Role of Space in Deterrence

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Abstract

A proper space strategy agrees with the universal and overarching logic of strategy. Therefore, the concept of deterrence has applicability in the space domain. Space activities and policies are relevant for deterring conflict, as well as maintaining international peace and stability. Although deterrence has a legitimate role in future space strategy, it is not the panacea for preventing conflict, because history teaches that deterrence will at times fail due to miscalculation, uncertainty, or chance. This is also true for deterring acts of aggression in space.

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Introduction

Secure access to space is a critical national security interest for many countries. Space-reliant technologies enable vital activities – including commerce, trade, environmental monitoring, intelligence collection, and governmental actions. Consequently, many countries will seek to ensure access to and use of space through diplomatic, informational, military, and economic instruments of national power. The strategic importance of space means that in a potential conflict, an adversary will be incentivized to blunt this advantage and challenge command of the domain. To discourage this behavior and protect one's national interests in space, the concept of deterrence is salient. The recent return of discourse focused on great power competition – fueled by Chinese belligerency in its territorial disputes and Russian adventurism on its borders and abroad – has a distinct space element and highlights that space deterrence will be a principal theme in space strategy for many space powers.

Since the beginning of the Space Age, some polities considered operations and activities in space as a means of supporting the ends of national policy. Thorough analysis of the nexus between space and deterrence, however, remained unexplored for decades largely for two reasons (Thomson 1995). First, space deterrence was considered to be closely coupled with nuclear deterrence thinking from the Cold War because space systems enabled nuclear command and control, supported early warning of ballistic missile launch, and served as national technical means of verification in arms control measures. Any interference against national security space systems was thought to be a potential precursor to a nuclear war. Second, in the immediate post-Cold War world, there was not a significant or explicit space threat to be deterred. China's 2007 direct ascent anti-satellite (ASAT) weapon test and subsequent military posture in space has been a catalyst that has prompted policy makers and strategists within the United States to more fully consider the role of deterrence in space strategy.

When developing space deterrence strategies, strategists should acknowledge the unity in strategic experience. The fundamental concept of deterrence is enduring and has been studied in depth. Just as Carl von Clausewitz identified the universal nature and changing character of war, the nature of deterrence is enduring, while its implementation differs between different domains of warfare and each geopolitical context (Clausewitz 1989). Consequently, when considering the role of deterrence in space, the strategist may use historical experience and lessons – from antiquity to the present day – to better understand the relationship between the space domain and deterrence theory. This chapter presents many of the most fundamental topics of space deterrence. Admittedly, much of the current literature on space deterrence focuses on the strategic challenges facing the United States; however, the lessons to be gleaned are often relevant to other countries. The concepts presented in this chapter are meant to guide readers and future strategists, thereby aiding them in thinking about deterrence in space and allowing them to identify sound arguments, train their judgment, and avoid pitfalls when crafting strategy (Clausewitz 1989).

Space Deterrence

Fundamentally, deterrence efforts seek to affect the decision-making of others and influence their behavior. This is reflected in a commonly used definition that *deterrence* refers to persuading a potential enemy that it is in its own interest to avoid certain courses of activity (Schelling 1966). When a potential adversary forgoes certain actions or some forms of behavior that they would otherwise have carried out due to intolerable costs, this is commensurate with deterrence – through either denial or punishment. In its most simple form, deterrence involves persuading an adversary that the risks or costs of an action exceed any perceived benefit or gain.

Because states derive strategic advantages from satellites and potential rivals may seek to deny a state this advantage, the concept of "space deterrence" is a relevant concept for space powers. Deterrence by punishment, compellence, deterrence by denial, and dissuasion are important ideas in the formulation of a sound space strategy. Taking the commonly accepted definition mentioned previously, *space deterrence* refers to persuading a potential enemy that it is in its own interests to avoid certain courses of activity in, through, or from space. Regardless of the chosen terminology or definition, what is ultimately important is that there are actions that can be taken relative to space that affect the decision-making of others.

One of the most essential distinctions in deterrence theory is between deterrence by punishment and by denial (Snyder 1961). *Deterrence by punishment* concerns the threat of credible and potentially overwhelming force or other retaliatory action against any would-be adversary to discourage potential aggressors from conducting hostile actions. *Deterrence by denial* refers to the capability to deny the other party any gains from the behavior that is to be deterred (Snyder 1961). This concept refers similarly to deterring an adversary by presenting a credible capability to prevent it from achieving the potential gains adequate to motivate the action (Krepinevich and Martinage 2008).

A related but distinct concept is *compellence*, which involves convincing an adversary to cease some current undesired action. Compellence is often described as a direct action that persuades an opponent to give up something that is desired (Schelling 1966). While deterrence has a negative object – it discourages unwanted actions – the object of compellence is positive. Effort is expended to force or convince an actor to conform to one's will.

Both military and nonmilitary means are applicable when seeking to affect the thinking of others to enable deterrence by punishment, deterrence by denial, and compellence. Nonmilitary means equate to the *soft power*, or the diplomatic, informational, and economic instruments of national power (Nye 2005). Nonmilitary means can be used to affect another state leader's thought processes – whether reinforcing a currently held view that is beneficial to the deterring state or changing the view of another state's leadership or polities. Consequently, a practical implementation of space deterrence may entail political and diplomatic efforts, such as new international treaties or agreements; multimedia stories presenting news in a favorable perspective; and commerce and trade activities that increase one's own economic influence or affect negatively a potential adversary or opposing alliance (Klein 2019).

Deterrence by Punishment

A deterrence by punishment approach in space is underpinned in the belief that the threat of credible and potentially overwhelming force or other retaliatory action against any would-be adversary is sufficient to deter most potential aggressors from conducting hostile actions in space. Such a strategy should clearly convey the capability and credibility behind the threat and communicate the specific behavior sought to be discouraged (Morgan 1977). As part of its broader space strategy, the United States seeks to deter attacks against its satellites. The 2017 US National Security Strategy conveys that harmful interference or attacks targeting US satellites will be met with a deliberate response in the "time, place, manner, and domain" of its choosing (The White House 2017). A US joint doctrine describes that, consistent with the right to self-defense, the United States may utilize its space assets to target the space capabilities of an adversary to deter potential threats (Joint Chiefs of Staff 2018). Some security experts view that the punishment portion of the US space deterrence strategy has been pursued and emphasized extensively, perhaps to the detriment of other approaches to secure US interests in space (Johnson-Freese 2017).

Many analysts have identified challenges associated with implementing a deterrence by punishment approach in the space domain. These include establishing appropriate thresholds for retaliation for both non-kinetic and reversible attacks on satellites, differences in severity due to no loss of life when compared to terrestrial action, and having the requisite attribution capabilities and processes.

The absence of explicit threshold that a state would retaliate against complicates efforts to deter adversaries. Some policy makers question whether non-kinetic and reversible actions are hostile acts or armed attacks that warrant a military response (Harrison et al. 2017). Reversible and non-kinetic actions on satellites supporting tactical operations may be treated differently from large-scale kinetic attacks on satellites supporting nuclear command or control or early warning missions. However, between these extremes, there is still a highly uncertain boundary that complicates deterrence efforts (MacDonald et al. 2016). Ultimately, what is considered an armed attack or hostile act in space necessitating a retaliatory response will depend on the broader geopolitical context.

Another challenge for a space deterrence strategy is that attacks on satellites typically are unlikely to result in loss of human life. Consequently, hostile actions in space may be considered by some polities to be less escalatory or grave as conflict on Earth. The frequently used adage that captures this thinking is "satellites don't have mothers." This view may cause decision-makers to view aggression in space as never rising to levels that would warrant a military response, whether terrestrially or in space. Moreover, because military actions in space are unlikely to produce direct casualties, there may be an appeal to turn to these activities as tensions between competing states escalate (MacDonald et al. 2016). Perceptions that hostilities in space are less severe than terrestrial conflict can be discouraging to those hoping to deter attacks against one's satellites.

Regardless, the thought that the non-casualty-generating effects of space actions preclude a deterrent threat is unfounded. Article 2(4) of the United Nations Charter describes the need to refrain from the threat or use of force against a state's territorial integrity – which may be interpreted as a state's physical property. Self-defense and retaliatory threats to deter a potential armed attack against a state's satellites are then appropriate and justified. Upon further examination, one may dispel a historical challenge surrounding space deterrence by punishment: a hostile action against a state's space systems may still be deterred by threat of retaliation, even if there is no loss of life.

Yet another challenge to effective deterrence in space lies in the difficulty of attributing who or what caused a satellite to cease to function normally. Military actions in space can produce various effects, may be non-kinetic and reversible, and in some cases these effects may be difficult to identify and attribute. An effective deterrent requires timely assessment of the event to orient and respond appropriately. Operating at hundreds to more than 30,000 km above the Earth's surface makes it difficult to physically inspect and track satellites, thereby making determining and assessing damage an onerous endeavor. The hostile space environment – where satellites face solar activity, scorching and frigid temperatures, radiation, electromagnetic activity, and an increasing amount of debris – further complicates efforts (Wright et al. 2005). Operators must distinguish between intentional interference from adversaries and interference arising from normal operation in a hostile environment.

Some authors argue that the difficulties associated with attribution may be less worrisome than originally thought (Harrison et al. 2009). An attack on a state's satellites unconnected to a terrestrial strategic event is thought to be highly unlikely. Attacks on satellites will occur following the terrestrial breakdown of general deterrence between states. The source of an attack may be less nebulous than space deterrence literature has declared, particularly if the attacking state launches a coordinated attack on many satellites to try to gain command of space early in the conflict. Drawing from this example, intelligence gleaned prior to the attack may be a more meaningful method of attribution than enabled by postattack space situational awareness (SSA) assessment.

Regardless of this assessment, in the current context of the global proliferation of counterspace capabilities, there will likely be ample room for misperception and miscalculation in a state's leadership. This necessitates robust SSA capability to address issues of identifying, assessing, and attributing activities that occur in orbit. Greater SSA capabilities allow a state to differentiate between intentional attacks and malfunctions due to the satellite itself or the hostile environment it inhabits, thereby reducing the potential for misinterpretations and miscalculations (Sheldon 2008). Effective SSA capabilities will necessitate knowing what on-orbit systems are present, along with their location, capabilities, historical anomalies, operating patterns, and intended use. Such information will facilitate those preparatory measures needed to pit one's strengths against a potential adversary's weakness. Because SSA is a global endeavor, information sharing architectures must be designed to include

the international community and commercial industry. This means that much of the data and resulting information provided through SSA systems should be releasable and disseminated to many of those participating in the global effort.

Today's security challenges can complicate the implementation of a deterrence by punishment strategy. While some security analysts assess that thresholds for retaliation, differences in severity for space actions, and ensuring a sufficient attribution capability may be less problematic than many think, it remains to be seen whether this is confirmed in practice.

Deterrence by Denial

Among many security professionals, *deterrence by denial* is often associated with the concept of *dissuasion* – activities that seek to influence the decision calculus of potential adversaries to discourage the initiation of military competition. A strategy incorporating dissuasion seeks to convey the futility of conducting a hostile act, affecting the confidence of a potential adversary's leadership and causing decision-makers to not pursue a military confrontation in the first place. To be most effective, dissuasion activities occur before a threat manifests itself. Some national security professionals note that dissuasion works outside the potential threat of military action as a kind of "pre-deterrence," because those states dissuaded will not require to be deterred by punishment (Krepinevich and Martinage 2008). While a deterrent that seeks to punish an adversary is tailored to distinct actions by specific actors at definite times, deterrence by denial commonly lacks this specificity and exists as a general deterrent, one that shapes the security environment through a broad, latent deterrent effect originating from one's reputation and capabilities (Morgan 1977).

A deterrence by denial strategy for space seeks to frustrate or complicate the adversary's plans by introducing greater costs and reducing associated benefit. Over the past several years, there has been a greater emphasis on the role of deterrence by denial in the broader US space deterrence strategy. Rather than threatening retaliation against the aggressor's satellites or terrestrial targets of value, a US space deterrence by denial strategy emphasizes reducing an adversary's incentive to attack US satellites (Vedda and Hays 2018). A potential adversary may be deterred if it concludes that an attack in space will be ineffectual in achieving the desired effect. Much of deterrence by denial and dissuasion necessitates preparing for potential conflict during peacetime. Because dissuasion involves discouraging the initiation of military competition, for the space domain the requisite peacetime preparedness is included within the contexts of *space mission assurance* and *resilience*.

According the US joint literature, mission assurance entails a process to protect or ensure the continued function and resilience of capabilities and assets – including personnel, equipment, facilities, networks, information and information systems, infrastructure, and supply chains – critical to the performance of the Department of Defense mission essential functions in any operating environment or condition (Office of the Assistant Secretary of Defense for Homeland Defense 2015). Similar to mission assurance but with a different focus, *resilience* is an architecture's ability

to support mission success with higher probability; shorter periods of reduced capability; and across a wider range of scenarios, conditions, and threats, despite hostile action or adverse conditions (Joint Chiefs of Staff 2018). Resilience may leverage cross domain solutions, along with commercial and international capabilities. By definition, space mission assurance and resilience efforts can prevent a potential adversary from achieving its objectives or realizing any benefit from aggressive action. Space mission assurance and resiliency help convey the futility of conducting a hostile act and, consequently, enhance deterrence by denial and dissuasion efforts.

Space mission assurance efforts consist of *defensive operations*, which include off-board protection elements; *reconstitution*, which includes launching replacement satellites or activating new ground stations; and *resilience*, which includes on-board protection elements (Joint Chiefs of Staff 2018). Resilience in capabilities includes disaggregation, distribution, diversification, deception, protection, and proliferation. *Disaggregation* is the separation of dissimilar capabilities into separate platforms or payloads. *Distribution* utilizes a number of nodes, working together, to perform the same mission or functions as a single node. *Diversification* is contributing to the same mission in multiple ways, using different platforms, different orbits, or systems and capabilities of commercial, civil, or international partners. *Deception* is hiding one's strengths and weaknesses from one's adversaries. *Protection* is utilizing active and passive measures to ensure space systems provide mission support in any operating environment or condition. *Proliferation* is deploying larger numbers of the same platform, payloads, or systems of the same type to perform the same mission.

Space mission assurance may be supported by a number of preparations preceding a potential conflict. These preparations may include hardening against cyber threats and signal jamming, incorporating shutters for remote sensing satellites to minimize the effects of dazzling by lasers, or increasing the mobility of satellites through novel propulsion technologies (Kueter and Sheldon 2013). Preparations taken in peacetime may include employment of proliferated constellations of small satellites to complicate an adversary's space ambitions. Furthermore, the conduct and training of one's space and terrestrial forces may grant an ample deterrent effect, even if no ancillary preparations have been made. One method of frustrating an adversary's plans may be to train forces to fight under degraded conditions where military forces lose access to space-enabled capabilities, thereby depriving potential aggressors some of the appeal of attacking satellites (Harrison et al. 2009). Consequently, a potential aggressor may be convinced that the prospects for success are too costly, with little benefit.

Another method of frustrating an adversary's space control plans is to reduce one's vulnerability by transitioning traditional space-derived services to terrestrial alternatives, a concept termed *space avoidance*. Its advocates seek to increase space deterrence by minimizing one's presence in space, thereby diminishing an adversary's perceived benefits of attacking one's satellites (Coletta 2009). For example, some space avoidance advocates suggest this may be achieved by using unmanned aerial systems (UAS) for tactical reconnaissance systems instead of

remote sensing satellites. Creating redundancy through terrestrial alternatives is prudent, but one should not be misled when judging whether reliance on space can be abated entirely. UAS are a valuable supplementary resource to space-derived intelligence, surveillance, and reconnaissance (ISR); however, most UAS still require space-derived positioning information and communications to operate. Many forms of military power – sea power and airpower, for example – cannot easily reduce reliance on space-derived services. While states should seek to increase terrestrial redundancy to complicate an adversary's plans, a strategy of space avoidance intending to greatly reduce reliance on space is not feasible in modern warfare.

Alliances, international cooperation, and the global proliferation of space power also play a significant role in deterrence by denial. This international dimension influences deterrence in several ways. First, the proliferation of states operating or deriving benefits from satellites creates stakeholders who would likely prefer that their satellites were not put in jeopardy. States outside of the deterrence relationship may have their satellites affected negatively if deterrence fails and conflict ensues, such as by orbital debris from kinetic attacks or the indiscriminate effects of broad radio-frequency jamming. Second, the deterring state may provide a global or multinational space-derived service, such as the US Global Positioning System satellites, which if attacked could potentially draw countries reliant on this service into the conflict on the side of the non-aggressor (Harrison et al. 2009). In these situations, an aggressor may be hesitant to attack space systems if it will have to potentially contend with an international response (Sheldon 2008). Third, allied or partner states may assist the deterring state when a conflict breaks out. The space systems of friendly countries can complement and supplement the deterrer's own capabilities, such as through data sharing agreements, interoperability, or even by assisting in the reconstitution of lost space capabilities. Adversary leadership may be deterred from targeting US satellites if they perceive that the United States could leverage the capabilities of its allies to nullify any anticipated benefit (Sheldon 2008).

Some security experts consider the North Atlantic Treaty Organization (NATO) as being uniquely positioned to bolster deterrence in space through its cooperative alliance. The alliance is increasingly reliant on space for its collective defense and economic prosperity, and an attack on the space assets of any one ally impacts the security of all allies (Schulte 2012). Security experts assert that while NATO is dependent on space-enabled capabilities, its space doctrine and planning have not kept up. Presently, NATO officials are considering how the alliance should address the growing military capabilities of Russia and China, to include issuing NATO's first strategy for space. The strategy is expected to make space an official domain of operation, giving structure to discourse on military developments in space and NATO's response. The alliance may also decide that attacks in space would trigger the organization's Article 5 provisions on collective defense, although internal differences on the subject remain. Analysts have long held that NATO should continue to build the expertise and capacity to conduct operations enabled by space; ensure that doctrine, requirements, and planning account for the operational advantages provided by space; and adapt exercises and training to ensure forces can

effectively exploit space-based capabilities (Schulte 2012). It is still uncertain whether NATO's space strategy will implement these recommendations.

A deterrence by denial strategy presents its own challenges. The cost of fielding and launching the most robust, defendable space systems can become a financial burden (Coletta 2009). Hardened, dispersed, disaggregated, or diversified capabilities may cost more to develop, launch, integrate, and operate. Also, resilient architectures may not be able to match the performance of those exquisite space systems. In most cases, smaller, proliferated constellations of satellites will augment, rather than replace these exquisite systems. The space strategist then must consider the benefits of defensive approaches, along with associated time and fiscal procurement costs, when finally deciding upon the best approach. Another challenge of deterrence by denial is that one's space mission assurance and resilience efforts must be widely publicized to be effective in dissuading others.

Both deterrence by punishment and deterrence by denial are fundamental to an understanding of deterrence theory in space. Though deterrence can be valuable in one's attempts to prevent attacks and dissuade aggression, deterrence is not a panacea that will always prevent conflict. Clausewitz's wisdom is insightful. An adversary may strive to have the greatest likelihood of success by expanding its relative superiority, but even without this advantage, an adversary may find war attractive if there is no better option (Clausewitz 1989).

Principles of Space Deterrence

Because deterrence is a strategic behavior, its fundamental nature is enduring, even though its implementation changes with time and for each geopolitical situation. To understand the role of deterrence in space, it is important to identify deterrence's most enduring concepts along with their relation to space strategy.

Primacy of the Adversary's Decision-Making

A deterrence strategy is not a game of solitaire. All too often, policy makers and warfighters forget that those to be deterred may be unwilling or even unable to be deterred. Because war and deterrence are both within the realms of strategy, one must recognize that deterrence is a contest between two independent wills (Clausewitz 1989). The adversary's perceptions and decision-making are the paramount variables determining whether deterrence succeeds or fails. Regardless of the potential credibility of deterrence efforts, an adversary has an independent will and may not necessarily comply. Those to be deterred may fail to comprehend the threat or costs before them, doubt the credibility of the deterrent, or find that their policy ends are significant enough to warrant the costs and risks associated with ignoring the deterrence attempt (Sheldon 2008). Even if the deterring state has increased the costs and minimized adversary benefit through its defensive capabilities or with the demonstrated ability to respond, the decision to be deterred rests with the potential adversary.

Polities and their leadership cannot always be deterred, and they may decline to be coerced, even when heavily physically damaged, hoping for a change in strategic fortune (Gray 2007). "Fools," as some may call them, are far more likely to commit errors of a kind that result in wars or at least a high measure of regional disorder, because they will not be swayed in their decision for violence regardless of the threat of a severe military response to a hostile attack (Gray 2007). In such situations, deterrence could be irrelevant, because the foolish foreign leader may not believe in the latent or explicit threats issued or may not care whether or not the threat of retaliation is honored. Sometimes, if the enemy has nothing to lose, even a very risky action may be preferable to maintaining the status quo. Ultimately, it does not a matter whether one thinks a potential adversary should be deterred given an action or situation; it only matters how the adversary's leadership and decision-makers interpret any action within their worldview and mental constructs. Regardless of the amount of political will and military strength behind a deterrent message, the potential adversary's perceptions are what decide the success of a deterrence strategy.

Deterrence Cannot Be Guaranteed

Strategic history demonstrates that one should be less than confident in the certainty of deterrence. It is possible, and perhaps even probable at times, that deterrence will fail. Ambiguity, miscalculation, incompetence, friction, and chance are all prevalent in deterrence and serve to ensure that deterrence is a highly uncertain venture. The primacy of the psychological aspects in this manifestation of strategy further adds to the uncertainty of deterrence (Sheldon 2008). There is the fundamental, persistent threat that the countries in a deterrence relationship will trip, accidentally or inadvertently, into war (Gray 1991). Some may be quick to forget that, much like war, deterrence is a strategic behavior and accordingly suffers from complexity, nonlinearity, and unforeseeable occurrences that can thwart even the most careful and comprehensive planning. This complexity and nonlinearity should be considered and addressed when developing national strategies and operational plans.

One of the significant drawbacks of deterrence theory is identifying when it actually succeeds in causing an adversary not to proceed with an undesired behavior. Assessing the efficacy of deterrence is onerous because successful deterrence must be tested negatively with events that do not occur (Gray 1991). Because of the inability to draw convincing conclusions from events which did not happen, both the policy maker and strategist will likely be left with ambiguous lessons for the development of future strategies.

Credibility and Political Will Are Required

Even with a sufficient capability to support affective deterrence, this capability can be rendered inconsequential if the deterring state lacks the will and credibility to carry out the deterring action (Sheldon 2008). Credibility is the perceived likelihood that the deterring state will follow through with its threat, if its terms are not obliged (Snyder 1961). There is a fundamental tension between credibility and prospective pain. Because of a rational fear of retaliation, the more painful or extreme a potential action is, the less likely it is to be taken, and the less likely it is that anyone will

believe it will be taken (Gray 1993). Credibility is dependent on the specific context of the security relationship, and effective credibility relies heavily on the political will of the deterring state to carry out its punitive actions.

While the possession of capability is essential, projecting the willingness to use punitive military force is paramount for deterrence to succeed (Schelling 1966). For this reason, there needs to be a belief that the political will exists to respond with severe military response if attacked in order for deterrence to work. One of the most dangerous scenarios is one in which the deterring state's determination to fight is underappreciated (Gray 1991). Having the requisite political will in using punitive action should deterrence fail is easily subject to misperception, and communicating political will does not inherently make it true or believed (Schelling 1966). Measuring the efficacy of projecting capability and political will, therefore, lies with those to be deterred.

Effective Communication Is Required

Any effort to affect an adversary's decision-making is best served by clearly communicating one's desire, intent, capability, credibility, and rationale for military response. This requisite communication may be achieved through official statements or policy documents or more importantly through a demonstrated history of consistent actions (Klein 2019). If the deterring state is not clear in identifying the specific behaviors that it is trying to deter and conveying the threat of what will transpire if an aggressor chooses not to be deterred – along with the defensive capabilities mobilized to discourage them – then the prospects for successful deterrence are diminished. If one's deterrent message is not received or comprehended, then it will be difficult for deterrence to succeed (Schelling 1966).

In addition to the impediments in communicating deterrence in general, deterrence in space presents its own unique challenges that further complicate it potential success. The remoteness of space, highly classified nature of many of these systems, and perpetual concerns regarding dual-use technology all contribute to an environment where both sides of the deterrence relationship have limited awareness of or insight on the others behavior and conduct (Todd Harrison et al. 2017). Indeed, the dual-use nature of space systems can be particularly troublesome when attempting to clearly comprehend or communicate intent, because motive and intent are made more ambiguous when a state fields dual-use capabilities that can be used for civil, commercial, or military purposes.

Often in analysis of high-technology systems, capability is considered equal to intent (Gray 1993). While China is often at the center of debates over capability and intent, some security experts note the United States fields many of the same dual-use systems that elicit concern among its rivals (Johnson-Freese 2017). Intent is a frequently subjective matter and dependent upon one's worldview. For example, the Soviet Union viewed the US Space Shuttle program as a potential ASAT weapon because Soviet military leadership thought the Shuttle was capable of retrieving satellites and de-orbiting them (Wright et al. 2005). Assuming a worst case of intent based solely on an enemy's capabilities can raise the possibility of miscalculation and increase tensions among states when potentially none may be warranted.

To avoid any potential breakdowns in a deterrence strategy, clear communication of intent, credibility, capability, and what behaviors are sought to be deterred is paramount. While this would be difficult within the other domains, it is particularly important for deterrence in space.

Managing Escalation May Be Problematic

Escalation is an especially complicated issue for the space domain, where an absence of historical experience of military conflict leaves the strategist with little empirical evidence to draw upon. Clausewitz explains the challenge of managing escalation, describing how the interaction of forces tends to drive war to the extreme (Clausewitz 1989). Schelling agrees, writing that escalation sets a pace that cannot be directly controlled (Schelling 1966). The propensity for conflict to escalate means that the space strategist should not act first without considering the potential repercussions of military action (Clausewitz 1989). As a result, prudence is necessary in the formation of a space strategy centered on deterrence.

Escalating horizontally into a different domain could result in much greater escalation than previously anticipated. For instance, a state's response to an attack on its satellites could involve terrestrial targets, thereby potentially causing causalities or violating another state's sovereignty. This horizontal escalation may be politically provocative and could drive further escalation. In many cases, militaries rely heavily on commercially procured and provided satellite services. Attacks against these commercial services could be seen as an inappropriate action that is escalatory to the international community.

Prospects for Strategic Misperception

Strategic theory shapes how states prepare for and conduct strategy. This dimension then is pertinent when considering the execution of strategy. Understanding the strategic theoretical dimension calls for an appreciation, or at the very minimum recognition, of potential differences in interpretation of strategic theory of the adversary. Strategy mismatches – in which there are different cultural and social understandings in the theories of deterrence and escalation control – are some of the most dangerous situations between states. This danger arises because states, whose leaders may consider themselves to be rational and reasonable in not seeking direct military confrontation, may find themselves in such a war, despite their intent or desire. Because of the different understandings of deterrence in preventing war or deterrence's ability to control escalation during conflict, it is important to underscore the differences between American and many Western countries' views and the perceptions of Russia and China. The Russian military's strategy of "escalate to de-escalate" and the Chinese view of using "compellence" through military actions to avoid conflict are two strategic approaches to deterrence that are not emphasized in Western views on deterrence but must be well understood by policy makers and strategists.

In describing *strategic deterrence*, Russian military writings describe the term as an approach seeking to induce fear in opponents, whether in peace or war.

Therefore, the concept includes elements of what others may call *deterrence*, *containment*, and *coercion* (Fink 2017). Russia's approach to deterrence is grounded in its understanding of internal and external threats, including a sense of military asymmetry compared to the West. Russian military doctrine describes perceived dangers from the United States and NATO readiness to use military force, instability and terrorism that could challenge Russia's sovereignty, and a local conflict on its vast borders that could escalate into hostilities, which could include the use of nuclear weapons (Klein 2019). In the Russian perspective, strategic deterrence is not entirely defensive. Within US security circles, some may consider Russia's view of strategic deterrence as an "escalate to de-escalate" strategy – even though that term is not used within Russian military doctrine or strategies – because the strategy comprises the use of military force and actions to potentially de-escalate hostilities or tensions (Schneider 2017). The Russian concept transcends a traditional perception of deterrence having failed if conflict erupts. Therefore, deterrence can continue to work in times of war to prevent escalation, to ensure de-escalation, or for the swift termination of conflict on terms acceptable to Russia.

As with Russia, the Chinese concept of deterrence is fundamentally different than American and Western thinking. Analysis of Chinese writings notes the Chinese concept of deterrence includes a significant element of compellence and coercion; therefore, Chinese deterrence goals may include actions seeking to intimidate the opponent through economic, diplomatic, or military coercion in a way that directly affects an opponent's interests in order to compel the foe to submit to Beijing's will (Kaufman and Hartnett 2016). As a result, the Chinese see deterrence as having a positive object for achieving political ends, whereas the West typically places emphasis on the negative object of deterrence: the discouragement of actions. There are nuances in the Chinese terms used, especially those with more coercive connotations.

Chinese strategists view escalation not as a risk to be avoided but a means to manipulate an adversary (Lewis 2018). China also places special emphasis on overwhelming an opponent through rapid escalation, an approach that – when coupled with manipulation of an opponent's perceptions of the costs of a conflict through coercive measures – increases the chances for dangerous misperceptions. Chinese writings note that along a continuum of conflict, there may be scenarios where militaries are involved but war has not yet formally broken out (Kaufman and Hartnett 2016). Differences between Chinese and American views of deterrence include the Chinese focus on compellence, including coercion, rather than solely on dissuasion. Therefore, the Chinese idea of deterrence manifests itself in both coercive and dissuasive terms (Cheng 2018).

Differences in deterrence theory among Russia, China, and the United States are significant in how they may manifest in practice. Russia's emphasis on harnessing escalation to its advantage and Chinese views on compellence, military activities short of war, and rapid escalation create opportunities for misperceptions and potentially an irreversible slide into conflict that no state desires. These strategy mismatches also have implications for space deterrence because they demonstrate

how states may approach deterrence in this domain differently, potentially in ways that make it more likely that conflict will occur.

Space Deterrence Has a Terrestrial Aspect

While this chapter focuses on space deterrence, it is essential to emphasize that deterrence and prospective conflict in space do not occur in isolation from a political and terrestrial context. This has two implications for space deterrence. First, even when there are times of significant instability in the space domain between two powers, the broader strategic landscape of inherent stability within other domains may restrain the initiation of conflict in space (MacDonald et al. 2016). Alternatively, a stable space environment could witness conflict if instability in other domains caused deterrence efforts to break down between rival space powers. Second, deterrence by punishment strategies attempting to prevent aggressive behavior in space is not limited in their targeting to the space environment. A strategy of space deterrence could succeed if it threatened terrestrial assets valued by the potential aggressor, and not necessarily just their space systems, a view that corresponds with the 2017 National Security Strategy. Therefore, there are complex interdependencies that exist between space and terrestrial domains in the effective implementation of a space deterrence strategy.

Space strategy indirectly influences general deterrence by enhancing the lethality of terrestrial forces and by increasing transparency in a deterrence relationship between competing states.

Space-based or space-enabled communications, surveillance, early warning, and navigation services can enable better coordination, communication, logistics, and superior situational awareness to terrestrial forces, thereby enhancing these terrestrial forces' response time, tempo, and operating efficiency. Space-enabled forces can typically engage an adversary with greater speed, precision, and coordination when compared to forces that lack sufficient command of space. Some analysts assess that the strategic effect accorded by space capabilities shifted the basis of US deterrence strategy from the threat of nuclear punishment to denial of the adversary's conventional offensive success (Coletta 2009). Space-enabled capability is thought to give a state's military the ability to increase the lethality and efficacy of its forces, which can in turn create a powerful deterrent to a would-be adversary. Many within China and Russia believe that US space-enabled conventional forces can cripple the command and control of their forces, even without the use of nuclear weapons (Lewis 2018).

Space also contributes to deterrence by creating transparency between adversary states. Space-based systems' global and nearly ubiquitous nature allows satellites to peer into the normally opaque actions of states and provide greater insight to decision-makers (Smith 2016). Satellites' freedom of overflight creates transparency between states, which is essential for deterrence to succeed. This information and knowledge help alleviate some of the unfounded fears between states and may aid in preventing strategic miscalculations. It must be emphasized that space-based capabilities do not allow one to be privy to thoughts and intentions of an adversary, and consequently, uncertainty will persist, even if mitigated to some degree (Smith 2016).

Conclusions

Space imparts many strategic benefits that enable the military and nonmilitary activities of states. The strategic effect derived from space-based capabilities will not remain unchallenged when states drift toward war. Consequently, space powers will likely seek to implement a practical space deterrence strategy to protect their national interest and achieve political ends. Even though deterrence has a legitimate role in future space strategy, it is not the panacea for preventing conflict. Strategic history teaches that deterrence will at times fail due to miscalculation, uncertainty, or chance – ideas incorporating the concept of Clausewitzian friction. This may also be the case for deterring acts of aggression in space, especially considering China, Russia, and the United States have different perspectives on deterrence and escalation control. Facing recent nefarious activities of China and Russia, security commentators in the United States now emphasize a return to great power competition. Space has a unique role in this competition because all three great powers are also great space powers that seek to broaden their use of space while also fielding capabilities to contest command of this domain. Space deterrence will then play an important role within the global community in the future.

Albeit this chapter has emphasized the enduring nature of war and strategy (and therefore deterrence), the character of war changes with time. The implementation of space deterrence should also be expected to change. This change is currently reflected by the growth of the commercial space sector (particularly in the United States, Europe, China, and Japan) – whether in reusable or responsive launch vehicles or mega-constellations of Earth imaging and communications satellites. Studies of space deterrence often omit the potential role of the burgeoning commercial space sector. The exponential growth in commercial capabilities means that denying space services or degrading another's access to or use of space will become even more challenging for great space powers. The commercial space industry can help convey the futility of conducting a hostile act in space, because it will be difficult to deny products or services through a hostile action. This fact may cause a potential adversary's leadership to avoid military confrontation in the first place. Therefore, deterrence by denial may play a greater role than deterrence by punishment during future strategic deliberations than it has to date. This situation is an advantageous development, because governments can focus less time and resources on fielding military-related programs for use in times of conflict, instead giving more support to those commercial services and capabilities that can be used for the benefit of all.

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