Strategy Research Project

Current Challenges in Deterring the Use of Space Weapons

by

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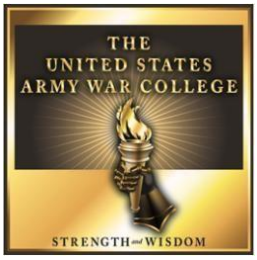

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Abstract

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The United States is facing significant threats to critical space assets due to emerging military technologies such as direct assent anti-satellite weapons and directed energy weapons. The U.S. Space Policy identifies deterrence as a key method to prevent attacks on space systems and proclaims the inherent right to respond to defeat attacks if deterrence fails. The threat of punishment by itself is insufficient to deter either opportunistic states or anonymous actors from employing these technologies to achieve strategic surprise. In light of these challenges, the United States must strengthen its current space deterrence approaches to prevent future attacks on space borne assets. This paper first reviews the relevant strategic documents regarding space deterrence. Second, it identifies the impact anonymity, the lack of international norms and frameworks, and a currently tepid U.S. declaratory policy poses as potential sources of failure to space deterrence. Finally, this strategic research project offers practicable recommendations to overcome limitations that inhibit the implementation of deterrence strengthening mechanisms in line with the National Space Policy in the present strategic environment.

Current Challenges in Deterring the Use of Space Weapons

> Chinese and Russian military leaders understand the unique information advantages afforded by space systems and are developing capabilities to disrupt U.S. use of space in a conflict.[1]
>
> —James R. Clapper (2014)

Space provides essential capabilities that are instrumental components of the nation's military and economic power. Major disruptions to either military or commercial space systems could create catastrophic consequences to the American way of life. Ensuring a sustainable, stable, and accessible space environment is therefore, a vital national interest of the United States.[2] Today's rapidly changing environment caused by potential adversaries closing the technological gap with U.S. capabilities is particularly evident in the space domain. Potential adversaries are developing new systems that exploit previously unchallenged vulnerabilities and are increasingly challenging to defeat. The need for deterrence of these threats is clear and is called for in the strategic documentation of the United States, but the approaches taken by the nation have not yet appeared to reduce the risk of failure sufficiently. Accordingly, the United States must make the strategic choices necessary to strengthen its current space deterrence activities in response to the increased threat environment to prevent future attacks on its space-borne assets.

This strategy research project explores the state of deterrence in space in the context of the current strategic environment considering advancing technologies and recent U.S. approaches. First, it reviews the relevant strategic documents regarding space deterrence. Second, it identifies the impact the current state of anonymity, the lack of international norms and frameworks, and a tepid U.S. declaratory policy has on

potential sources of failure to space deterrence. Finally, this strategic research project offers practicable recommendations to overcome limitations that inhibit implementation of deterrence strengthening mechanisms in line with the current National Space Policy that address the challenges of the new strategic environment.

The Changing Space Operating Environment

The United States updated the National Space Policy in November of 2010 in recognition of the potential risk to national security interests posed by new vulnerabilities to space systems. The policy describes the new environment as a place of "ever-increasing number of nations and organizations using space." Then it notes that the "interconnected nature of space capabilities and the world's growing dependence on them mean that irresponsible acts in space can have damaging consequences for us all."[3] This new space environment, described in the National Security Space Strategy as "contested, congested and competitive"[4] is creating challenges for the United States to maintain its preeminence in space. The policy acknowledges that the changes in the space environment require the need for additional international cooperation to maintain stability in space, but also ominously implies that the space systems upon which the United States relies to provide marked military advantages are attractive targets that new weapons technologies place at increasing risk. To address this risk, the established policy is "consistent with the inherent right of self-defense, [to] deter others from interference and attack" on allied space systems.[5] This portion of the policy acknowledges that deterrence will remain a crucial element of the strategy to prevent future attacks against space systems, as the nation seeks other approaches to provide for a sustainable, stable and accessible domain.

From the beginning of spaceflight, the United States has operated in an indefensible space domain that remained constantly susceptible to attack from other technologically enabled countries. As early as 1962, both the United States and the Soviet Union experimented with anti-satellite capabilities. In that year, the U.S. THOR program proved that electromagnetic pulses created from the detonation of low-yield nuclear weapons high in the atmosphere could effectively attack satellites. The test ended up disabling three orbiting satellites as well as the electrical grid of Honolulu.[6] Although successful, the test showed that attacking satellites was also rife with potential for collateral damage. The inherent risks of attacking space systems with such indiscriminate weapons were far too great to consider and provided an effective early deterrence.

Today's environment is significantly different. With over sixty nations now actively operating in the space domain,[7] the strategic environment has radically transformed in a way that greatly affects the choices of nations. Today's space systems are integral pieces of the overall U.S. military and economic architectures, yet remain highly vulnerable to attack. New anti-satellite technology can engage specific satellites with precision, thereby reducing the risks to one's own systems. Similar to cyberspace, adversaries now see the potential of precision strikes in the space domain as a way to mitigate the overwhelming U.S. military advantage in the air, land, and sea by negating the advantages provided across domains from space.[8]

The 2007 Chinese anti-satellite demonstration reawakened the world to the potentially devastating effects of space weapons. This direct ascent weapon directly targeted and destroyed one of China's own satellites. Although international outcry over

the irresponsible use of space resulted due to the generation of space debris, China has not abated the further development of space weapons. Further testing occurred in 2010, 2013 and 2014, although in a non-destructive manner.[9] In each series of tests, the missile improved; analysts now believe that medium earth orbit and geostationary orbits where the global positioning system and strategic communications satellites reside may soon be at risk.[10] Directed energy weapon technologies have similarly proliferated. The United States, Russia, and China have all tested directed energy weapons capabilities against satellites.[11] The current *US Intelligence Community Worldwide Threat Assessment* highlights that these disruptive and destructive threats will only increase as more adversaries continue to pursue comparable capabilities.[12]

Currently, there is no concrete defense against these technologies. Therefore, the strategic challenge resides in deterring their use in conflict. Fortunately, space has remained a peaceful domain to date. This has occurred despite lack of established international frameworks outlining proper activities for space. The single defining international agreement is the Outer Space Treaty of 1967, signed during an era consisting of only two dominant space-faring nations. Its major provisions serve to protect space as a global common, to ensure no use of weapons of mass destruction in space, and to ensure no weapons exist on celestial bodies. The treaty's prescription for the peaceful use of space does not extend to the use of modern weapons in space other than weapons of mass destruction.[13] Proposed frameworks over the years have proffered additional restrictions to the militarization of space, but they remain unratified.

The National Space Policy seeks these additional frameworks through the establishment of international measures for safe operations. The policy, though, is not

binding to other nations and can only propose that others follow the stated principles.[14] As part of the effort to encourage the responsible use of space, the policy seeks the development of confidence-building measures if "equitable, effectively verifiable, and in the national security interests of the United States."[15] The National Space Security Strategy cites deterrence as one of the strategic approaches the United States for maintaining assured access to military and intelligence space capabilities, but also supports the development of norms, best practices, and confidence-building measures.[16] It is in the implementation of these complementary approaches that the nation seems to be experiencing challenges that are preventing attainment of these goals.

The January 2012 Defense Strategic Guidance lists space as one of the military's priority missions and directs "selective additional investments" in advanced capabilities to defend its operational capability.[17] Unfortunately, the current operating environment of space has perhaps changed the most in this regard. A seemingly constant budget reduction in the past few years stands in contrast to the funding-levels that propelled the U.S. into space following Sputnik. United States Strategic command, which operates the U.S. military space systems, notes in its posture statement "today's budget environment remains a concern" at a time that forces must modernize to meet these new challenges.[18] The choices strategic leaders make in resourcing space are significantly alter the deterrence capabilities of the nation.

Deterrence Theory

Deterrence emphasizes the intent to use force to maintain beneficial behaviors. Lawrence Freedman in his book *Deterrence* states that deterrence is the "potential or actual application of force to influence the action of a voluntary agent."[19] The core of

deterrence, then, is the reliance on credible threat of harm to achieve ones objectives. This customary definition establishes the primary method of deterrence to punish an uncompliant adversary, which is an interest-based deterrence. John Mearsheimer in *Conventional Deterrence* describes deterrence by denial as another type of interest-based measure. Deterrence by denial focuses not specifically on punishment, rather on convincing an opponent that his undesired objectives on the battlefield are unreachable.[20] Most discussions of deterrence focus on interests. However, Freeman notes that deterrence theory differs in practice. Norms-based approaches more closely resemble how deterrence actually works in the international system. [21] This approach focuses on values and establishing norms in a manner that makes them inviolable.[22] Using ways focused on both an interests-based and norms-based approach facilitates a stronger deterrence.

Challenges to Maintaining a Strong Deterrence in Space

Deterrence has served the United States well and has proved to be effective in keeping threats to our space systems in check. Relying upon deterrence as the centerpiece of strategy, however, becomes more tenuous in increasingly complex security environments.[23] Increasingly capable technologies are spreading to more and more participants in the space domain; they are altering the established fundamental calculus of deterrence. A time is approaching when an asymmetric strike on U.S. space capabilities may provide such a significant advantage to a nation that the traditional calculus that has maintained deterrence to date will fail.

Facing a Security Dilemma

Oddly enough, the success of the national security space program has led to this point of deteriorating deterrence. A problem with maintaining deterrence is the security

dilemma.[24] The enhanced security and military effectiveness gained through the application of space power has made other nations feel less secure and makes them more likely to counterbalance with increases in defense capabilities.[25] They are therefore seeking new counterspace technologies to enhance their own feeling of security. The result, of course, is U.S. wariness that these advances are aggressive and threatening to the security of space assets. This leads to a cycle of increased defenses for and resiliency in the nation's space systems, which is a costly undertaking when other approaches may be similarly effective in keeping space secure from attack.

Further compounding the current dilemma is the perceived lack of political will in the United States to use military force in a period of fiscal austerity.[26] Following fourteen years of continuous war, there may be a sense of war-weariness that diminishes the credibility of deterrent threats. The question becomes what threshold is necessary to trigger future military responses to aggression in space in a nation tired of war. Traditional conventional deterrence requires a credible threat of harm that normally holds a population or strategic interest at risk to prevent a particular activity.[27] Typically, some sort of signaling such as moving military forces clearly communicates the credibility of a nation's threat. But in the space domain, it is not possible to indicate resolve to use force in such a clear, unambiguous manner. A maneuver of a space asset in response to aggressive activity in space does not carry the weight of similar maneuvers in other terrestrial domains. Therefore, the strength of deterrence in space corresponds to the strength of the will to commit other forces. If political will or fiscal commitments weaken, the strength of space deterrence weakens correspondingly.

Orbital mechanics forces deterrence activities to occur in the other domains. Debris from an attack on a space system will eventually populate surrounding orbits, thereby posing harm to objects residing there. For the United States, which has a disproportionately larger percentage of assets in space than potential adversaries, a retaliatory strike in space would be fraught with additional risks to its own systems that make such a response unlikely. Adversaries understand this limitation in response options and may subsequently not comprehend the full extent of risk in acting in a hostile manner in space.

Miscalculation

Freedman identifies the incomprehension of risks as an element in the failure of deterrence.[28] The perception of being able to attack the United States in space without facing a retaliatory strike in kind adds to the miscalculation of risk. The further separated a response is from the initial provocative activity, the more difficult the evaluation of the likelihood of possible responses becomes. Inaccurate calculations of the risk involved in disregarding deterrence actions make the likelihood of attacks more likely.[29] To a degree, the Chinese have already committed miscalculations in their space weapons program. If they had correctly predicted the overwhelmingly negative reaction to the irresponsible production of space debris, they would not have likely conducted their 2007 anti-satellite test. While the response to the incident may have given them pause in their destructive testing, their intent to employ weapons any differently in times of conflict has not changed.

In fact, China still believes space weapon development is essential to prepare for future conflicts, specifically with the United States over Taiwan.[30] The Chinese belief that space is an immature domain similar to air warfare in World War I that will mature

into full space warfare in the future is fueling the development of counter-space technologies.[31] Yet China portrays a public posture of a peaceful space program while rapidly growing its space power that is capable of challenging the U.S. military.[32] The seeming contradiction between Chinese statements and capability growth are troubling for the United States, which has long had a dominant position in space and aids in furthering miscalculation over each other's activities in space and during crises.

In the face of crises, deterrence is most likely to fail if one side has an asymmetric advantage. John Mearsheimer describes in *Conventional Deterrence* that if a weapon possessed by one side provides for a capability of surprise, the likelihood of the failure of deterrence increases.[33] This will be increasingly true in cases of conflicts over limited objectives, during which one party can achieve success before an adversary mobilizes defenses.[34] This is the scenario concerning the U.S. military in regards to potential conflicts in Asia, which further increases the chances for future miscalculation regarding China's anti-satellite weapons programs.

Further adding to the likelihood of a failure of deterrence is in the case of one side possessing technological advantages that supports surprise. Rip Bulkeley and Graham Spinardi argue in *Space Weapons: Deterrence or Delusion?* that the value of technology will be lost if countermeasures emerge prior to first use.[35] Therefore, logic dictates that the benefit of early use of anti-satellite weapons outweighs any advantage in refraining from their use. As part of strategic calculations, antagonists will weigh the potential loss of that advantage due to the possible development of countermeasures. If the loss seems imminent in times of crises, it is reasonable to assume that adversaries

would use available counterspace weapons instead of assuming the risk of ultimately losing that advantage.

A larger variable in the miscalculation problem is determining a country's commitment to enforcing the previously established deterrent threat. In other words, will a country really react forcefully to protect their interests in space? The country may simply mitigate the effects of aggressive action, particularly if political will has waned. Mearsheimer describes this as a "credibility of commitment" issue and raises the question of whether a nation will use force in defense of interests outside of its national territory given the likelihood of increasing costs and risk.[36] Although the National Space Policy and National Space Security Strategy specify the U.S. right to respond to aggression in space with force, the commitment to do so is debatable. The U.S. public response following China's latest 2013 anti-satellite test stated simply "the launch appeared to be on a ballistic trajectory to GEO" and that no "objects associated with this launch remain in space."[37] This tepid language hardly signifies commitment to deterring these types of activities. Much stronger statements in the international dialogue would clearly communicate the commitment to deterring these types of activities.

Anonymity

The vastness of the space domain leads to additional challenges in deterring aggressive actions. Activities that may have harmful effects on a space system may seem to originate from almost anywhere.[38] In the case of terrestrial directed energy weapons, the point of origin of an attack can originate in the hemisphere facing the satellite. In 2008, the Terra Sat and LANDSAT satellites experienced an undetermined source of interference on telemetry and command links. Ruling out system anomalies and other environmental factors, analysts concluded the interference was purposeful

and originated from an undetermined location on Earth.[39] Even with the increasing capability of satellite interference tools, the geolocation of offending signals is often indeterminate or untimely in providing definitive attribution.

Compounding the issue of attribution is determining whether the “attack” was intentional or accidental.[40] Collisions between space objects occur, even between satellites: Consider the 2009 destruction of Iridium 33 by Cosmos 2251. Cosmos 2251 was a defunct, non-maneuverable satellite - never intended to be a threat. Yet this seemingly non-threatening object destroyed Iridium 33 without the United States having predictive warning of the event.[41] Although this case was unintentional, future acts may not be.

The determination of intention is difficult. Drifting satellites placed on collision courses intentionally may only collide with their intended targets after significant intervals further obscuring intent. In this manner, systems catalogued as non-threatening because they have reached end-of-life or otherwise been dormant may in fact have utility as weapons. Any method of using anonymity provides advantage to an antagonist. The challenge of identifying objects in space increases as the object becomes smaller or further from Earth. Without the means to identify and track with the resolution to see these objects, intent cannot be determined.

Learning the cause of a sudden disruption or failure of a satellite on orbit will remain a problem until space observation capabilities improve. Some may argue that international conflicts or tensions occurring at the same time of these events may provide a link their cause.[42] Simple deductions can produce assumptions of causality for incidents that occur in close temporal proximity to the deterioration of relations with

other technologically capable countries.[43] However, causality based upon other events will remain circumstantially derived unless augmented with irrefutable proof produced through other methods. Without definitive proof of an aggressive act, the nation's leaders would not likely initiate retaliatory strikes. Knowing this provides potential adversaries with opportunities to use the cloak of anonymity to avoid the harm of the deterrence.

Strengthening Mechanisms for Today's Environment

The potential for failure of deterrence due to the foregoing reasons obliges U.S. strategists to devise surer ways to prevent and address aggression in space. Although acknowledged in the strategic documents of the United States, the following approaches need improved implementation to provide real value for deterrence.

Reducing the Attribution Problem

Reducing the attribution problem in the space domain requires enhancing capabilities to identify space objects and to increase space situational awareness.[44] Unfortunately, the military has not kept pace with the need in this area. In fact, by decommissioning the Space Fence in 2013, the nation has lost capability.[45] The military organization charged with the mission of tracking and identifying space objects, the Joint Space Operations Center, tracks approximately 16,000 of the estimated 521,000 objects on orbit.[46] This glaring gap in the knowledge of potential threats further facilitates the belief that an aggressive space actor may surreptitiously act against vital military capabilities.

A robust space object surveillance and identification system can assist in determining intentions of space objects launched by space-faring nations. Over a decade ago, the 2001 Space Commission report recognized this need when it

emphasized that “U.S. must develop and maintain intelligence collection capabilities…that will enable it to better understand the intentions…of potentially hostile states and entities.”[47] In the 2014 United States Strategic Command Posture Statement, Admiral Haney addressed the continued challenges in space. He confirmed that the key to maintaining U.S. advantage in space will be “developing a robust situational awareness of the space environment across the dimensions of time, space, and spectrum.” [48] He also called for the sustainment of investments to preserve the capability advantage that we maintain in space.[49] Similarly, the identification, notification, and forensics of non-kinetic attacks also require ground-based or on-orbit monitoring for directed energy weapons activity. Sensors that reduce timeliness and geolocation accuracy of harmful electronic radiation would provide better knowledge of the operating environment. Enhancing such capability will remove the current veil of anonymity and inform national leader’s response actions by allowing operators to distinguish between operating anomalies and hostile actions.[50]

Unfortunately, budget decisions seem to be curtailing rather than enhancing capabilities in this area. In Fiscal Year 2014, the Air Force canceled one new planned space surveillance asset and sensor redundancy due to budget cuts.[51] Additionally, the 2015 National Defense Authorization Act directs most of the space budget away from monitoring capabilities to “offensive space control and active defense capabilities.”[52] The problem with this approach is that it does nothing to reduce the threats of deterrence due to anonymity in space. In fact, the offensive nature of this direction could exasperate the on-going security dilemmas perceived by other nations.

The Air Force recognized the need for increased investments to "address growing threats while enhancing the ability to identify, characterize, and attribute all threatening actions" and requested funding again for these systems in its Fiscal Year 2016 proposed budget.[53] This is more in line with the Secretary of Defense's desires in terms of an offset strategy that requires disciplined choices in investment that meet the nation's future threats and emphasizes developing systems for space, among others.[54] Funding and building these systems is critical to deny the benefit of anonymity in space.

Cooperation in Space

The rapid expansion of participants in the space domain has made the environment more congested making the need for cooperation greater than ever before. Cooperation in space begins with establishing agreed norms, establishing confidence-building measures, and ultimately by sharing resources. More than sixty countries are now actively using space systems.[55] New internationally recognized norms that prevent the escalation of aggressive behavior in space have not developed nor have all participants formally embraced them by ratifying new legal frameworks.

Theresa Hitchens and Michael Katz-Hyman argue in "Establishing Space Security: A Prescription for a Rules-based Approach" that a code of conduct for space can be the foundation of a recognized international norm to establish permanent deterrence. They point out that various codes of conduct already constrain some military activities and can expand to cover military activities in space.[56] The purpose of such codes is to reinforce behaviors that are beneficial to all participants. In this way, a space code of conduct would reinforce the norms-based approach to deterrence and reduce the chances of failures caused by miscalculation. The space community has called for such codes in the past, but the nation has not embraced them even though

the National Space Policy seeks to “expand international cooperation on mutually beneficial space activities.”[57]

A 1986 Aspen Strategy Group Report concluded that negotiated measures such as a code of conduct are critical for future stability in space. The report further noted that threatening maneuvers such as close passes and rendezvous operations, debris mitigation, separation requirements, limits on anti-satellite capability and directed energy weapons testing should be included in the code.[58] In 2008, the European Union offered an updated code for space activities designed to minimize the likelihood of accidents that remains an unsigned draft document.[59] Hesitation over constraints to missile defenses and anti-satellite weapons has stalled further pursuit of the document, although it has been confirmed to consistent with existing U.S. practices.[60] This is a start in the right direction, but the code should cast a wider net that further reduces miscalculation errors by limiting risky, military behavior in space that participants perceive as aggressive. As the United States begins to look more favorably upon the draft code of conduct, as some are suggesting,[61] the document can be the vehicle to capture these requirements and formalize the norms of behavior to reduce perceived aggressive actions in space.

Confidence-building measures employed in conjunction with a code of conduct would also reduce problematic misperceptions. Confidence-building measures are arrangements negotiated among states that promote understanding and trust to reduce tensions and opportunities for miscalculation. They promote effective relations by eliminating causes of misunderstanding regarding the military activities of other states.[62] Confidence-building measures for space could include a forum for all space-faring

nations to address issues that may be contentious in nature. These efforts seem already to be developing, but they need formalization to address military activities with more clarity. In 2013, the United Nations produced a report, *Transparency and Confidence-Building Measures in Outer Space Activities* that suggested several voluntary measures that nations could adopt to foster international cooperation in space.[63] The United States was a contributor and signatory to the report. The country must now formalize the organizations and structures to implement these measures.

The Department of Defense has an important part to play in establishing these measures. The military's space operations centers can be the focal point for the establishment of communication channels between nations that can facilitate understanding in crises and reduce tensions during critical moments. Again, the foundation for these efforts exists. The combined U.S. and Russian 1999 Y2K missile-warning center guarded against inadvertent computer glitch warnings and the combined tracking effort during the reentry of the Mir space station in 2001 provide nascent models of establishing shared communications.[64] Today's Space Situational Awareness Sharing program provides limited space data to non-U.S. governmental organizations.[65] In December 2014, the Chinese government asked the United States to start sharing additional satellite collision warnings directly with their satellite operators to ensure quicker responses.[66] These example programs can spawn wider confidence-building measures among more nations that foster the sharing of information deemed critical regarding perceived aggressive actions and ultimately reduce the chance for miscalculation.

Cooperating more fully with other space-faring nations increases transparency and can reduce the current security dilemma. This is a form of deterrence by entanglement. An aggressor's risk-benefit calculations is complicated by increasing the number of countries involved in the problem. While deterrence by entanglement normally focuses on economic interactions of a globalized world, the theory applies well to space when countries co-utilize space systems for their economic or security issues.[67] Hostile actions directed towards a satellite would therefore draw the response all the nations using the satellite.[68]

Going forward, the nation should explore further methods of entanglement. The United States and China once had effective cooperation on space activities with China even launching several U.S. satellites in the 1990s.[69] In order to bolster deterrence the nation should rekindle this cooperation. Entangling China with U.S. space power makes sense as China's space power continues to increase. The more independently capable our adversaries become in space, the less reliant they will be upon U.S. space capabilities and the easier their risk-benefit calculations become in determining the value of hostile actions in space. Entanglement therefore reduces the likelihood that other countries would attack a space system and thereby degrade their own capabilities.[70]

Altering the Calculus of Deterrence

Assuming that states will behave as rational actors when contemplating attacks in space, they will conclude on maintaining security when their calculations favor the avoidance of risk instead of seeking the benefit of aggression. To influence these calculations, the United States must deny the benefit of an attack and make sure that adversaries are aware that any benefits would be insignificant compared to the

anticipated response. The National Security Space Strategy calls for this deterrence by denial approach by “strengthening the resilience of our architectures” and use of cross-domain solutions to maintain capabilities in the event of an attack.[71] Such methods generally deny the benefits of an attack by adding redundancy, which is extremely costly to achieve and ultimately aggravates the concerns of those facing security dilemmas. Even so, these strengthening and cross-leveling functions have not changed the current risk-benefit equation since nations are still pursuing anti-satellite technologies. Reliance on the current passive safeguards such as systems hardening, system dispersal, and maneuvers amounts to maintaining the status quo.[72] In reality, these efforts generally prevent the consequences of an attack from becoming devastating; they do not necessarily deny benefits of objective to the adversary. Redundancy may not be the best approach. Demonstrations, military exercises, as well as technical analyses can effectively display to potential adversaries that aggressive actions will not afford them their desired asymmetric military advantage.

While such efforts reduce the consequences of a potential attack, the effort must focus on increasing the effectiveness of the deterrence strategy. Effective deterrence begins with a firmer declaratory policy that works in reducing miscalculation by ensuring those that are contemplating aggressive actions in space perceive the costs resulting from those actions as prohibitive.[73] Without these clear limits denoting the framework of escalation, others might not understand the deterrent message.[74] Declarations regarding the right to respond to aggression in space provide the first step in a process that must ensure that potential aggressors understand the nation’s resolve to respond to aggressive acts in space.

The recent on-orbit explosion of the Defense Meteorological Satellite Program Flight 13 satellite provided an event that the United States could have used to further a declaratory policy, but did not. Nearly a month elapsed between the satellite's suspicious destruction and any public announcement of the event.[75] The United States should have immediately announced the destruction of the satellite to the international community and used the opportunity to reinforce the right of response to aggression in space. The statements would then explain that the country is determined to identify the cause of the event and would respond accordingly if analysis concluded that nefarious activity caused the event. Compare this with the recent response to the cyber hack of the Sony Corporation where U.S. officials quickly and publicly attributed the attack to North Korea and the President affirmed the U.S. right to proportional response.[76] The strength of the response to threats to the nation's cyber domain was clear and powerful. Failure to do so for events in space leaves the question of whether the United States is truly willing to respond to hostile acts in space.

Assuming aggressors intend to attack U.S. space systems to deny a military advantage in the other domains, the United States must clearly affirm its responses will be proportionate, but not necessarily in space. These declaratory statements must therefore clearly address the linkage between cross-domain proportionality. New participants in the space domain do not have an established set of international norms to refer to in formulating their expectations of a response. There is no existing framework for escalation to aggression in space since the world has yet to experience warfighting in that domain.[77] Therefore, threats of retaliation are not sufficiently clear without an abundant description of the linkage between actions in one domain that will

determine responses in the other.[78] Declaratory policy can make those linkages of the escalation framework clear.

Recommendations

Deterrence in the space domain will not succeed with only implied threat of harm. Although strategic documents point to the use of additional strengthening mechanisms, the nation has not seized available opportunities for implementation. Leaders must commit the financial resources and political will to enable the broad approaches that address both norms-based and interest-based deterrence in space.

Reducing Attribution Weaknesses

The nation must relook acquisition of space technology in terms of an offset acquisition strategy that focuses on the most cost-effective deterrence technologies. Funding active defense and space control systems does not solve the attribution problem that weakens deterrence. The nation's space leadership has clearly identified the need for advanced space object surveillance. They have repeatedly stated the requirement for capability to close the gap in tracking that prevents accurate identification of presently undetectable space objects. The nation must fully fund space situational awareness programs as called for by the military's top space leadership to provide for complete tracking of objects in space and close the gap. To address directed energy weapon threats, acquisition mandates should require space systems to include sensor and interference geolocation capability on all payloads across the radiofrequency spectrum to include optical bands that identify directed energy weapons threats.

Without these additional capabilities, the United States faces increased operational risk in the conduct of both space operations and the space support provided

to the entire range of U.S. military operations. Development of anti-satellite technologies and directed energy weapons provides a means for an aggressive adversary to attack the United States asymmetrically to gain an advantage in another domain. Without these additional capabilities, the risk-benefit calculus may eventually indicate an advantage for attacking, particularly if the initiator of an attack can remain unknown.

Deterring hostile actions in space depends on a complete understanding of what is operating in the space domain, knowledge of who is responsible for what set of capabilities, and an understanding of the intention of activities.[79] These additional capabilities will mitigate the risk of the growing congestion of the space environment. Further, they will provide indications of capability and intent of adversary systems. Additional capabilities will also help keep pace with trends towards continued miniaturization with smaller nano-satellite technologies.[80] Only additional space object surveillance and identification capability with improved resolution and post-attack forensic capability will deter the benefit of an attack in space provided by anonymity.

Cooperate in Space

To reduce the problem of U.S. capability dominance in producing strategic dilemmas, the nation must alter the perceptions of threatened countries by initiating cooperation in space through a whole of government approach. The first step is for Congress to formalize agreements on rules of behavior, or a code of conduct, which support our national security in space and share information on space activities. The Department of Defense acknowledges the benefits of such a code and supports the formal adoption of one as consistent with the nation's strategies.[81] However, the Department of Defense cannot establish the code on its own accord. The nation must now move forward with the work of the United Nations for the adaptation of the draft

International Code of Conduct for Outer Space Activities that is suitable to U.S. interests. Understandably, there will be hurdles to garner both the domestic and international consensus required, but the need for more detailed frameworks is now urgent, as more participants are entering space.

Furthermore, as a confidence-building measure, the military must open communications with other developing space nations that goes beyond satellite collision warnings. The United States currently shares space situational data with five countries and forty-one commercial entities, and is seeking agreements with five additional countries.[82] These agreements need extensions for wider sharing of information with other space-faring nation military operations centers to reduce uncertainties associated with military activity in space and reduce perceptions that lead to the security dilemma. Eventually, the nation must overcome its reluctance to cooperate with others, including potential adversaries. Personnel exchanges, exercises, and the permanent opening of operations centers as was done with Russia in the 1990s needs to occur with new entrants to space. This will establish deterrence by entanglement and will align potential adversary's interests with U.S. interests. While this seems exceedingly challenging given the current political environment, particularly with China, this may be the strongest method to enhancing deterrence. Of course, others may elect not to participate, but the true risk remains with the nation's commitment to this course of action.

Uncertainty regarding how some countries will regard space as a domain in which they may gain an advantage over the United States through militarization further complicates an already complicated strategic environment. These proposed measures then become the basis for international norms as a means to prevent the future

militarization of space and reduce the chances for conflicts to escalate into space warfare. The transparency gained through the establishment of confidence-building measures will also ultimately lead to more cooperation in space. These measures also mature the peaceful utilization of space among the growing number of participants. These actions will as well reduce the security dilemma faced by some nations by effectively sharing information on intentions and capabilities.

Toughen the Tone of Declaratory Policy

Finally, the United States must reinvigorate an explicit declaratory policy that firmly announces the intention and right to respond to aggressive actions with proportional military responses in other domains.[83] This requires application of political will to ensure space as a safe global commons and addresses the credibility of commitment weaknesses of deterrence. All events that affect the assured access to space require a forceful and public response, especially future unexplained satellite anomalies or further provocative Chinese direct ascent anti-satellite tests. As part of this, the policy should dictate clearly those actions that pass a threshold as acts of war and that would accordingly trigger a military response. Building the escalation framework would work to reduce conflict in space by clarifying the cost-benefit calculations of levels of aggressive action and would therefore limit those actions if responses were accordingly severe. As with any declaratory policy, the United States must be ready to respond with force the next time an attack or interference occurs on a space system.

To succeed, U.S. leaders must rigorously adhere to this framework to reverse the appearance of a lack of resolve in the future use of force. In this regard, the recommendation limits political choices and therefore increases the strategic risk to the

country: crossed escalation thresholds will require armed responses. However, an appropriate framework that describes aggressive actions in terms of intent and seriousness provides for flexibility in determining true acts of war. In that manner, acts of aggression separate themselves from inconsequential activities that would not require a retaliatory, armed response.

The benefit of clearly articulating the risk framework of aggressive actions in space will ultimately reduce the likelihood of an asymmetric attack by an adversary. Certainty of response and understanding of an established framework reinforces deterrence and minimizes miscalculation.[84] Since the purpose of asymmetric attacks is to gain an advantage in another domain, the clear understanding of a proportional armed response in other domains is the most effective deterrent.

Conclusion

The United States requires assured access to applications of force from all warfighting domains to succeed on future battlefields. The space domain, upon which the military has become reliant for effective operations, needs an effective approach to bolster the deterrence posture that provides long-term security in space for maintaining U.S. capability advantage. Ultimately, the nation's strategic guidance documents for space policy and strategy identify this changing environment and affirm a fundamental reliance upon deterrence while seeking other strengthening mechanisms that will reduce the likelihood of attacks in space.

Deterrence, however, is a strategy that is prone to failure when used without supporting mechanisms. The challenges to effective deterrence in space include the militarization of space due to perceived security dilemmas, an ungoverned domain fraught with opportunities for miscalculation, assumptions on the lack of U.S. resolve to

respond to aggression in space, and a supposed anonymity provided by unmonitored reaches of the domain. The implementation of measures to strengthen deterrence as described in the National Space Policy needs prioritization by government officials to reduce the likelihood of its failure in space by counteracting these challenges.

None of the proposed recommendations guarantees protection from a determined actor using advanced technology to attack U.S. space systems. However, a deterrence strategy without any supporting measures is weaker in today's complex space environment. These recommendations will support the goals of the National Space Policy and enable the country to minimize the likelihood of future attacks. These proposed measures best position the nation for assured access to space power until such a time that other methods can with better assurance, prevent or defeat, anti-satellite and directed energy attacks.

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