responses. In this regard, it is useful to keep in mind that space control tools are already in use and this trend will only grow. (See Appendix 2.)

Should an incident occur, there would likely be little to no time for dress rehearsals or planning/policy debates. If the U.S. and our allies are not in front of these scenarios, they will definitely be playing catch-up in a perilous environment with potentially immense stakes. It is hoped that this report will serve as a useful early warning device with respect to the progress urgently required to maintain space as a secure, globally-shared domain.
CONFERENCE PROGRAM

The conference is held under the auspices of Minister of Foreign Affairs, Karel Schwarzenberg, Minister of Defence, Alexandr Vondra, Minister of Transport, Radek Šmerda, and Lord Mayor of Prague, Bohuslav Svoboda.

SUNDAY, 12 JUNE 2011
Venue: Residence of the Lord Mayor of the City of Prague, Mariánské nám. 1

18:00–20:00 OPENING RECEPTION (by special invitation only)
Welcome Remarks:
Bohuslav Svoboda, Lord Mayor of Prague
Alexandr Vondra, Minister of Defence, Czech Republic
Norman L. Eisen, Ambassador of the United States to the Czech Republic
Kai-Uwe Schrogl, Director, European Space Policy Institute
Oldřich Černý, Executive Director, Prague Security Studies Institute

MONDAY, 13 JUNE 2011
Venue: The Ministry of Foreign Affairs, Czernin Palace, Loretánské nám. 5

8:30–9:00 COFFEE AND REGISTRATION

9:00–9:30 OPENING SESSION
Moderator: Oldřich Černý, Executive Director, Prague Security Studies Institute
Welcome Remarks: Jiří Schneider, First Deputy Minister of Foreign Affairs, Czech Republic
Opening Remarks: Kai-Uwe Schrogl, Director, European Space Policy Institute

9:30–10:45 PANEL 1: “DEFINING SPACE SECURITY FOR THE 21- CENTURY”
Moderator: Scott Pace, Director, Space Policy Institute, George Washington University
Panelists:
Michel Bourbonniere, Legal Counsel, Canadian Space Agency, and Professor, Royal Military College of Canada
Sylvia Kainz-Huber, Deputy Head, Space Policy & Coordination, Directorate General Enterprise and Industry, European Commission
Giuseppe Morsillo, Director of Policies, Planning and Control, European Space Agency
Frank A. Rose, Deputy Assistant Secretary for Space and Defence Policy, Bureau of Arms Control, Verification and Compliance, US Department of State

10:45–11:00 COFFEE BREAK
11:00–12:30 PANEL 2: “TRANSATLANTIC APPROACHES TO INTERNATIONAL SPACE SECURITY COOPERATION”
Moderator: Jeff Kueuter, President, George C. Marshall Institute
Panelists:
Frank Asbeck, Principal Advisor, Security and Space Policy, European External Action Service, European Commission
David Bair, Chief Technical Officer, Eutelsat
Michael Sheehan, Professor, International Security and Politics of Space, Swansea University
Maj. Phillip Verroco, Chief of Space Policy, Joint NATO Strategist, Joint Airpower Competence Centre

12:30 BUFFET LUNCHEON
Keynote Speech: Hirofumi Katase, Deputy Secretary-General, Strategic Headquarters for Space Policy, Cabinet Secretariat, Japan
Introduced by: Brian T. Kennedy, President, Claremont Institute

14:00–15:30 PANEL 3: “GOVERNANCE OF SPACE ACTIVITIES”
Moderator: Xavier Pasco, Senior Research Fellow, Foundation for Strategic Research
Panelists:
Geraldine Naja, Head of the Coordination with EU Institutions, European Space Agency
Dumitru-Dorin Prunariu, Chairman, United Nations Committee on the Peaceful Uses of Outer Space
Eric R. Sterner, Fellow, George C. Marshall Institute
David A. Turner, Deputy Director for the Office of Space and Advanced Technology in the Bureau of Oceans, Environment and Science, US Department of State

15:30–15:45 COFFEE BREAK

15:45 – 17:30 PANEL 4: “SECURITY POLICY DIMENSIONS OF SPACE SITUATIONAL AWARENESS (SSA)”
Moderator: Jana Robinson, Resident Fellow, European Space Policy Institute
Panelists:
Christian Bréant, Director for Research and Technology, European Defence Agency
Col. Carsten Breuer, Chief of the Strategy & Policy Branch, Ministry of Defence, Germany
Tomaž Lovrenčič, Director, European Union Satellite Centre
Atsuo Suzuki, Director, Defense Policy Division, Bureau of Defense Policy, Ministry of Defence, Japan

19:30 GALA DINNER (BY SPECIAL INVITATION ONLY)
Venue: Mlýnec Restaurant, Old Town

Keynote Speech: Admiral Dennis C. Blair, former US Director of National Intelligence and Commander-in-Chief of US Pacific Command
Introduced by: Roger W. Robinson Jr., Co-Founder, Prague Security Studies Institute, and former Senior Director of International Economic Affairs, US National Security Council
TUESDAY, 14 JUNE 2011
Venue: The Ministry of Foreign Affairs, Czernin Palace, Loretánské nám. 5

8:00–8:45  COFFEE AND REGISTRATION

9:00  OPENING REMARKS
Pierre-Louis Lempereur, Counsellor for Outer Space Issues, Office of the
EU Representative for Non-Proliferation and Disarmament Issues

9:30 – 10:45  PANEL 5: “TRANSATLANTIC SPACE CRISIS MANAGEMENT FOR THE FUTURE”
Moderator: Aude-Emmanuelle Fleurant, Head, Armament and Defence Economy
Research Group, French Military Academy Strategic Research Institute
Panelists:
Richard DalBello, Vice President of Government Relations, Intelsat General Corporation
James Finch, Director, Policy and Strategy Development Global Strategic Affairs, Space
Policy Office of the Under Secretary of Defence for Policy, US Department of Defence
Kai-Uwe Schrogl, Director of the European Space Policy Institute
Col. Vladimír Šilhan, Defence Advisor, Permanent Representation of the Czech Republic to the EU

10:45 – 11:00  COFFEE BREAK

11:00 – 12:30  PANEL 6: CONCLUDING PANEL WITH THE SESSION MODERATORS
Moderator: Kai-Uwe Schrogl, Director, European Space Policy Institute
Panelists:
Aude-Emmanuelle Fleurant, Head, Armament and Defence Economy Research
Group, French Military Academy Strategic Research Institute
Jeff Kueter, President, George C. Marshall Institute
Scott Pace, Director, Space Policy Institute, George Washington University
Xavier Pasco, Senior Research Fellow, Foundation for Strategic Research
Jana Robinson, Resident Fellow, European Space Policy Institute

12:30  CLOSING LUNCHEON
Keynote Speech: “Unlocking the Potential of Space Technologies for the Czech Republic”
Jiří Žák, Deputy Minister of Transport for Foreign Relations and Satellite Systems, Czech Republic
Introduced by: Oldřich Černý, Executive Director, Prague Security Studies Institute
LIST OF PARTICIPANTS

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Spain

Dennis C. Blair  
Former Director of National Intelligence  
and Commander-in-Chief of US Pacific Command  
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CONFERENCE REPORT

Introduction
On 12–14 June 2011, a conference was convened in Prague entitled “Space Security through the Transatlantic Partnership”, co-sponsored by the European Space Policy Institute (ESPI) and the Prague Security Studies Institute (PSSI). It was the first non-governmental transatlantic conference of its kind dedicated to this topic with the participation of over one hundred senior space policy officials and high-level representatives of multilateral institutions, NGOs, academia, and industry from Europe, the U.S., and Japan. They included: the U.S. Departments of State and Defense, the U.S. Strategic Command; the European Space Agency (ESA); the European Council, the European Commission (EC), the European External Action Service (EEAS), the European Defence Agency (EDA); the European Union Satellite Centre (EUSC); the Japanese Ministry of Defense; Japan Aerospace Exploration Agency (JAXA); and the Strategic Headquarters for Space Policy in the Cabinet Office. The overarching goal of the conference was to solicit and assess both converging and diverging views on the multi-faceted subject of space security and seek to establish an on-going “Track II” non-governmental process designed to assist with the crafting of a future architecture for the management of this key dimension of space policy on a trilateral, and eventually global, basis.

Summary of the Proceedings
The shared interest of Europe, the United States and Japan in strengthening space security is growing steadily. There is a common view of the pressing need to safeguard space-based assets, which perform essential tasks for most of the world’s population, as well as to ensure free access to,
and responsible behaviour in, space. The conference was comprised of five panels over the period of one and a half days covering the following topics:

- Defining space security for the 21st century
- Transatlantic approaches to international space security cooperation
- Governance of space activities
- Security policy dimensions of Space Situational Awareness
- Transatlantic space crisis management for the future

**Defining Space Security for the 21st Century**

Beyond the two traditional space powers, the U.S. and Russia, Europe and other new actors have changed the geostrategic setting in space (particularly China) and will shape space policies, and associated national policy decision-making, for the 21st century. Several conference participants noted that space is not a sanctuary. It is borderless with predictable orbital paths and assets that are vulnerable. Although nations will differ in what is viewed as an appropriate response to an incident or conflict, there is a need to forge a common understanding of space security "red lines" of acceptable behaviour. Space assets (including ground-based) are properly regarded as critical infrastructure and their disruption or damage would result in far-reaching economic, political, and geostrategic consequences. As space has become more congested, contested and competitive, a number of speakers indicated that there is a desire to strengthen diplomatic channels and promote measures to enhance stability, including best practices guidelines, prior notifications of launches of space vehicles, and closer coordination (including joint ventures). With the increasing presence in space of private operators, it is vital to integrate them into international space security initiatives and dialogues. There was also a general view expressed that organizations such as NATO need to determine their role in the future architecture of space security.

**Transatlantic Approaches to International Space Security Cooperation**

Several participants observed that the transatlantic partnership in the field of space security is only now developing. The European Union (EU) is a new actor in this field and is interested in pursuing enhanced international cooperation. In this connection, the U.S. wishes to see the EU, and relevant European institutions and Member States, as global players with substantial influence. Recommended preconditions to implementing meaningful transatlantic cooperation on space security are firm political leadership, shared interests, realistic milestones, technological capabilities, and trust in handling sensitive data and information. By establishing its own brand of diplomacy, Europe could also contribute indirectly to U.S. space diplomacy, for example, by bringing actors like China and Russia into the transatlantic dialogue. Japan could play a similar recruiting role among Asian space-faring nations and aspirants. In terms of global space diplomacy, the draft Code of Conduct for Outer Space Activities introduced by the EU represents the leading collective action to date for the protection of the space environment. It is a document which encourages responsible behaviour in space on a voluntary basis. There was general agreement that the Code is not meant, or well-suited, to resolve conflicts in space. Besides the Code, Europe, the U.S., and Japan should stake out mutual positions concerning the Group of Government Experts on Outer Space TCBMs in 2012 and the UN Committee on the Peaceful Uses of Outer Space (COPUOS) working group on long-term sustainability.

**Governance of Space Activities**

There was broad agreement that, beyond the provisions of the Outer Space Treaty (OST), there exists an increasing demand for new norms, rules, and soft law. Space governance involves strategy, a budgetary framework, development of infrastructure, and regulatory requirements. Challenges to space security need to be publicly debated using various platforms. The COPUOS is the most comprehensive policy forum to seek modalities to increase the stability and sustainability of space activities. It
is a venue that involves space experts and deals with practical issues (unlike the Conference on Disarmament that emphasizes arms control and is highly ideological). Outside the COPUOS, the draft Code mentioned above constitutes a first step toward creating political, rather than legal pressures. The theory is that understanding what constitutes responsible behaviour increases strategic stability. It was acknowledged that nations should develop their own “best practice” policies and procedures, including effective enforcement measures. In this connection, private sector initiatives, including the Space Data Association (SDA), should be incorporated into space policy decision-making. To improve governance, better coordination between governments and private operators, as well as the pursuit of bilateral agreements, were among the steps discussed. The involvement of emerging space powers (e.g. China, India, Australia, Brazil, etc.) in space governance deliberations is likewise deemed desirable.

**Security Policy Dimensions of Space Situational Awareness**

Space Situational Awareness (SSA) is regarded as a lynchpin capability for ensuring the safety and security of satellites and spacecraft and enabling the monitoring and understanding of a constantly changing space environment. SSA is not an end in itself, but a method for safeguarding national security assets and sovereignty. The U.S. has the world’s most comprehensive SSA capability and Europe is seeking to develop an autonomous capability. Incorporating NATO as a player in a transatlantic SSA configuration seems to some an appropriate move. SSA is also a highly useful diplomatic tool and the sharing of SSA data constitutes one of the most potent, globally-available space transparency measures. It likewise contributes to managing the pressing issue of orbital space debris. Coordination and shared input are essential to improving the future upgrading of SSA tools and possibilities for interoperability. The involvement of the private sector and intergovernmental institutions in any global SSA efforts is essential. In short, it is important to strengthen collective capability to face new challenges such as flying formations (clusters) of small satellites.

**Transatlantic Space Crisis Management for the Future**

Crisis management is complex and necessitates an understanding of the type of crisis (man-made or natural), the assets involved (their size and purpose), the nature of the crisis (isolated or occurring among several assets) and the global geopolitical environment. The primary objective of space crisis management is to avoid conflicts or disruptive “incidents” in space. The growing dependency on space assets has revealed weaknesses in dealing with space emergencies. There are at least three activities that can be pursued in peacetime: promoting the responsible use of space; deterring attacks or purposeful disruptions; and the building of international partnerships. A robust space crisis management posture can also reduce the possibility of terrestrial conflict. Part of crisis management is considering vulnerability, redundancy, and ability to reconstitute, not only for military, but also civilian assets. Crisis management also involves detailed operational aspects. The Shriever wargames, for example, facilitate testing how technologies and different groups may interact in crisis circumstances. Cooperation in crisis management among governments, and governments and private operators, requires joint standards and exercises. The goal is to make reacting to many space-related contingencies a routine exercise.

**Current Outlook**

There is now a widespread recognition of global dependency on space systems accompanied by a desire for maximum autonomy in a number of areas. Collaboration in space is viewed as the only sustainable path forward. A strong transatlantic partnership, together with Japan, is a key engine that can build on shared values and security interests. This like-minded alliance group can serve as the template for global cooperation and set meaningful standards. Virtually all space-faring nations desire to mitigate orbital debris, secure free access to space and avoid misunderstandings, mishaps, and misperceptions. Given the complex space environment involving new actors and technologies, there is a need for more creative transparency and confidence-building measures (TCBMs), especially...
given the fact that no new viable space treaty has been proposed. The concept of Space Traffic Management (STM) also warrants further examination.

Conclusion and Recommendations

The Prague conference was universally regarded among the participants as an important contribution to this rapidly emerging issue area and unique in its ambition to push the envelope of trilateral discussions on space security beyond the limited scope of current deliberations. Currently a sizable void exists in the allied space security dialogue. During this “Track II” kick-off event, the door was opened on a range of less-acknowledged areas of space security, including: the robust counterspace activities of China; the implications of the dual-use nature (i.e. equipment and technology with both civilian and military applications) of much of the space infrastructure of allies and adversaries; and the absence of many threat scenarios in the planning of influential managers of national space assets.

The conference participants expressed support for continuing to develop this new “Track II” initiative. The immediate next steps will include preparing a conference report that lists the most relevant areas of space security discussed at the conference that could benefit from further dialogue, research and trilateral exchanges. Such a report should also emphasize those dimensions of space security that hold the most potential for ground-breaking advances in transatlantic and trilateral cooperation and communication (e.g. transparency and confidence-building measures, counterspace contingencies, SSA, etc.). Some of the recommendations put forward included:

» Integrate space security into broader foreign policy and international security deliberations
» Exploit the EU – US dialogue as an important platform for space security discussions, accompanied by NGO expert groups
» Involve commercial operators in policy debates on major issues, including unintentional interference; regulatory compliance; access to space; SSA and collision avoidance; and cyber security
» Identify guidelines based on common understandings which define responsible behaviour in space
» Seek better understanding of the connective tissue among SSA, TCBMs and crisis management
» Continue to engage governments in forging a better understanding of the draft Code of Conduct for Outer Space Activities
» Identify several concrete activities for initial practical collaboration
» Explore establishment of a combined space operations centre as a vehicle for closer cooperation, including the sharing of information on the space environment, objects, and interference
» Examine the prospects for multi-layered coordination ranging from incidents to major threats via engaging in joint exercises between governments and private operators (beyond the Shriever wargames) to establish a crisis response roadmap
» Assess the potential of joint US – EU – NATO exercises on different contingencies associated with transatlantic crisis management pilot projects
» Involve Japan’s space security stakeholders as full partners in transatlantic space security deliberations
» Understand the potential consequences of space failures in the context of terrestrial crises (including economic and civilian aspects)
» Identify the next venue for “Track-II” exchanges among the independent space policy communities, the broader foreign policy and national security agencies, the academic communities and industries of Europe, the U.S. and Japan.
APPENDIX 2: INSTANCES OF OFFENSIVE SPACE CONTROL

Below are specific examples of satellite interference by foreign countries or rogue actors:

» A U.S. earth observation satellite, Landsat-7, which is joint managed by NASA and the U.S. Geological Survey, reportedly experienced at least 12 minutes of interference on October 20, 2007 as well as July 23, 2008 that was believed to be caused by hackers.

» On June 20 2008, an earth observation satellite managed by NASA, Terra EOS AM-1, experienced at least 2 minutes of interference, during which time hackers gained command of the satellite (although no commands were issued).

» The services of UAE-based Thuraya Satellite Telecommunications Company were reportedly jammed by Libya in February 2011 during Col. Gaddafi’s efforts to repress the revolt targeting his regime. The jamming was reportedly orchestrated by Libya’s intelligence agency.

» Iran is well known to be jamming signals from satellites dating back to the Green Movement uprising of late-2009. Broadcasters, such as BBC and Deutsche Welle, were affected, implicating satellite transmissions overseen by such companies as Eutelsat.

» It was reported in May 2012 that North Korea had increased its efforts to jam South Korean television signals, specifically via the satellite programing of the Korean Broadcasting System.

» In September 2011, it was reported that North Korean GPS-jamming caused a U.S. spy aircraft to make an unexpected landing. The aircraft, an Army RC-7B ARL (Airborne Reconnaissance Low), was part of a joint U.S.-South Korean military exercise. According to the report, North Korea’s “current jammers are reportedly a mixture of old vehicle-mounted Russian hardware and a modified version that the North tweaked on its own,” although new capabilities are being developed.53

» Allegations emerged in July 2009 that Pakistan’s Inter Service Intelligence (ISI) were assisting terrorists by spoofing the signals of Thuraya mobile phones using powerful transmitters and interfering with the Indian government’s ability to intercept signals and trace the callers.54

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