Threatening Celestial Lines of Communication:

A Naval Counterspace Concept for Deterring China's Preemptive Space Strike

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14. ABSTRACT

This paper submits a new space deterrence concept for future United States Space Command operations. United States Space Command's current space conflict deterrence strategy relies too heavily on integrating space capabilities across the joint services. This paper reverses this perspective and examines how United States Space Command could repurpose existing joint weapon platforms to deter aggressive space competitors. Naval surface action groups are the focal point of this deterrent concept. Surface action groups' counterspace weapons are analyzed to determine if they provide a credible threat to the People's Republic of China's celestial lines of communication. The weapons examined include the Tomahawk Land Attack Missile model E, the AN/SLQ(V)5, and the Standard Missile-3 Blocks IB and IIA. The paper concludes with recommendations to transform the deterrence concept into a viable option for United States Space Command.

15. SUBJECT TERMS (Key words)
Celestial Lines of Communication, Direct Ascent Anti-Satellite, Co-Orbital Anti-Satellite

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Introduction

According to the United States Space Command (USSPACECOM) Strategic Vision, USSPACECOM considers its primary mission the deterrence of "aggression through the provision of space warfighting options that preserve United States' and Allied competitive advantage."[1] USSPACECOM seeks to deter aggressive actions in space by achieving space superiority and integrating space capabilities across the joint forces. While striving for this level of space dominance is a noble endeavor, the vision statement provides sparse substance regarding how USSPACECOM intends to achieve its deterrence mission. USSPACECOM has not accurately framed the space deterrence issue. Joint forces already use space capabilities to conduct their various operations. Simply integrating additional space services across joint platforms does not provide a foundational strategy to deter space conflict with a near-peer competitor.

USSPACECOM must examine new space control concepts and determine how the joint services can provide their organic counterspace capabilities to deter a preemptive space strike from a near-peer adversary. Deterring powerful competitors in space requires USSPACECOM to evolve their concept of space control towards using joint platforms to threaten an adversary's celestial lines of communication (CLOC).[2] The appropriate question must then be, which joint platforms can USSPACECOM leverage immediately to threaten a competitor's CLOC? USSPACECOM should repurpose and organize U.S. Naval surface action groups (SAG) to deter a space conflict with a near-peer adversary by posturing them in critical locations to threaten the competitor's CLOC.

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[1] USSPACECOM Public Affairs, *Commander's Strategic Vision*, 6.

[2] Klein, *Space Warfare*, 51-54. Klein defines CLOC as lines of communication in and through space "used for the movement of trade, materiel, supplies, personnel, spacecraft, electromagnetic transmission, and some military effects." CLOC consists of physical and non-physical domains. The physical domain includes anything tangible that either supports or travels through space. The non-physical domain consists of electromagnetic transmissions to, through, and from space.

Few weapon systems offer more counterspace capabilities in single platforms than the *Arleigh Burke* guided-missile destroyers (DDG) and the *Ticonderoga* class guided-missile cruisers (CG). Therefore, this deterrence analysis will focus on deploying DDGs and CGs in SAGs, deemed counterspace SAGs, and staging them in key areas to threaten an enemy's CLOC with their counterspace weapons. Within the CLOC concept, the terms ground segment and space segment will constitute the physical domain. The link segment will denote the non-physical domain, consisting of the electromagnetic transmissions to and from space. Together, these three segments form the definition of CLOC used throughout this analysis and are the framework against which to analyze using counterspace SAGs to deter aggressive space actors. The People's Republic of China (PRC) recently transformed itself into a capable spacefaring nation and has demonstrated threatening counterspace capabilities. The PRC is arguably the United States' most formidable space competitor and will be the subject of this deterrence concept.

Current Strategic Assessment and Deterrence Concept

The PRC is committing tremendous economic and political capital to constitute its space enterprise. The PRC strives to be a global space power by 2030 and intends to compete with the United States in space militarily and economically.[3] The PRC currently possesses a suite of direct ascent anti-satellite (DA-ASAT) missiles capable of destroying U.S. satellites through low-Earth orbit (LEO).[4] In 2010, the PRC began testing co-orbital counterspace techniques when it used two Shijian satellites to conduct proximity operations. By 2019, the PRC demonstrated co-orbital object placements via their TJS-3 satellite.[5] Organizationally, the PRC established the People's Liberation Army Strategic Support Force (PLASSF) in 2015 to oversee the

[3] Bowe, *China's Pursuit of Space Power Status and Implications for the United States*, 2.
[4] Pollpeter, *China's Space Narrative*, 14-15. The Chinese have incrementally improved their ASAT technology, with initial success in 2007 when they employed an SC-19 DA-ASAT to destroy one of their defunct weather satellites. From 2013-2018, the PRC tested several DN-3 DA-SATs that demonstrated trajectories that could reach higher orbits, thus placing numerous high-value U.S. military satellites at risk.
[5] Ibid, 15.

employment, training, and tactics development of its DA-ASAT weapons and other counterspace capabilities.[6]

China's concept of space superiority mirrors U.S. space operations doctrine. PLASSF doctrine describes the space domain as the new center of gravity for military operations and denotes, "the goal of space warfare and space operations is to achieve space superiority."[7] Given these doctrine considerations, the PLASSF is prepared to conduct a rapid preemptive space attack to blind their opponent and gain the initiative in a large-scale conflict.[8] The PRC deploys and operates its space forces through an extensive space tracking and control network and several domestic launch complexes. This intricate collection of ground systems constitutes the bulk of China's CLOC, and a successful preemptive space strike would require this system to be intact.

Counterspace SAGs would provide USSPACECOM with a flexible and mobile deterrent against the PRC's preemptive space strike. In this deterrence concept, counterspace SAGs could patrol international waters near China's CLOC, placing portions of their CLOC's three segments under threat through a combination of kinetic and non-kinetic capabilities. The persistent CLOC threat posed by the counterspace SAGs would dampen the effectiveness of China's preemptive strike by initiating attacks on vital space infrastructure and space assets after a verified attack. This deterrence concept will determine the optimal locations for Counterspace SAGs to inflict maximum damage against Chinese CLOC. The PRC could abandon its preemptive attack strategy if counterspace SAGs inflicted sufficient damage against their CLOC. The Chinese would deem a preemptive strike against the United States cost-prohibitive, achieving the desired deterrent effect.[9] The PRC's ground segment is the foundational element of their CLOC.

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[6] Harrison, *Space Threat Assessment*, 10.
[7] Weeden, *Global Counterspace Capabilities,* 63.
[8] Ibid.
[9] Chairman, U.S. Joint Chiefs of Staff, *Joint Operations,* Joint Publication (JP) 3-0. JP 3-0 defines deterrence as "the prevention of action by the existence of a credible threat of unacceptable counteraction and/or belief that the cost of action outweighs the perceived benefits." The proposed deterrent strategy can achieve this by threatening PRC

Therefore, the deterrence concept analysis must begin with examining the counterspace SAG's kinetic performance against China's ground segment elements.

Ground Segment

The PRC's ground segment controls their space enterprise and provides the communications required to operate their counterspace weapons, making elements of the ground segment ideal targets for counterspace SAGs. The ground segment infrastructure provides the space situational awareness necessary to track their space assets and record the orbital patterns of U.S. satellites, giving them predictive models to use for their DA-ASATs and co-orbital threats.[10] The PLASSF Space System Department oversees and operates PRC military space assets and launch centers through the Xi'an Satellite Control Center (XSCC). The PLASSF also fuses and distributes tracking information to the People's Liberation Army Rocket Force through the Beijing Space Command and Control Center (BSCCC).[11] The XSCC sends and receives telemetry, tracking, and control (TT&C) updates through several subordinate tracking stations within China. Each subordinate station monitors and controls a designated segment of the PRC's space enterprise. Many of these tracking stations lie near China's coastline and are within the kinetic range of counterspace SAGs patrolling the seas along the Chinese mainland.

Tomahawk Land Attack Missiles (TLAM) Block IVs carried on *Arleigh Burke* DDGs and *Ticonderoga* CGs pose a credible threat to the PRC's ground segment. The TLAM Block IV is the ideal kinetic system to engage the XSCC, BSCCC, and subordinate TT&C stations. The TLAM Block IV munition has a robust Global Positioning System (GPS) anti-jam capability to help it survive in China's GPS degraded environment. [12] If the GPS anti-jam capability fails, the TLAM Block IV can still perform terminal guidance using its Digital Scene Matching Area

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CLOCs with counterspace SAGs. Alternatively, counterspace SAGs would give the United States a ready option to initiate a preemptive attack, if required, against Chinese CLOCs to alter the initial phase of a large-scale conflict in favor of the United States.

[10] Wood, *China's Ground Segment*, 12.

[11] Stokes, *China's Space and Counterspace Capabilities and Activities*, 23.

[12] Raytheon, "Tomahawk Cruise Missile", 1.

Correlation system (DSMAC).[13] The TLAM Block IV-E (TLAM-E) is now the only TLAM in production and has a 1,400 mi effective range.[14] This long-range would allow counterspace SAGs to strike elements of the PRC's ground segments from many locations within international waters. Figure 1 below demonstrates which PRC tracking stations and control centers would be within the TLAM-E's 1,400 mi effective range if a counterspace SAG patrolling the East China Sea were to fire the missile at the 200 nm economic exclusion zone (EEZ) boundary.

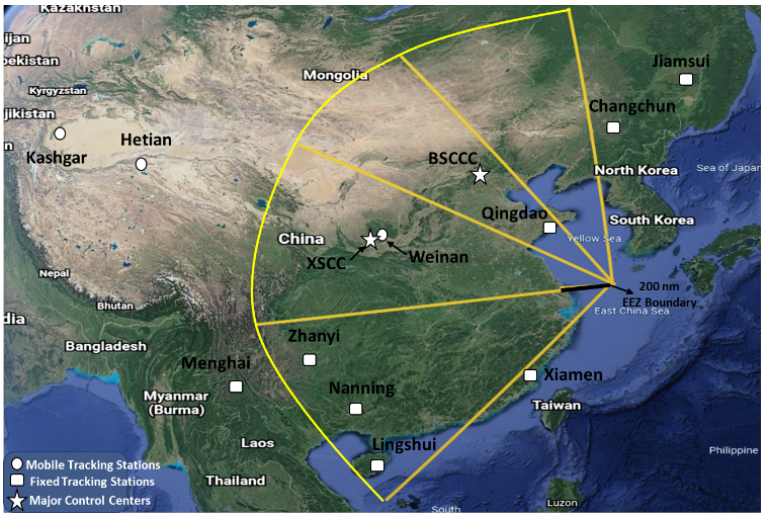

Figure 1: TLAM-E Effective Engagement Range (1,400 mi) from East China Sea[15]

Per figure 1, the TLAM-E engagement fan encompasses the XSCC, BSCCC, and many fixed subordinate tracking stations. The Jiamsui and Changchun tracking stations are not within the engagement fan as shown to avoid firing over North Korean airspace. However, TLAM-Es are steerable and could be guided around the North Korean border to prevent alarm. After performing this maneuver, the Jiamsui and Changchun stations would be well within the TLAM-E's engagement range. The Menghai station would be safe from a counterspace SAG in the East China Sea, but TLAM-Es could destroy the station if fired from a second counterspace SAG

[13] Ibid., 1-2. The DSMAC correlates stored geo-reference maps against data gathered through the Terrain Counter Matching guidance system to navigate accurately.
[14] Jones, "Long-range Precision Strike Cruise Missiles in NATO Operations", 33.
[15] Figure data reconstructed from information found in Wood, *Chinese Ground Segment*, 26. The distances and map were generated via the Google Earth tool.

patrolling the South China Sea, outside of the Lingshui station.[16] A coordinated kinetic response of this magnitude would cripple the PRC's space enterprise and degrade the PRC's ability to track our satellites for further counterspace strikes.

Destroying the XSCC alone would effectively isolate the fixed and mobile tracking stations, eliminating the centralized dissemination of new satellite tasking orders. Even if the TLAM-E strikes were marginally successful, destroying only the tracking stations along the coast, the PRC's space enterprise would still suffer degradation. The Xiamen subordinate tracking station supports sections of the Beidou constellation, the PRC's version of GPS, and its destruction would have wide-reaching impacts on China's precision guidance weapon systems.[17] The Lingshui tracking station monitors and controls the PRC's experimental spacecraft, and its elimination may affect the command and control (C2) of their co-orbital counterspace satellite prototypes.[18] Two counterspace SAGs dedicated to patrolling the East China Sea and South China Seas, respectively, provide sufficient kinetic weapons coverage over the PRC's space C2 centers and tracking stations. The SAGs' continuous presence would be a credible threat to the ground segment and could be sufficient to deter a PRC preemptive space strike. However, the ground segment is just one piece of the PRC's CLOC. The Chinese have sea based C2 nodes contributing to their burgeoning space influence via the link segment, and counterspace SAGs must threaten this CLOC layer to ensure adequate deterrence.

Link Segment

Counterspace SAGs could deter a Chinese preemptive strike by threatening or controlling the PRC's link segment using non-kinetic capabilities. Even with their ground segment in jeopardy, the PRC's space enterprise would remain controllable via the link segment. The PRC's

[16] Only the Kashgar and Hetian mobile stations in western China would be safe from a counterspace SAG's kinetic strikes.
[17] Wood, *China's Ground Segment*, 29.
[18] Ibid., 27.

link segment consists of civilian tracking and telemetry ships, collectively known as the Yuanwang fleet. The geographic limitations of China's ground segment require Yuanwang ships to deploy in support of satellite launches and missile tests.[19] The Yuanwang ships are positioned at various points in the Pacific Ocean to receive TT&C handover once the launch vehicle is out of the tracking stations' line-of-sight.[20] Intelligence analysts suspect the Yuanwang fleet supports military space assets.[21] However, the Yuanwang vessels maintain civilian status, limiting military responses against them. Kinetic strikes on these ships could carry undesirable legal consequences, but non-kinetic weapons provide a non-destructive and reversible alternative. Counterspace SAGs could use their electronic warfare systems to temporarily jam the Yuanwang fleet, thereby disrupting the PRC's link segment.

Within counterspace SAGs, the *Arleigh Burke* DDG and *Ticonderoga* CG's AN/SLQ-32 electronic warfare system could interfere with the Yuanwang fleet's transmissions. The AN/SLQ-32(V)5 electronic countermeasures (ECM) suite can detect surface radars beyond the horizon and sports the Sidekick multi-beam active jammer.[22] The AN/SLQ-32(V)5 system is undergoing a service-wide upgrade via the Surface Electronic Warfare Improvement Program (SEWIP) Block II, enabling full electromagnetic spectrum defensive and offensive measures.[23] The four active Yuanwang vessels execute their TT&C mission via S and C spectrum bands, common communication frequencies susceptible to signals interference.[24] Generally, the PRC allocates individual Yuanwang ships for single missions due to high maintenance costs.[25] A large-scale preemptive space strike would require numerous DA-ASAT launches, which could require the support of several Yuanwang vessels. In this scenario, multiple Yuanwang

[19] Jianing, "China Advances Maritime Space Monitoring and Control Capability," 1.
[20] Erickson, "China's Navigation in Space," 43-44.
[21] Weeden, *Global Counterspace Capabilities,* 27.
[22] Raytheon, *AN/SLQ-32(V)5 Shipboard ECM System*, 1.
[23] Stone, "Signaling Change," 22.
[24] Erickson, "China's Navigation in Space," 45.
[25] Ibid., 47.

deployments could indicate impending hostile actions. Counterspace SAGs patrolling the Chinese mainland could trail Yuanwang vessels as they depart their home ports and jam their TT&C transmissions using their SEWIP Block II systems.

Alternatively, if counterspace SAGs successfully destroyed sections of the PRC's ground segment, the Chinese would have to rely heavily on the Yuanwang fleet to assume the C2 workload for the space enterprise. In this situation, the Yuanwang fleet would have to remain near the Chinese mainland to assist with further DA-ASAT launches and provide the missing coverage. The Yuanwang's static posture would allow counterspace SAGs to employ their ECMs while remaining in a position to engage the residual ground segment elements. Counterspace SAGs would eliminate the PRC's link segment by disrupting the Yuanwang fleet. By destroying the ground segment and suppressing the link segment, counterspace SAGs would control two of the PRC's three CLOC layers and sever their ability to control their space assets over China, including co-orbital ASATs. However, the PRC's space segment would still be intact, allowing the PLASSF to continue a DA-ASAT attack based on previous U.S. satellite tracks. To achieve maximum deterrence, counterspace SAG's must threaten or control the PRC's space segment.

Space Segment

Counterspace SAGs can deter a Chinese preemptive space strike using TLAM-Es and Standard Missile-3s (SM-3) to threaten their space segment. The PRC's space segment consists of its domestic launch infrastructure, space launch vehicles, and all space assets in orbit. China's space segment must also include DA-ASAT missiles since their primary function is to travel in sub-orbital space to destroy adversarial LEO satellites. The Chinese have tested 10 DA-ASAT kinetic kill vehicles (KKV) onboard SC-19 and DN-3 interceptors.[26] Several DA-ASAT tests achieved suborbital trajectories, which are sufficient to deploy their KKV payloads and destroy

[26] Harrison, *Space Threat Assessment 2020*, 11.

LEO satellites.[27] During a preemptive space strike, analysts anticipate the PLASSF would need to launch at least 20 DA-ASATs to destroy the United States' contingent of LEO intelligence satellites. [28] All four PRC launch sites would likely be required to support a space strike of this magnitude. Counterspace SAGs patrolling international waters within the East China Sea would be a credible threat to PRC launch infrastructure and possess the kinetic capabilities to destroy or degrade the launch sites during the early stages of a verified space strike. Using TLAM-Es, counterspace SAGs could simultaneously engage several launch sites while eliminating China's ground segment elements. Figure 2 below indicates which PRC launch sites would be within the TLAM-E's 1,400 mi engagement range.

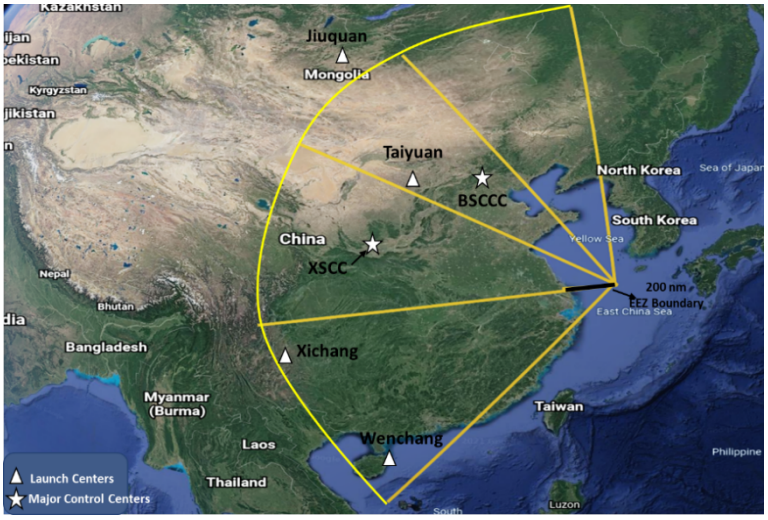

Figure 2: PRC Launch Centers within TLAM-E Effective Engagement Range (1,400 mi)[29]

According to the graphic, counterspace SAGs patrolling outside of the 200 nm EEZ would be able to strike three of four PRC launch sites.[30] Destroying the Tiayuan and Xichang launch sites would have cascading effects on the PRC's space enterprise.[31] Consequently,

[27] Weeden, *Chinese Direct Ascent Anti-Satellite Testing*, 2-3.
[28] Easton, *The Great Game in Space*, 3.
[29] Figure data reconstructed from information found in Wood, *Chinese Ground Segment*, 22. The distances and map were generated via the Google Earth tool.
[30] If the counterspace SAGs were to launch TLAM-Es just outside of the PRC 24 nm contiguous zone, the missiles would have sufficient range to reach the Jiuquan site, holding the PRC's entire launch enterprise at risk.
[31] Wood, *China's Ground Segment*, 36-38. Many LEO and high-inclination satellites launch from the Tiayuan launch center onboard Long March Rockets. The Xichang site has launched all Beidou satellites, as well as numerous communication and Earth-observation satellites.

TLAM-E strikes on these launch sites would not only hinder additional DA-ASAT launches, they would impede the PRC's ability to reconstitute their satellite constellations following the United States' retaliatory space strike. However, not all DA-ASATs launch from fixed sites, and intelligence analysts suspect that many operational DA-ASATs reside on mobile launchers. The SC-19 interceptor was adapted from the DF-21, a road-mobile medium-range ballistic missile (MRBM).[32] During a 2013 SC-19 DA-ASAT test, a DigitalGlobe imagery satellite observed the interceptor housed on a transporter-erector-launcher (TEL).[33] If the PRC were to deploy numerous DA-ASATs onboard TELs, counterspace SAGs might not have the targeting information or capacity to engage the mobile threats with TLAM-Es. However, once PRC DA-ASATs were underway, counterspace SAGs could use their SM-3 Block IBs to destroy the KKVs in flight. Aegis Ballistic Missile Defense (BMD) DDGs and CGs must be included in the counterspace SAG concept to complete their deterrence strength in the space segment layer.

Incorporating Aegis BMD ships into counterspace SAGs would ensure sufficient kinetic counters for the DA-ASAT element of the PRC's space segment. If deterrence were to fail, Aegis BMD ships could employ SM-3 Block IBs to destroy DA-ASATs from both fixed and mobile launch platforms. The SM-3 Block IB was designed to intercept MRBMs, like the SC-19 DA-ASAT, in their midcourse flight trajectories.[34] The Block IB variant has advanced target seekers and attitude control systems for adjusting its course in-flight, allowing it to destroy exo-atmospheric KKV targets in 34 of 43 flight tests.[35] Aegis BMD ships equipped with Block IB missiles are a credible threat to Chinese DA-ASATs, but SM-3 improvements are underway to make the SM-3 even more capable against DA-ASATs.

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[32] Easton, *The Great Game in Space*, 2.
[33] Weeden, *Chinese Direct Ascent Anti-Satellite Testing*, 2.
[34] O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program*, 4.
[35] Ibid., 35.

The SM-3 Block IIA is currently supplanting the SM-3 Block IB model. Compared to the Block IB, the Block IIA possesses superior range, sensor processors, and KKV, and the Block IIA is designed to counter MRBMs and intercontinental ballistic missiles (ICBM).[36] The Block IIA has performed six successful intercept tests, including the SM-3's first ICBM intercept from an Aegis BMD ship in November 2020.[37] The SM3 Block IIA's superior range and improved KKV could successfully counter the PRC's LEO DA-ASATs. Between the SM-3 IB and IIA models, Aegis BMD ships could field potent kinetic threats to the PRC's operational DA-ASATs.[38] Counterspace SAGs containing Aegis BMDs ships would provide sufficient countermeasures to deter the PRC's preemptive space strike, and if deterrence failed, those same weapons could decimate China's operational DA-ASATs.

Counterspace SAG Challenges

Counterspace SAGs operating in the East and South China Seas would face difficult challenges at the onset of a space conflict with the PRC. By patrolling China's littoral waters, counterspace SAGs would be within the PRC's anti-access and area-denial coverage (A2/AD), consisting of an array of land and sea based missile threats. The PRC operates a range of precision-guided anti-ship missiles from its mainland.[39] These missiles could strike a patrolling counterspace SAG from nearly anywhere within China. Additionally, the People's Liberation Army-Navy (PLAN) divides its naval forces to guard sections of the seas bordering China. There are 19 DDG class destroyers and 28 guided-missile frigates distributed between the PLAN East Sea Fleet (ESF) and South Sea Fleet (SSF).[40] During a preemptive strike, the ESF and SSF

[36] U.S. Government Accountability Office, *Missile Defense: Ballistic Missile Defense System Testing Delays Affect Delivery of Capabilities*, 3.
[37] U.S. Department of Defense, "U.S. Successfully Conducts SM-3 Block IIA Intercept Test against an Intercontinental Ballistic Missile Target," 1.
[38] U.S. Government Accountability Office, *Missile Defense: Ballistic Missile Defense System Testing Delays Affect Delivery of Capabilities*, 45. The Missile Defense Agency is currently procuring 351 Block IIA missiles and will soon equip Aegis BMD ships with this extensive inventory to destroy the PRC's DA-ASATs.
[39] U.S. Department of Defense, "Military and Security Developments Involving the People's Republic of China 2020," 55-56. The DF-21 MRBM and DF-26 intermediate-range ballistic missile have effective ranges of 1,500 km and 4,000 km.
[40] Dutton, *China's Evolving Surface Fleet*, 35.

would have the forces and weapons needed to engage counterspace SAGs operating in the South and East China Seas.[41] By combining the PLAN fleets and land-based missiles with their numerous land-based aircraft, the PRC could field a strong defense for their CLOCs and deter counterspace SAG operations. In this scenario, the lack of sea control could preclude successful space control.

Despite being deployed in a contentious environment, counterspace SAGs would have a short engagement timeline during a space conflict, limiting their exposure to retaliatory strikes. Space warfare will not be a protracted event; the PRC would only need hours to initiate and complete a preemptive space strike.[42] Therefore, counterspace SAGs would only need to fight and survive during this short timeframe. Within this engagement window, counterspace SAGs would not be static and would present moving targets to PRC forces as they maneuver to inflict maximum damage upon China's CLOC. To achieve this, counterspace SAGs would only need temporary and local sea control to fire their kinetic weapons against the ground and space segments and perform ECMs against the Yuanwang vessels to disrupt their TT&C transmissions. Additionally, the ships within counterspace SAGs would provide substantial air and missile countermeasures. Counterspace SAGs consisting of several DDGs, CGs, and Aegis BMD variants would possess enough anti-air missiles and ECMs to provide the defense-in-depth required to bolster their survivability as they transit between positions to continue their counterspace attacks. Upon completing their space control mission, counterspace SAGs would immediately withdraw from the PRC's hazardous littoral A2/AD environment, divest their counterspace function, and regroup with larger Naval elements to prepare for surface warfare engagements.

[41] Ibid., 58-60. PLAN destroyers field YJ-83 and YJ-62 anti-surface ship missiles, among others, that can attack enemy vessels up to 120 nm and 250 nm, respectively.
[42] Szymanski, "Techniques for Great Power Space War", 89-90.

Recommendations

USSPACECOM could transform the counterspace SAG deterrence concept into reality by relying on its subordinate Combined Force Space Component Command (CFSCC). The CFSCC plans, assesses, and integrates space operations with coalition partners and joint forces.[43] Using the PRC as a case study, the CFSCC could work with U.S. Indo-Pacific Command and the Department of the Navy to identify DDGs, CGs, and their Aegis BMD variants in the theater that could rapidly establish counterspace SAGs. These surface forces could be earmarked for pre-determined counterspace SAGs in contingency plans, forming and deploying when tensions with the PRC arise. Counterspace SAGs are not meant to be a permanent unit construct and should only be employed to deal with a specific space threat. If the threat dissipated, counterspace SAGs would dissolve, and the individual ships would return to their home unit to refit and prepare for traditional surface actions. Temporarily repurposing existing surface ships into counterspace SAGs also avoids new ship procurements.

Regarding mission ownership, counterspace SAG operations should fall under the Joint Task Force-Space Defense (JTF-SD).[44] The JTF-SD would be responsible for planning counterspace SAG deployments and operations against the PRC. The JTF-SD could also conduct exercises to develop counterspace SAG techniques, tactics, and procedures to refine the deterrence concept further.[45] Most importantly, the JTF-SD could establish standing rules of engagements and mission authorities for counterspace SAGs, empowering their commanders to take pre-determined actions when a verified space attack is underway. Beyond the PRC scenario, the JTF-SD could plan for operations against any space competitors' CLOC across all theaters, providing USSPACECOM with the means to deter preemptive space strikes worldwide.

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[43] U.S. Space Command Public Affairs, "Organization and Subordinate Commands", 1.
[44] Ibid. According to the website, along with mission partners, the JTF-SD conducts "space superiority operations to deter aggression, defend U.S. and Allied interests, and defeat adversaries throughout the continuum of conflict."
[45] The JTF-SD could then derive operational gaps from these exercises and act as USSPACECOM's capability requirements overseer to improve counterspace weapon systems.

Conclusion

USSPACECOM's current space warfare deterrence strategy focuses too narrowly on integrating space capabilities across the joint services and is insufficient to deter a preemptive space strike. USSPACECOM can improve its deterrence posture against space competitors, like the PRC, by leveraging existing Naval surface units and reorganizing them into counterspace SAGs. These counterspace SAGs could deter China's aggressive space actions by endangering their CLOC using kinetic and non-kinetic weapon systems. Regarding kinetic weapons, the TLAM-Es have sufficient range to endanger, and destroy if needed, most of the PRC's ground segment and launch infrastructure. The SM-3 Block IBs can destroy DA-ASATs in their mid-course flight, completing the counterspace SAG's threat against China's space segment. Counterspace SAGs equipped with the AN/SLQ(V)5 ECMs would possess the non-kinetic means to disrupt the Yuanwang fleet, thereby jeopardizing the PRC's link segment. Counterspace SAGs would face complex challenges while operating in China's littoral waters, but their maneuverability, short mission duration, and robust missile defense countermeasures would maximize their survivability. USSPACECOM could transform counterspace SAGs into reality by using the CFSCC and JTF-SD to earmark surface ships across all combatant commands and develop the plans and authorities required to deter China's preemptive space strike and other space competitors worldwide.

Glossary

Direct Ascent Anti-Satellite Missile (DA-ASAT) – a space weapon, launched from any Earth-based platform, designed to intercept and destroy a satellite. DA-ASATs are based on ballistic missiles but carry a kinetic kill vehicle as a payload. The kill vehicle uses onboard sensors and attitude control systems to track and destroy targets in sub-orbital trajectories.

Co-orbital Anti-Satellite Threats (Co-orbital ASAT) – space-based weapons released from host satellites in the same orbital path as the target. The co-orbital ASAT threat can also be the host satellite. Co-orbital ASAT satellites use rendezvous maneuvers to get close to a target satellite and use robotic arms or other onboard devices to destroy the target.

Celestial Lines of Communication (CLOC) – the lines of communication to and through space used for the movement of personnel, space vehicles, electromagnetic transmissions, and other military effects. CLOC consist of physical and non-physical domains. The physical domain includes anything tangible that either supports or travels through space. The non-physical domain consists of electromagnetic transmissions to, through, and from space.

Bibliography

Bowe, Alexander. *China's Pursuit of Space Power Status and Implications for the United States.* Washington D.C.: U.S.-China Economic and Security Review Commission, April 11, 2019. Accessed April 28, 2021. https://www.uscc.gov/sites/default/files/Research/USCC_China's Space Power Goals.pdf.

Department of Defense. *Military and Security Developments Involving the People's Republic of China 2020.* Washington D.C.: Office of the Secretary of Defense, August 21, 2020. Accessed May 7, 20201. https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF.

Dutton, Peter A., and Ryan D. Martinson. *China's Evolving Surface Fleet.* No. 14. Newport, RI: CMSI Red Books, July 2017. Accessed May 8, 2021. https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1013&context=cmsi-red-books.

Easton, Ian. *The Great Game in Space: China's Evolving ASAT Weapons Programs and Their Implications for Future U.S. Strategy.* Arlington, VA: Project 2049 Institute, 2009. Accessed May 2, 2021. https://project2049.net/wp-content/uploads/2018/05/china_asat_weapons_the_great_game_in_space.pdf.

Erickson, Andrew, and Amy Chang. "China's Navigation in Space: What New Approaches Will China's Space Tracking Take?" U.S. Naval Institute *Proceedings* 138, no. 4 (April 2012): 42-47. Accessed May 1, 2021. https://www.scribd.com/document/274917895/Erickson-Chang-Proceedings-042012.

Harrison, Todd, Kaitlyn Johnson, Thomas Roberts, Tyler Way, and Makena Young. *Space Threat Assessment 2020.* Washington D.C.: Center for Strategic Studies and International Studies, March 2020. https://aerospace.csis.org/wp-content/uploads/2020/03/Harrison_SpaceThreatAssessment20_WEB_FINAL-min.pdf.

Jianing, Yao. *China Advances Maritime Space Monitoring and Control Capability.* Ministry of National Defense of the People's Republic of China, June 23, 2017. Accessed May 2, 2021. http://eng.mod.gov.cn/news/2017-06/23/content_4783536.htm.

J Jones, Antonio. "Long-Range Rrecision-Strike Cruise Missiles in NATO Operations." Monterey, CA, March 2014. Accessed May 1, 2021. https://core.ac.uk/download/pdf/36733697.pdf.

Klein, John J. *Space Warfare: Strategy, Principles and Polity.* London: Routledge, Taylor & Francis Group, 2014.

O'Rourke, Ronald. *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress.* Washington D.C.: Congressional Research Service, February 25, 2021. Accessed May 4, 2021. https://fas.org/sgp/crs/weapons/RL33745.pdf.

Pollpeter, Kevin. *Testimony before the U.S.-China Economic and Security Review Commission Hearing on "China in Space: Strategic Competition."* Arlington, VA: CNA China and Indo-Pacific Security Affairs Division, April 2019. Accessed April 27, 2021.

https://www.uscc.gov/sites/default/files/Kevin%20Pollpeter%20USCC%2025%20April.pdf.

Pollpeter, Kevin, Timothy Ditter, Anthony Miller, and Brian Waidelich. *China's Space Narrative: Examining The Portrayal of the US-China Space Relationship in Chinese Sources and Its Implications for the United States.* Montgomery, AL: China Aerospace Studies Institute, 2020. Accessed April 27, 2021. https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Space%20Narrative.pdf?ver=FGoQ8Wm2DypB4FaZDWuNTQ%3D%3D.

Raytheon. *AN/SLQ-32(V)5 Shipboard ECM System.* Goleta, CA: Space and Airborne Systems, 2010. Accessed May 4, 2021. https://www.scribd.com/document/42567279/rtn-sas-ds-slq32v5.

Raytheon. *Tomahawk Cruise Missile: Tomahawk Land Attack Missile*. 2006. Accessed May 2, 2021. https://www.scribd.com/document/46459011/tomahawk-missile.

Stokes, Mark, Gabriel Alvarado, Emily Weinstein, and Ian Easton. *China's Space and Counterspace Capabilities and Activities.* Edited by Project 2049 Institute. U.S.-China Economic and Security Review Commission, March 2020. Accessed April 30, 2021. https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf.

Stone, Adam. "Signaling Change." *C4SIR Journal on Electronic Warfare*, June 2019. Accessed May 1, 2021. https://www.scribd.com/document/423822934/C4SIR-Journal-on-Electronic-Warfare.

Szymanski, Paul. "Techniques for Great Power Space War." *Strategic Studies Quarterly*, 2019. Accessed May 8, 2021. https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13_Issue-4/Szymanski.pdf.

United States Space Command Public Affairs. *Commander's Strategic Vision: Never A Day Without Space.* Colorado Springs, CO, February 22, 2021. Accessed April 3, 2021. https://www.spacecom.mil/Portals/32/Images/cc-vision/usspacecom-strategic-vision-22feb21.pdf.

United States Space Command Public Affairs. *Organization and Subordinate Commands.* Colorado Springs, CO, 2021. Accessed May 8, 2021. https://www.spacecom.mil/Organization/.

U.S. Department of Defense. 2020. *U.S. Successfully Conducts SM-3 Block IIA Intercept Test* US Department of Defense. "U.S. Successfully Conducts SM-3 Block IIA Intercept Test against an Intercontinental Ballistic Missile Target." Washington D.C.: US Department of Defense, November 17, 2020. Accessed May 6, 2021. https://www.defense.gov/Newsroom/Releases/Release/Article/2417334/us-successfully-conducts-sm-3-block-iia-intercept-test-against-an-intercontinen/.

U.S. Government Accountability Office. *Missile Defense: Ballistic Missile Defense System Testing Delays Affect Delivery of Capabilities.* GAO-16-339R.Washington D.C., April 28, 2016. Accessed May 5, 2021. https://www.gao.gov/assets/gao-16-339r.pdf.

U.S. Office of the Chairman of the Joint Chiefs of Staff. Joint Operations. Joint Publication (JP) 3-0. Washington, D.C.: CJCS, 17 January 2017, ch. 1 22 October 2018.

Weeden, Brian. "Chinese Direct Ascent Anti-Satellite Testing." Secure World Foundation, April 2021. Accessed May 3, 2021. https://swfound.org/media/207183/swf_chinese_da-asat_fact_sheet_apr2021.pdf.

Weeden, Brian, and Victoria Samson. *Global Counterspace Capabilities: An Open Source Assessment.* Washington D.C.: Secure World Foundation, April 2021. https://swfound.org/media/207162/swf_global_counterspace_capabilities_2021.pdf.

Wood, Peter, Alex Stone, and Taylor Lee. *China's Ground Segment: Building the Pillars of a Great Space Power.* Montgomery, AL: China Aerospace Studies Institute, March 2021. Accessed April 27, 2021. https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Space/2021-03-01%20Chinas%20Ground%20Segment.pdf?ver=z4ogY_MrxaDurwVt-R9J6w%3d%3d.