DETERRENT AND DEFENSIVE APPLICATIONS OF ORBITAL ANTISATELLITE WEAPONS

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The United States and its Allies and partners face increasing threats in space from orbital antisatellite systems produced by Russia and China. US and Ally orbital antisatellite capabilities intended to deter aggression should be acknowledged in order to signal resolve and the threat of cost imposition. Simultaneously, the highly specialized subset of these systems to be used in defensive capacities benefits from continued classification, despite the fact this secrecy detracts from the deterrent effects of these systems.

The United States' access to and use of space is a vital national interest.[1] US, Ally, and partner space systems face increasing threats from Russian orbital antisatellite (O-ASAT) developments and Chinese dual-use systems on orbit. Presenting a full range of deterrent capabilities may require US Space Command to operate O-ASAT weapon systems to protect US, Ally, and partner space systems on orbit. This article presents an architectural approach for employing O-ASATs to produce a deterrent effect while preserving a defensive capability should deterrence fail.[2]

To dissuade potential adversaries from engaging in hostile acts in space, O-ASAT systems intended to deter aggression must be acknowledged to communicate resolve and the threat of cost imposition. At the same time, O-ASATs used to defend a broader space enterprise benefit from secrecy to reduce vulnerabilities and preserve the element of surprise, thus detracting from their deterrent effect.[3]

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1. White House, *United States Space Priorities Framework* (Washington, DC: White House, December 2021), 3, https://www.whitehouse.gov/.

2. "From the Ultimate High Ground," US Space Command (USSPACECOM) (website), accessed September 7, 2023, https://www.spacecom.mil/.

3. Gregory D. Miller, "Preventing War with a Warfighting Domain: Nuclear Deterrence Lessons for Space," *Astropolitics* 19, no. 1–2 (2021): 39, https://doi.org/.

If the United States employs O-ASATs for deterrent and defensive purposes, it must overcome the tensions between fielding overt O-ASATs for deterrence and keeping them secret to provide defensive capability. Addressing this problem for O-ASAT systems requires an architectural design incorporating space mission assurance (SMA) principles that "protect or ensure the continued function and resilience" of critical space capabilities and assets. Such an architectural design will deliver inexpensive, proliferated overt capabilities for deterrence through cost imposition, supported by highly technical, classified systems for defensive operations should deterrence fail.[4]

Deterrence and Defense: A Primer

Deterrence is "the manipulation of an adversary's estimation of the cost/benefit calculation of taking a given action."[5] In practice, the actor sending a deterrent message—the deterrer—attempts to convince an opponent that the perceived benefits of hostilities will be denied and met with unacceptable punishment such that the status quo is preferable.[6]

Deterrence by denial of benefit, accomplished through passive and active methods, involves convincing the opponent that the estimated probability of gaining their objective is insufficiently low or not worth the cost.[7] Deterrence through punishment or cost imposition acts on the aggressor's estimate of possible costs against what they value and may not affect their chances for gains.[8] In other words, cost imposition focuses on holding at risk what the opponent values and is countervalue in nature.

Deterrence is a psychological endeavor because it occurs in the opponent's mind.[9] For deterrence to work, the opponent must believe hostilities will be ineffective and counterproductive due to the perceived costs such that they withhold hostilities and preserve the status quo. The psychological element of deterrence requires the deterrer to communicate this idea to the opponent. Additionally, the opponent must believe not only that the deterrer is capable of denying benefits and imposing costs but also that the threats are credible, meaning that the deterrer will follow through on their commitment to retaliate and deny the benefits of initiating unwanted actions.[10]

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4. Office of the Assistant Secretary of Defense for Homeland Defense & Global Security (OASD [HD&GS]), *Space Domain Mission Assurance: A Resilience Taxonomy* (Washington, DC: Department of Defense [DoD], 2015), 2, https://man.fas.org/.

5. Austin Long, *Deterrence—From Cold War to Long War: Lessons from Six Decades of RAND Research* (Santa Monica, CA: RAND Corporation, 2008), 7, https://www.rand.org/.

6. Karl Mueller, "The Continuing Relevance of Conventional Deterrence," in *Netherlands Annual Review of Military Studies 2020: Deterrence in the 21st Century—Insights from Theory and Practice*, ed. Frans Osinga and Tim Sweijs (Hague, Netherlands: T. M. C. Asser Press, 2021), 49.

7. Glenn Herald Snyder, *Deterrence and Defense: Toward a Theory of National Security* (Princeton, NJ: Princeton University Press, 1961), 15.

8. Snyder, 15.

9. Mueller, "Continuing Relevance," 49.

10. Robert P. Haffa, "The Future of Conventional Deterrence: Strategies for Great Power Competition," *Strategic Studies Quarterly* 12, no. 4 (2018): 96–97.

The concept of defense is a necessary component to credible deterrent threats but is distinct from deterrence. While deterrence focuses on preventing unwanted activity, such as war, defense focuses on responding to such activity. The goal of deterrence is typically to delay the onset of war indefinitely; the goal of defense is to win the war and minimize the damage to one's side. Defense is thus the reduction of future costs and risks if deterrence fails. Defensive capabilities are used to resist attack and mitigate or prevent war damage, including in some cases to maximize friendly gains.[11] Such capabilities are counterforce in nature because they focus on countering an opponent's attacking forces and resisting their ability to inflict damage.

Deterrence and defense have distinct but related goals that manifest before and after an unwanted action, respectively. Therefore, strategies for achieving each concept present different objectives. Efforts to enhance deterrence are centered on peacetime objectives, whereas defensive activities provide a wartime value.[12] Because deterrence occurs in an opponent's mind before their decision to attack and requires communicating the credible use of capable forces, this presents a dilemma for defensive forces that benefit from the element of surprise to maximize their effectiveness and reduce vulnerabilities to those capabilities.

Activities to enhance deterrence can detract from defensive capabilities and vice versa due to the tension between conveying the credible use of forces and preserving reliable options to counter an attack. Additionally, some forces are better suited to produce deterrent effects, though they do not provide an effective denial and damage-alleviating capability.[13] Finally, deterrence by threat of cost imposition is not focused on the direct defense of the forces in question. Instead, it threatens the broader punishment of an adversary, raising the cost of an attack.[14]

Deterrent forces designed for cost imposition against countervalue targets may not be suited for counterforce targets necessary to resist an attack. For example, nuclear weapons as a countervalue implement may impose tremendous costs on an adversary's cities but do little to defend against an incoming salvo of nuclear weapons in kind.[15]

On the other hand, defensive capabilities focused on counterforce targets required to resist attack and mitigate war damage may do little to deter aggression if they cannot inflict satisfactorily high costs on an opponent. Antiaircraft artillery may resist strategic bombers but would be mild deterrents by their inability to impose high costs on an adversary's assets outside the artillery's defensive reach.

This tension requires simultaneously considering the reduction of the probability of war through deterrence and mitigating its consequences through defensive measures. As this analysis suggests, to field effective forces designed to create a deterrent effect before the war and defensive capabilities at the onset of war requires a blend of

11. Snyder, *Deterrence and Defense*, 3–5.
12. Snyder, 4.
13. Snyder, 4.
14. Michael J. Mazarr, "Understanding Deterrence," in *Netherlands Annual Review*, 16.
15. Snyder, *Deterrence and Defense*, 6.

attributes applied to a nation's military forces.[16] These attributes must provide cost imposition via countervalue strategies communicated to an opponent as capable and credible while maintaining defensive counterforce capabilities that reduce vulnerabilities and retain the element of surprise to resist attack if deterrence were to fail.

The US Deterrence Strategy

The *National Security Strategy* pursues deterrence through an integrated approach. Integrated deterrence combines all instruments of US national power with Allies' and partners' capabilities across all domains and theaters during peace, competition, and armed conflict to dissuade potential adversaries from hostile activities.[17] Integrated deterrence seeks to demonstrate to an adversary that the United States' combined strengths and capabilities present unacceptable costs outweighing the benefits of the adversary's pursuit of conflict.

Central to this approach is the flexibility of options it provides US leadership by working across all instruments of national power, including military, informational, diplomatic, financial, intelligence, economic, legal, and developmental together with Allies and partners. Integrated deterrence allows the United States to shape adversary perceptions of risks and costs of actions, at any time and across any domain.[18]

The *National Defense Strategy* articulates how the Department of Defense will pursue deterrence by utilizing all domains acting together. The strategy articulates three ways to organize deterrent effects: deterrence by denial, deterrence by resilience, and deterrence by direct and collective cost imposition.[19] Using integrated deterrence, the strategy implements denial of benefit through the imposition of costs by leveraging all available branches and domains. For example, an attack against US and Allied space systems can be deterred by denying the benefit of attack through resilient systems while presenting the threat of retaliation—cost imposition—within any domain. Fielding O-ASATs could complement deterrence by cost imposition within the space domain by increasing the availability of options to US leaders' integrated deterrence strategy.

Deterring and Defending in Space

The United States requires access to and use of space to enable its way of life. Critical infrastructure for national security, the economy, transportation, science, technology, and other sectors rely on space-based capabilities.[20] Therefore, the Department of

16. Snyder, 4–5.

17. Joseph R. Biden Jr., *National Security Strategy* (Washington, DC: White House, October 2022), 22, https://www.whitehouse.gov/.

18. Biden, 20; and Chairman of the Joint Chiefs of Staff (CJCS), *Strategy*, Joint Doctrine Note (JDN) 1-18 (Washington, DC: CJCS, April 25, 2018), viii, https://www.jcs.mil/.

19. Lloyd J. Austin III, *2022 National Defense Strategy of the United States of America* (*NDS*) (Washington, DC: DoD, October 2022), 8, 9, https://media.defense.gov/.

20. White House, *Space Priorities Framework*, 3, 6.

Defense recognizes space as a vital US national interest.[21] The *Defense Space Strategy*, subordinate to the *National Defense Strategy*, addresses deterring adversary attempts to degrade US critical infrastructure and defending against the hostile use of space. The space strategy requires the United States to protect and defend Ally, partner, and commercial space capabilities.[22]

Role of US Space Command

Within the Department of Defense, US Space Command is tasked with the protection and defense of US space assets. In particular, it "plans, executes, and integrates military spacepower into multi-domain global operations to deter aggression, defend national interests, and when necessary, defeat threats."[23] Given the command's area of responsibility of 100 kilometers above mean sea level, it is uniquely poised to command and control the use of O-ASAT weapon systems should they one day be fielded.[24]

Space Force and Deterrence

The US Space Force leads the development of space system architectures provided to Space Command, thus providing deterrence methods relevant to the command's strategy. Its perspective on integrated deterrence is captured in the Space Force Strategy Note, *Integrated Deterrence*. The strategy note is a primer for strategic Space Force topics and is not considered an authoritative document.[25] Yet it highlights considerations for military space forces from the perspective of the Space Force chief of strategy and resources.[26]

Implications from the strategy note are drawn from the integrated deterrence concept of the *National Security Strategy* and *National Defense Strategy* and apply the space mission assurance framework to achieve denial of benefit from attack. The framework outlines mechanisms for denial of benefit and constitutes deterrence insofar as this framework is successfully communicated and interpreted by an opponent as credible and capable enough to deny sufficient benefits of a prospective attack. As the strategy note states, "Any space mission assurance efforts must be widely publicized and demonstrated in order to be effective in dissuading others."[27]

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21. Austin, *NDS*, 5.

22. DoD, *2020 Defense Space Strategy Summary* (Washington, DC: DoD, 2020), 2, https://media.defense.gov/.

23. USSPACECOM, "Ultimate High Ground."

24. *Hearing on U.S. Strategic Command and U.S. Space Command in Review of the Defense Authorization Request for Fiscal Year 2023*, 118th Cong. (2022) (statement of General James H. Dickinson, commander, USSPACECOM), 12, https://www.armed-services.senate.gov/; and CJCS, *Joint Space Operations*, Joint Publication (JP) 3-14 (Washington, DC: CJCS, 2023), 1-2.

25. US Space Force (USSF), *Integrated Deterrence*, Space Force Strategy Note 1-23 (Washington, DC: USSF, February 6, 2023), 0.

26. USSF, 1.

27. USSF, 6.

The space mission assurance framework articulates the denial of benefit through three approaches: defensive operations, reconstitution, and resilience. Defensive operations provide space domain awareness for warning and counterforce systems for defense.[28] Reconstitution replenishes lost functions after an attack or catastrophic event, exemplified by rapid launch and the establishment of new ground stations when needed. Resilience is "the ability of an architecture to support the functions necessary for mission success . . . in spite of hostile action."[29]

Resilience methods are subdivided into six categories: disaggregation, distribution, diversification, proliferation, protection, and deception. Disaggregation separates capabilities onto different platforms so that the effect of losing one platform does not result in multiple mission impacts. Distribution is accomplished by using various distributed nodes working together as a single node to reduce the effect of any node's loss. Diversification uses a variety of sources, payloads, and partners in different orbits to contribute to the same mission.

Proliferation is achieved through quantities of scale where contributions of many copies of the same platform, payload, or system accomplish a mission. Protection includes onboard active and passive countermeasures to mitigate and deny adverse effects to missions. Finally, deception requires hiding the strengths and weaknesses of capabilities to reduce an opponent's ability to anticipate and counter that capability.[30] Incorporating principles of space mission assurance into Space Force space system architectures can aid US Space Command's ability to deter through the denial of benefit.

The strategy note does not discuss implications for establishing deterrence by cost imposition but does state that "significant defensive and offensive space capabilities may dissuade others from attempting to compete in space."[31] This implies the inclusion of counterforce systems for defense and countervalue systems for offensive operations may be required to fully complement a deterrence strategy by cost imposition.

Deterrence and Defense in the Competition Continuum

The US military operates under a spectrum of conflict known as the competition continuum, "a world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict."[32] Effective deterrence during competition below armed conflict can prevent a transition to armed conflict.[33] Space Command, employing Space Force and other military space systems on orbit, must contribute to integrated deterrence below armed conflict and to defense in armed conflict.

28. OASD (HD&GS), *Space Domain*, 3.
29. OASD (HD&GS), 3.
30. OASD (HD&GS), 6–8.
31. USSF, *Integrated Deterrence*, 6.
32. CJCS, *Competition Continuum*, JDN 1-19 (Washington, DC: June 3, 2019), 2, https://www.jcs.mil/.
33. CJCS, 5–6.

O-ASATs in Deterrence and Defense

US Space Command may be required to enhance deterrence by direct and collective cost imposition in the space domain. O-ASATs could achieve this as part of a broader integrated deterrence strategy. This strategy would be suited for deterring an adversary that valued their space systems by complicating their cost-benefit calculations before they initiate armed conflict. Fielding orbital space weapons for a cost imposition deterrence strategy would require their general capabilities to be communicated in some capacity that conveyed the message to an opponent that the weapons could inflict high costs and that the United States would credibly use them. The command may also require O-ASATs designed to provide a counterforce component to fulfill the defensive operations element of space mission assurance for the space enterprise.

O-ASATs, like satellites with traditional space missions, are subject to the characteristics of the space environment. The satellites' propellant required to maintain their position and attitude or adjust their orbits is not currently refreshed and constrains their operational life and orbital regimes. Once satellites are placed in an orbital regime, such as low Earth orbit, highly elliptical orbit, or geosynchronous orbit, they are generally confined to those orbits. Due to their limited maneuverability, observers on the ground can track satellites and predict their orbits. States without tracking equipment can purchase satellite tracking data commercially, and US Space Command publishes tracking data at Space-Track.org.[34] Military and intelligence satellites maintain levels of secrecy to obscure mission details. Still, their general purposes can be inferred based on the orbits they are placed in and the characteristics of their radio emissions.[35]

O-ASATs must contend with these realities that challenge their durability as a deterrent threat. Durability consists of survivability, resilience, and sophistication.[36] Survivability relates to the opposing nations' knowledge of satellites' predicted orbits through their space-tracking capabilities. Further, many countries can disrupt, degrade, and destroy satellites with kinetic and nonkinetic means.[37]

China, Russia, and India have ground-based direct-ascent ASAT missiles capable of targeting and destroying satellites.[38] Threats exist on orbit, as demonstrated by Russia's tests of an O-ASAT near a US national asset beginning in 2019.[39] China has fielded an orbital servicing platform in geosynchronous orbit with dual-use capabilities

34. Defense Intelligence Agency (DIA), *Challenges to Security in Space, Space Reliance in an Era of Competition and Expansion* (Washington, DC: DIA, 2022), 43, https://www.dia.mil/; and Login page, Space-Track.org (website), accessed September 21, 2023, https://www.space-track.org/.

35. Air Command and Staff College (ACSC) Schriever Space Scholars & Air War College (AWC) West Space Seminar, *AU-18 Space Primer* (Maxwell AFB, AL: Air University Press, 2023), 19, https://www.airuniversity.af.edu/.

36. Miller, "Preventing War," 38.

37. Miller, 40.

38. Todd Harrison et al., *Space Threat Assessment 2022* (Washington, DC: Center for Strategic and International Studies [CSIS], 2022), 3, https://csis-website-prod.s3.amazonaws.com/.

39. DIA, *Challenges to Security*, 29; and W. J. Hennigan, "Exclusive: Strange Russian Spacecraft Shadowing U.S. Spy Satellite, General Says," *Time*, February 10, 2020, https://time.com/.

that could be operated nefariously as an O-ASAT.[40] Other nations possess the ability to jam and lase satellites, causing various levels of degradation to satellite systems.[41]

Satellites generally cannot return to a secure base or hide in a hangar until an opportune moment for deployment. Though a spaceplane can be protected on the ground and transit between the Earth and space, it requires a rocket launch that is generally restricted to a few locations potentially vulnerable to conventional strikes, eliminating its effectiveness in space if not already on orbit. Additionally, timelines necessary to respond to threats in orbit may be shorter than launching in a crisis, thus detracting from a spaceplane's ability to provide a counterforce capability. Further, conducting a launch precludes the element of surprise, and a spaceplane must also contend with survivability considerations once in orbit.

Resilience, referred to as weapon potency, describes the extent to which an opponent can nullify a weapon system once employed and remain effective as a deterrent or defense once revealed.[42] If an O-ASAT system has a limited magazine depth, it must be refreshed once used.[43] If an O-ASAT's capability is predicated on its secrecy, it does not provide a deterrent effect. If its capability depends on the element of surprise, then it suffers as a defensive measure once revealed.

The level of sophistication a space weapon possesses contributes to its ability to deter. If an opponent can copy the weapon system, it can be used against the deterrer. This factor encourages the deterrer to hide its capability for defense, thus nullifying the deterrent effect of that space weapon.[44]

Achieving a deterrent effect with O-ASATs requires they be communicated to an opponent as capable and their implementation credible. This provides a dilemma for a singular capability that opponents can target to counteract and duplicate, reducing its deterrent and defensive strength once revealed.[45] The solution to overcome obstacles of O-ASAT system durability is to identify an architecture of systems that achieve deterrent and defensive effects through different approaches that complement each other.

O-ASATs and Space Mission Assurance

The SMA framework provides principles to enhance the denial of benefit and thus improve survivability attributes within an O-ASAT's architecture. For example, the Space Force could develop multiple types of capabilities and reveal some of them, reducing their element of surprise to communicate a capability for deterrence while reserving other capabilities to maintain defensive options in the outbreak of war.[46] Fielding multiple types of O-ASAT systems could achieve the principles of defensive

40. DIA, 18.
41. DIA, 17, 28; and Harrison et al., *Space Threat Assessment 2022*, 10, 21, 33.
42. Miller, "Preventing War," 41.
43. Miller, 42.
44. Miller, 43.
45. Miller, 39.
46. Miller, 52.

operations, reconstitution, and resilience, thereby providing options for deterrence and defense while minimizing the effects of survivability, potency, and sophistication.

Two satellite developmental approaches to O-ASATs, when combined, can achieve SMA principles: inexpensive assets in large quantities and highly specialized assets in smaller quantities. Inexpensive assets are typically small and fulfill a limited range of capabilities. Their strength is in their high numbers and ability to work as a broader architecture to accomplish a defined mission set. Owing to their lower costs, inexpensive assets are best suited for reconstitution and proliferation strategies.

Highly specialized assets primarily focus on delivering superior capabilities, requiring enhanced technical sophistication. As a result, each satellite is typically more expensive and individually more capable than inexpensive assets for a defined mission. These systems are costly to proliferate and therefore better served by onboard protections that enhance their survivability but add weight and additional cost. Finally, these systems are appropriate for deception tactics because their lower numbers more easily obscure their purposes and capabilities.

Architectures can use both approaches to achieve elements of disaggregation—spreading their specific effects across the constellation, distribution—enabling them to work together by sharing data to accomplish their missions, and diversification—placing assets in different orbits to complement each other. The United States' missile warning satellite systems aim to achieve this architectural design of combining the two approaches using specialized systems like the Space-Based Infrared System (SBIRS) coupled with the proliferation of Tranche 0 and Tranche 1 satellites developed by the Space Development Agency.[47] This constellation of satellites achieves resilience through proliferation and diversification, allowing its mission to endure disruption to one of its satellites.

Achieving deterrence through denial of benefit and cost imposition while preserving defensive capabilities with O-ASATs requires the two types of system designs be pursued simultaneously. Inexpensive O-ASATs are suitable for overtly communicating a countervalue capability to an opponent. Yet they are more challenging to conceal, resulting from the large quantities required for their resilient attributes. By contrast, highly technical, specialized systems are easier to keep secret due to their fewer numbers and are more capable of fulfilling a counterforce role against adversary O-ASATs should a conflict break out.

Both approaches require their effects and capabilities to be measured by different standards, those of counterforce and countervalue, so combining them provides an aggregate utility to the architecture.[48] Both approaches seek to maximize a deterrent

47. Sandra Erwin, "L3 Harris to Deliver Five Missile-Warning Satellites for 2023 Launches," *SpaceNews*, July 27, 2022, https://spacenews.com/; US Government Accountability Office (GAO), "Missile Warning Satellites: Comprehensive Cost and Schedule Information Would Enhance Congressional Oversight," GAO (website), September 22, 2021, https://www.gao.gov/; and DoD News, "Space Development Agency Successfully Launches Tranche 0 Satellites–Space Development Agency," Space Development Agency (SDA), April 2, 2023, https://www.sda.mil/.

48. Snyder, *Deterrence and Defense*, 5.

capability while preserving and enhancing a defensive one by leveraging the principles of space mission assurance.

O-ASATs for Defensive Value

Highly specialized O-ASATs focused on delivering the most effective capabilities are appropriate for the counterforce role. These systems can be designed to maintain the element of surprise and can provide the greatest effects to contend with the most capable adversary O-ASATs. To preserve their survivability, weapon potency, and sophistication while maintaining the element of surprise, these systems and their capabilities should be closely guarded and kept secret, thus protected from adversary copying.[49] The systems could field nonkinetic weapons to increase their magazine depth to mitigate weapon potency concerns—preventing the system from being nullified after use.[50]

These O-ASATs are likely the most expensive due to the premium placed on providing capability. Owing to their cost, these systems would be constrained to a relatively small constellation, reducing their ability to rely on proliferation or reconstitution for survivability. Such systems could instead depend on protection measures, although this would add to their costs per unit. Highly advanced O-ASATs would also depend on deception and could be hidden through various means, such as posing as benign satellites in peacetime. Obscuring a satellite's true purposes would be challenging at scale and would therefore be suited to low-density constellations.

These O-ASATs could fulfill the defensive operations component of space mission assurance's denial-of-benefit principles for the broader space architecture by providing counterforce capabilities to resist attacks from adversary O-ASATs. These capabilities would not directly contribute to deterrence by denial of benefit. But if armed conflict broke out and highly developed systems successfully denied an attacker after deterrence failed, this denial could deter an opponent from risking future hostilities.[51]

If selectively revealed prior to the start of hostilities, they may also provide an immediate deterrence role in situations transitioning from below-armed conflict into armed conflict by complicating adversary planning. This strengthens the perception by the adversary of the overall architecture's capability, despite introducing additional vulnerability by compromising the element of surprise.

Along with the stated benefits, secret, highly specialized O-ASATs present drawbacks that extend beyond their limited deterrent role. They are less likely to be used during competition below armed conflict because revealing them presents disadvantages to their defensive value. Their highly classified nature presents barriers to integrating and exercising these systems with international partners. Low numbers of highly classified systems would be expected to result in a smaller cadre of trained

49. Miller, "Preventing War," 44.
50. Miller, 41–42.
51. Miller, 44; and Snyder, *Deterrence and Defense*, 32.

personnel to operate them and to develop tactics, techniques, and procedures (TTPs) for their implementation, which may also reduce their effectiveness in war. Finally, the nature of their classification makes it more difficult to partner with industry to incorporate new solutions from smaller companies that may not possess the classified accesses required. Moreover, such companies may also be excluded due to higher costs resulting from tighter security measures.

O-ASATs for Deterrent Value

Deterrence by cost imposition in space using an O-ASAT system requires the ability to communicate a countervalue capability that satisfactorily overcomes the challenges of survivability, weapon potency, and sophistication to an adversary who also deems their use credible. Overt inexpensive O-ASATs scalable to large quantities focused on a countervalue mission are appropriate for in-space options to provide deterrence through cost imposition. These systems enhance US messaging options within the competition continuum, especially below the level of armed conflict, that do not reveal their most sensitive capabilities. Further, these systems provide a countervalue benefit during armed conflict by disabling critical supporting military satellites in times of war. Overt O-ASATs facilitate increased numbers of personnel trained on their capabilities and allow greater collaboration with Allies and partners.

Communication

An adversary must value the continued existence of its space systems in order for countervalue-capable O-ASATs to have a deterrent effect. Moreover, credible communication through public announcements, messaging, and demonstrations of capabilities through exercises and testing help ensure the countervalue capability is taken seriously and incorporated into an adversary's cost-benefit calculations as they consider initiating hostilities.[52]

Overt systems would enable US Space Command to respond to challenges on orbit within the competition continuum, especially during situations below armed conflict. For example, friendly O-ASATs can escort an adversary O-ASAT out of a defined keep-out zone like a fighter aircraft escorts intruding aircraft out of its airspace. Russia demonstrated an O-ASAT capability in 2020 with its test of Cosmos 2543 near a US satellite.[53] With an overt capability, the United States could respond to close approaches from O-ASATs—an example of an aggressive action below armed conflict—to communicate credible resolve and consequences within the space domain. Overt O-ASATs provide Space Command the ability to communicate through actions on

52. USSF, *Integrated Deterrence*, 4, 5; and Stephen L. Quackenbush, "Deterrence Theory: Where Do We Stand?," *Review of International Studies* 37, no. 2 (2011): 761.

53. DIA, *Challenges to Security*, 29; and Hennigan, "Strange Russian Spacecraft."

orbit that unacceptable behavior will be opposed and send a message of strong normative disapproval.[54]

Capability

Capabilities of overt O-ASAT systems would primarily be intended to hold adversary military-supporting satellites at risk, including satellite communications; intelligence, surveillance, and reconnaissance; position, navigation, and timing; and others. These military-supporting satellites generally have limited protections and maneuverability, making them ideal targets for inexpensive O-ASATs and less susceptible to weapon potency concerns resulting from their target's limited defenses. Therefore, the capability of an O-ASAT to target an adversary military-support satellite is not diminished by the general awareness of the O-ASAT's weapon's capabilities. Additionally, incorporating reconstitution as a strategy for space mission assurance refreshes the weapon potency of the constellation.

Inexpensive O-ASAT systems would rely on SMA principles of reconstitution and proliferation to enhance their survivability. Simultaneously, secretive O-ASAT systems provide qualities of disaggregation, distribution, and diversification across an integrated architecture that achieves denial of benefit from attack.

The proliferation of inexpensive overt O-ASATs enhances deterrence by complicating adversary decision calculus and increasing demands on their targeting during armed conflict. These systems affect adversary risk assessments by increasing the anticipated costs for any potential aggressor during hostilities.[55] Proliferating these relatively inexpensive systems complicates an adversary's cost-benefit calculation by driving complexity and making countering multiple targets more expensive. In addition to increasing the monetary costs of a potential attack, an attack against high numbers of O-ASATs risks escalation, denying a low-risk fait accompli.[56] Fielding overt O-ASATs presents the adversary with greater burdens, complicating a first strike by shifting an adversary's focus from targeting friendly, expensive supporting satellites required for a terrestrial conflict toward countering relatively inexpensive assets.

Deterrence commitments made by inexpensive O-ASATs will be less effective if they can be countered, but the deterrer does not need to prove they can defeat the opponent if they can convince the opponent that sufficient costs would outweigh the opponent's prospective gains.[57] An adversary may field O-ASATs that are superior in capability to the friendly inexpensive O-ASATs, detracting from the inexpensive weapons' ability to deter attack. Still, adversary O-ASAT systems must also overcome survivability, weapon potency, and sophistication challenges that can be exploited by fielding more capable secretive systems in reserve. By blending the two

54. Patrick M. Morgan, "Taking the Long View of Deterrence," *Journal of Strategic Studies 28*, no. 5 (2005): 755.

55. Mazarr, "Understanding Deterrence," 19.

56. Mazarr, 20.

57. Miller, "Preventing War," 35.

approaches, overt and secret, the denial of benefit from attack can be achieved even if deterrence fails.

O-ASAT capabilities are enhanced by introducing overt assets that permit greater contributions to TTPs and military expertise. Revealing O-ASATs and relieving barriers presented by classification allow for a broader cadre of military units to participate in exercises and TTP development and to contribute to doctrinal philosophies on their use. General B. Chance Saltzman, chief of space operations for the US Space Force, has emphasized the necessity of increasing combat credible forces:

> A ready force has the training, tactics, and operational concepts required to accomplish the mission across the spectrum of operations—from competition to high-intensity conflict. A combat-credible force has the demonstrated ability to execute and sustain operations in the face of a determined adversary.[58]

Training with and exercising overt O-ASATs strengthens the overall military thinking and combat credibility of the units assigned to those systems. Additionally, these military professionals can apply lessons learned in exercises and TTP development to enhance defensive applications of secret O-ASAT systems. By fielding assets available for exercising and teaching general theory related to their use, overt O-ASATs bolster the knowledge base and requirements for more capable, overt, and secretive systems. This effect strengthens O-ASAT deterrence value by demonstrating a combat-credible team of military professionals trained to outthink an adversary.

Credibility

Space weapon systems may be among the first options to employ as tensions escalate toward armed conflict because they do not directly result in the loss of life. O-ASAT systems have narrow mission sets focused on disabling, disrupting, degrading, and destroying other satellites. The use of overt O-ASAT systems can instill credibility through their limited effects and lack of collateral damage.

Overt O-ASATs present the ability for the United States to incorporate Allies and partners within exercises and messaging strategies. Working with Allies and partners is central to the *National Security Strategy*, *National Defense Strategy*, and US Space Command strategies.[59] Exercising O-ASAT systems and demonstrating their general use cases can message to an adversary that the United States and its partners are prepared to respond to hostilities and give an impression of how that response might manifest. This adds credibility as the United States works with its Allies to exercise various contingencies and message potential responses to actions they deem unfavorable.

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58. Greg Hadley, "To Deter in Space, US Needs Resilience—and an 'Offensive Threat,' " *Air & Space Forces Magazine*, April 6, 2023, https://www.airandspaceforces.com/.

59. Biden, *National Security Strategy*, 11; Austin, *NDS*, iv; and Dickinson, statement, 3.

Additional Deterrence Considerations

Incorporating overt O-ASATs into US, Allied, and partner exercises and operations to achieve a legitimate deterrent effect can aid the development of international norms. The international adoption of normative behavior in space can reduce hostilities and the role of deterrence as the only means to dissuade unwanted actions. Norms establish regular behavior patterns and limit accidental interference and ambiguous activity.[60] As one analysis notes, in the absence of established internalized norms, deterrence socializes and helps educate actors by sending strong signals of normative disapproval. The existence of norms is confirmed and reinforced by actions to enforce them when violated.[61]

Norms are underwritten by deterrence associated with the threat of cost imposition, thereby increasing their effectiveness. Overt O-ASATs commanded by US Space Command can provide credibility for intervention when norms are violated. Yet as the analysis further contends, deterrence is most effective when employed in support of norms widely regarded as legitimate.[62]

Arms Race in Space?

The United States may receive criticism for fielding overt O-ASATs by advancing a perception that they may lead to an arms race in space.[63] Yet, Space Command is responsible for deterring threats from Russian O-ASAT developments and Chinese dual-use satellites while taking steps to defend against them. The command could pursue an approach that maintains its ability to deter and defeat threats that minimize the acceleration of an arms race in space to respond to threats. Such a strategy would enable the command to moderate the speed at which it reveals capabilities to match an adversary. Adopting a blended architecture of proliferated overt O-ASATs and secret O-ASATs would allow Space Command to manage the capabilities it displays to an adversary on orbit for deterrence while reserving capabilities for defense.

Deliberately revealing capabilities at parity with or, in some cases, inferior to an adversary can slow the dynamics of an arms race while preserving its greatest capabilities in secret. If an adversary adopts a similar strategy of proliferating O-ASATs, the command may choose to reserve its most capable O-ASATs to contend with those threats. By revealing O-ASAT capabilities, US Space Command's partnership with Allies could also demonstrate the responsible use of O-ASAT systems to contribute to developing normative behavior. Space Command and Allied demonstrations of normative behavior could create an environment that reduces the dynamics of a security dilemma created by the perception of an arms race in space.

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60. Martha Finnemore and Kathryn Sikkink, "International Norm Dynamics and Political Change," *International Organization* 52, no. 4 (1998), 894.

61. Morgan, "Taking the Long View," 761.

62. Morgan, 755, 760–61, 763.

63. Miller, "Preventing War," 44.

Conclusion

As part of a broader US integrated deterrence strategy, US Space Command may choose to employ O-ASAT weapon systems. Yet the command must simultaneously deter hostilities and prepare to defend its satellites from adversary O-ASATs. An architecture of O-ASAT systems can operate throughout the competition continuum, yet singular O-ASAT systems are susceptible to durability challenges from survivability, weapon potency, and sophistication concerns.[64] This incentivizes maintaining secrecy to preserve defensive value while detracting from these systems' deterrent effects.

A solution to this dilemma involves operating overt and secretive systems within an architecture of O-ASATs that implements principles of space mission assurance to overcome durability challenges.

Secretive systems may require extremely technologically advanced capabilities that will increase their costs, resulting in lower numbers of assets suited to protection and deception methods for survivability. Yet these O-ASAT systems are critical assets in the event of active hostilities. Overt O-ASATs and the broader space enterprise should be defended by these classified, specialized O-ASAT systems designed to provide counterforce capabilities reserved for armed conflict.

Working in conceptual concert with classified systems, overt O-ASAT systems strengthen deterrence through countervalue cost imposition by communicating a capable and credible threat. These systems enable US Space Command to improve its space professionals' warfighting abilities and incorporate Allies and partners into exercises and operational planning. Overt O-ASATs should be fielded as inexpensive systems suited for proliferation and reconstitution. Overt and secretive O-ASAT systems operated within an architecture incorporating principles of space mission assurance can allow US Space Command to employ deterrent and defensive capabilities on orbit. **Æ**

64. Miller, 39.