

*** DEPARTMENT OF THE AIR FORCE ***

AETHER

A JOURNAL OF STRATEGIC AIRPOWER & SPACEPOWER

SPACE POLICY

MOVING BEYOND AN ASAT TESTING BAN

BRAD TOWNSEND

BAIKONUR

CHRISTOPHER S. KERANEN

CYBER POLICY

MITIGATING CYBER VULNERABILITY

MARCO CATANESE

PRINCIPLES OF WAR

THE CONCEPTS OF MASS AND SURPRISE IN FUTURE AIR WARS

ALESSANDRO PODESTÀ

DEFENDING AND DOMINATING THE AIR LITTORAL

*KEVIN L. JACKSON
MATTHEW R. ARROL*

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FROM THE EDITOR

Dear Reader,

I am honored to join the distinguished Air University Press team as the new editor in chief of *Æther: A Journal of Strategic Airpower & Spacepower*, the flagship strategic journal of the Department of the Air Force. As a retired Air Force officer and now civil servant, I have spent most of the last 30 years proudly serving in the world's greatest air and space force. This is my second opportunity to fill the role of editor in chief, the first being my stint at the *Air & Space Power Journal* from 2011 to 2015. Much has transpired since those days, and I am excited to climb back into Theodore Roosevelt's proverbial arena to help inform, educate, and encourage robust debate among national security professionals.

We start this new year at a momentous time of change. Strategic uncertainty continues to be a major theme within the national security field. The Trump administration is taking shape and clearly signaling a new strategic direction on all fronts. Russia's war in Ukraine, great power competition conflict in the Middle East, homeland defense, energy policy, Western liberal ideals, and disruptive technologies are priorities high on President Donald Trump's list starting on day one of his administration. I am excited to see how the academic discussion unfolds in the next few years. It promises to be a journey of discovery and insight.

Time will reveal much in the coming days and years. Meanwhile we continue our scholarly pursuits in this Winter issue. Brad Townsend begins the **Space Policy** forum, mining new lessons from the Cold War-era administrations of Presidents Jimmy Carter and Ronald Reagan to provide a feasible path forward for the elusive anti-satellite testing ban. He proposes a limited ban that could benefit all spacefaring nations. Next, Christopher Keranen explores potential benefits for space security through cooperation efforts at Kazakhstan's Baikonur Cosmodrome. While competition with Russia and China complicate this proposal, the potential benefits may just outweigh the risks.

In **Cyber Policy**, Marco Catanese proposes an alternative path to an independent cyber force. He contends that such a cyber force is necessary to successfully defend and exploit the cyber domain. He believes the best path forward is to place it within the Department of the Air Force, as has been done with the Space Force.

From the Editor

Next, in **Principles of War**, Alessandro Podestà analyzes the concepts of mass, surprise, and technological innovation in airpower theory, using the First Gulf War as a case study. He argues that Western air forces need a paradigm shift that will transform the future of aerial warfare.

Finally, in a follow-up to *Æther's* Fall air littoral issue, Kevin Jackson and Matthew Arrol address domain challenges of this transitional space from a Joint perspective that builds on a littoral mindset at all levels to maximize future success. They advocate the necessity for a break from service parochialism and identify several takeaways from Russia's war in Ukraine.

Again, I am thrilled to be back and look forward to the days ahead as we tackle the issues vital to our national defense as they relate to air and spacepower.

~The Editor

MOVING BEYOND AN ASAT TESTING BAN

BRAD TOWNSEND

In 2022, Vice President Kamala Harris announced a voluntary commitment to a destructive anti-satellite (ASAT) test ban. Since then, the United States has not pursued additional space arms control measures, which would reinforce the test ban's international success in demonstrating the US commitment to responsible behavior in space. This article explores the possibility of a high-altitude test ban as a next step in space arms control, using lessons learned from Cold-War debates as a guide to how a future ban could be implemented. Technological developments mean that it is no longer feasible nor reasonable to accept a unilateral test ban, but it is possible to accept a high-altitude ASAT ban.

In April 2022, Vice President Kamala Harris announced that the United States “commits not to conduct destructive direct-ascent anti-satellite (DA-ASAT) missile testing,” opening a window for meaningful discussion on space arms control.¹ Since that announcement, a growing number of nations have signed on to the US-led ban. Yet none of the three foreign nations that have a proven DA-ASAT capability—India, Russia, and China—have expressed interest in such a ban. In December 2022, the UN adopted a resolution which called upon states “not to conduct destructive direct-ascent anti-satellite missile tests,” which Russia and China voted against while India abstained.² The United States, in addition, has not made any effort to follow up on the ban to advance additional space arms control measures.

While such a response may seem prudent given the lack of interest from the three nations with proven counterspace capability, the United States surrenders another opportunity to continue to delegitimize certain categories of space weapons—which it has yet to accomplish despite decades of its intermittent efforts. Nevertheless, looking back at such previous space arms control proposals—particularly the failed endeavor under President Jimmy Carter—can inform future work and help avoid the mistakes of the past.

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1. “FACT SHEET: Vice President Harris Advances National Security Norms in Space,” The White House, 18 April 2022, <https://bidenwhitehouse.archives.gov/>.

2. G.A. Res. 77 (41), Destructive Direct-Ascent Anti-Satellite Missile Testing, A/RES/77/41, Agenda Item 97 (7 December 2022), <https://documents.un.org/>.

This article argues that the United States should build upon the momentum started by its 2022 announcement of a unilateral destructive DA-ASAT test ban by calling for a ban on the development and use of all DA-ASAT weapons with caveats to preserve national ballistic missile defense systems. Essentially, the United States should implement a ban on the development and use of high-altitude DA-ASATs.

As the leading space power and the dominant military and economic power for the foreseeable future, the United States has enormous influence in legitimizing or delegitimizing behavior in international relations. Russia's invasion of Ukraine has shown that when the United States appears weak and indecisive on the world stage, as it did in the wake of the withdrawal from Afghanistan and apparent weakened domestic commitments to established alliance structures, revisionist states will take advantage of any such perceived vulnerability to try and reshape the international order. At the same time, the US commitment to the defense of Ukraine post-invasion has demonstrated that the United States still has enormous power to rally the international community and isolate revisionist states. While its commitment is showing signs of weakening, it has confirmed that US leadership is essential in creating and enforcing norms of behavior and generating effective global coalitions. With the growing threat of an unconstrained arms race in space, US leadership in establishing norms in space is more necessary now than ever.

Background

After World War II, the United States shaped an international order that it has upheld along with its Allies, with some hiccups, which has greatly benefited humanity as a whole for 80 years. Where the United States has faltered in establishing a rules-based order that benefits humanity and preserves economic and scientific opportunity is in space, arguably because it has not needed to since the fall of the Soviet Union.

Nearly a decade of negotiation led to the signing of the 1967 Outer Space Treaty, which forms the foundation of space law and regulation today. A handful of treaties followed quickly on the heels of the momentum established by its signing: the Rescue Agreement in 1968, which deals with the recovery of astronauts in distress; the space Liability Convention in 1972, which concerns itself with damage caused by objects in space to Earth or to other space objects; the Anti-Ballistic Missile (ABM) Treaty of 1972, an arms control agreement between the United States and USSR; and the Registration Convention in 1975, which involves the identification of space objects. After this spate of treaties, rising tensions between the United States and USSR led to backsliding on treaties as the provisions of the ABM Treaty were stretched through the Reagan-era Strategic Defense Initiative. With the fall of the Soviet Union, the need for negotiated agreements in the space domain disappeared, and the United States started to back away from the constraints of Cold War agreements, finally formally withdrawing from the ABM Treaty in 2002.

During this time, the United States and USSR nearly signed a treaty banning ASATs late in the Carter administration—an event that is often forgotten or overlooked today. Yet the negotiations were derailed by the Soviet invasion of Afghanistan

in December 1979 and the general souring of relations between the two blocs. Serious debate concerning the ban continued through the Reagan administration. Despite those failed efforts to achieve any binding agreement more than 40 years ago, the logic that went into shaping the various positions within the Carter cabinet, Reagan administration, and Congress is worth exploring as it informs the modern challenges of reaching a domestic and international consensus on an ASAT ban.

Lessons from the Cold War

At the tail end of the Ford administration, Soviet activities in the space domain were becoming increasingly concerning after a period of relative calm highlighted by the signing of the Strategic Arms Limitation Treaty (SALT I) and the Anti-Ballistic Missile Treaty in 1972. Both treaties recognized the necessity of national technical means (NTM) of verification—the means to confirm adherence to the treaties’ measures—and each party to the treaty agreed to not “interfere with the NTM means of verification of the other party.”³ While the treaty did not explicitly associate reconnaissance satellites with NTM, both parties understood this implication.

The reason for this obfuscation was the ongoing US policy of not publicly acknowledging the existence of reconnaissance satellites, which fit nicely with Soviet sensitivities. When SALT II negotiations stalled a few years later, the Soviets once again resumed ASAT development in 1975, which raised concerns in the Ford administration. These concerns centered on the growing US space national security apparatus’ vulnerability to attack, an issue that remains today. In 1976, a national security decision highlighted this vulnerability, especially as US space assets were trending toward a “smaller number of larger, more sophisticated satellites.”⁴ A National Security Council panel “concluded that space assets are now playing a key role in determining the effectiveness and capabilities of important elements of the military forces of both the US and the Soviets.”⁵ The panel further recommended that the United States “should not allow the Soviets an exclusive sanctuary in space” and recommended the development of a US anti-satellite capability.⁶ The previous ASAT capability was a limited nuclear system based on the central Pacific

3. Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms (SALT 1), US–USSR, 26 May 1972, 23 UST 3462, <https://treaties.un.org/>; and Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems, 26 May 1972, 11 ILM 784, sec. Article 12, <https://2009-2017.state.gov/>.

4. Brent Scowcroft, national security adviser, to secretary of defense and director of Central Intelligence, National Security Decision Memorandum 333, subject: Enhanced Survivability of Critical US Military and Intelligence Space Systems, 7 July 1976, 1, Box 1, National Security Adviser Study Memoranda and Decision Memoranda, Gerald R. Ford Presidential Library, Ann Arbor, MI, <https://www.fordlibrary-museum.gov/>.

5. Brent Scowcroft to the president, memorandum, subject: US Anti-Satellite Capability, 24 July 1976, 1, Box C45, 7/24/1976, Presidential Handwriting File, Ford Presidential Library, <https://www.fordlibrary-museum.gov/>.

6. Scowcroft, 1.

Johnson Atoll's Program 437—which had been largely dismantled in 1970—and what little remaining capability it possessed was decommissioned in 1975.⁷

The reasoning behind the United States letting its ASAT capabilities lapse was threefold. First, it perceived that the Soviet efforts to develop ASAT systems had largely stopped and only a residual program remained. Second, the United States also understood that any ASAT development would be contrary to the “spirit if not the letter” of SALT terms.⁸ Finally, there was concern that development of an ASAT capability would encourage the Soviets to resume their space weapons programs. Given the greater US dependence on space, preserving the status quo was certainly in the United States' favor.

Soviet resumption of ASAT testing changed the calculus behind adopting a passive posture in space, and President Gerald Ford signed a directive days before leaving office in January 1977, ordering the development of a non-nuclear ASAT capability and a means of “electronic nullification” to be held at a higher classification level than the ASAT capability.⁹ The directive also assigned the director of the Arms Control and Disarmament Agency responsibility for pursuing arms control initiatives designed to restrict the future development of ASAT capabilities.

Like with most policy directives signed shortly before administration changes, it was up to the next administration to review Ford's decision and determine whether to implement or ignore it. Carter was eager to negotiate arms control, and soon after taking office, he proposed opening a dialogue on a space weapons limit agreement to the Soviets.¹⁰ Meanwhile, the new administration also undertook a review of potential options and allowed the various stakeholders to weigh in. A few weeks after the August 1977 meeting to discuss these options and the acquisition of an actual ASAT capability, the cabinet-level participants adopted nuanced positions for and against a full or partial ASAT ban and outlined how the US acquisition of its own ASAT capability would play into negotiations, all of which was codified in a memorandum to the president.¹¹

In particular, the chairman of the Joint Chiefs of Staff, Air Force General George Brown, was opposed to any type of ASAT ban. He reasoned that the Soviets already had an operational system, and in the event of a ban, they possessed the knowledge to

7. Wayne R. Austerman, *Program 437: The Air Force's First Antisatellite System* (Air Force Space Command, 1991).

8. Scowcroft to the president, memorandum, 2.

9. Brent Scowcroft to secretary of state, secretary of defense, and director, Arms Control and Disarmament Agency, National Security Decision Memorandum 345, subject: US Anti-Satellite Capabilities, 18 January 1977, Box 1, National Security Adviser Study Memoranda and Decision Memoranda, Ford Presidential Library, <https://www.fordlibrarymuseum.gov/>.

10. “Issues Paper Prepared by the PRM-23 Inter-Agency Group: Arms Control for Anti-Satellite Systems Issue Paper,” 9 August 1977, in *Foreign Relations of the United States, 1977–1980*, vol. XXVI, Arms Control and Non-Proliferation [FRUS], ed. Chris Tudda (US Government Printing Office, 2015), 1, <https://history.state.gov/>.

11. “Memorandum from Secretary of Defense Brown to President Carter,” subject: Arms Control for Antisatellite Systems, 19 August 1977, in *FRUS*, <https://history.state.gov/>.

quickly develop a breakout capability, especially given the challenges of verification when even secretly possessing a handful of ASAT missiles provided significant military advantage.¹² A ban would therefore put the Soviets in a position of advantage to the United States, which had no operational capability or meaningful experience with ASATs. Brown determined that the United States should drop the idea of a ban and develop its own capability as a deterrent.

At a 1977 national space policy review meeting among various federal agencies including the Departments of Defense and State and the National Aeronautics and Space Administration (NASA), Assistant to the President for National Security Affairs Zbigniew Brzezinski took an opposing position and supported a comprehensive ban because it would serve US “security interests [and] reinforce stability and support [US] SALT efforts.”¹³ Brzezinski did not support the US acquisition of an ASAT capability and thought that a ban would prevent further Soviet ASAT development. The other participants at the meeting adopted some variation of these two opposing positions. The domestic policy battle lines were drawn.

With the positions of the various agencies established, relevant perspectives from two other groups came into play: an interagency group studying the ASAT issue and an Office of Science and Technology Policy Space Advisory Group. The advisory group supported the acquisition of a destructive ASAT focused on low altitudes as well as an electronic warfare capability.¹⁴ It also emphasized the difficulties of negotiating a ban when only the Soviets possessed a capability. Especially important were the difficulties of verification when only a handful of systems were necessary to cause a measurable impact on US space capabilities. This same verification argument has persisted through the modern era as the key point of resistance whenever the idea of some form of ASAT ban is subsequently raised.

With these difficulties in mind the interagency study group proposed four options. Option 1 offered no agreement other than the existing one under SALT to not interfere with the national technical means of verification. Option 2 would not limit any ASAT capabilities and avoid specifically designating any satellites as NTM assets. Option 3 would prohibit future capability development beyond what already existed—low-altitude interceptors. This option allowed for the development of a limited US anti-satellite capability. Option 4 proposed a comprehensive ASAT ban including testing and deployment, though it would allow for electronic warfare and research and development into ASAT systems. Under this option, the Soviets would have to dismantle their existing capabilities.

12. “Memorandum from the Chairman of the Joint Chiefs of Staff (Brown) to Secretary of Defense Brown,” subject: Antisatellites, 29 July 1977, in *FRUS*, <https://history.state.gov/>.

13. “Summary of Significant Discussion and Conclusions of a Policy Review Committee Meeting: PRM/NSC-23 Coherent Space Policy,” 4 August 1977, in *FRUS*, <https://history.state.gov/>.

14. “Issue Paper.”

In September 1977, Carter approved option 4 as laid out by the interagency study group.¹⁵ Carter proposed pursuing negotiations with the Soviets while also continuing US development of its own capability as a hedge though stopping short of actual testing. The president emphasized a need to develop adequate means of verification.

The first step in the negotiation process was to propose a moratorium on testing of the Soviet system as the US Arms Control and Disarmament Agency proposed a month prior. Following this decision, preliminary discussions with the Soviets began with Carter communicating directly with Soviet General Secretary Leonid Brezhnev in November. Carter made his desire to pursue an agreement on ASATs known and pointed out that Soviet ASAT testing and development were interfering with further SALT negotiations.¹⁶ Brezhnev replied that he was supportive of discussions but wanted to expand negotiations to include the US Space Shuttle. This added a new complication to the ASAT ban as the Soviets were concerned about the dual-use potential of the Space Shuttle. Their concerns were not baseless as, at that time, the US Air Force planned to acquire dedicated space shuttles for placing military satellites in orbit.

It quickly became clear that even after the president's direction of a way forward on ASAT development and negotiations, there were still many challenges to developing a workable agreement. Initial optimism for a speedy interagency consensus on the agreement details to present to the Soviets in line with presidential guidance quickly faded as "unforeseen complexities" kept arising in developing a detailed proposal.¹⁷ Once again the challenges associated with verification of compliance were especially concerning, since even a small ASAT capability that went undetected could provide significant military advantage. The potential variety of ASAT weapons beyond straightforward direct-ascent missile systems also created difficulties. The possibility of the Soviets developing high-energy laser weapons that could damage satellites caused enough concern in the administration that, as Brzezinski stated, it might "shatter our sense of technical superiority as badly as it was when the first Sputnik was orbited."¹⁸

15. "Memorandum from the President's Assistant for National Security Affairs (Brzezinski) to Secretary of State Vance, Secretary of Defense Brown, the Director of the Office of Management and Budget (McIntyre), the Director of the Arms Control and Disarmament Agency (Warnke), the Chairman of the Joint Chiefs of Staff (Brown), the Director of Central Intelligence (Turner), the Administrator of the National Aeronautics and Space Administration (Frosch), and the Special Advisor to the President for Science and Technology (Press)," subject: Arms Control for Antisatellite (ASAT) Systems, 23 September 1977, National Security Council, Institutional Files, Box 41, Folder 3, PRM-23 [3], Jimmy Carter Presidential Library, Atlanta, GA, in *FRUS*, <https://history.state.gov/>.

16. "Editorial Note" (Jimmy Carter to Soviet General Secretary Leonid Brezhnev, letter, 4 November 1977; and Brezhnev to Carter, letter, 15 November 1977), in *FRUS*, <https://history.state.gov/>.

17. "Information Memorandum from the Principal Deputy Assistant Secretary of Defense for International Security Affairs to Secretary of Defense Brown," subject: Antisatellite (ASAT) Arms Control Negotiations—Information Memorandum, 16 December 1977, in *FRUS*, <https://history.state.gov/>.

18. "Memorandum from the President's Assistant for National Security Affairs to President Carter: Soviet and US High-Energy Laser Weapon Programs," 28 November 1977, in *FRUS*, <https://history.state.gov/>.

Even though the dangers and complexities of an effective ASAT agreement continued to cause concern, a cabinet-level special coordinating committee agreed to the outline of a position on ASAT negotiations in February 1978. The negotiating position reached during this meeting went far beyond the original concept of a ban on simply ground-to-space ASAT missiles, amounting to a more comprehensive agreement on space weapons control.¹⁹

Formal negotiations with the Soviets commenced in June 1978, and while the discussions were generally well received, significant issues continued to arise. Both sides differed on defining what constituted a hostile act in space, and while the United States wanted to pursue an immediate moratorium on ASAT testing, the Soviets remained noncommittal.²⁰

Following the first round of negotiations the special committee met again, agreeing to decisively move away from using the term *hostile act*, because the term references the legal equivalent of an act of war and any violation of a treaty using this term might obligate the harmed party to initiate armed conflict.²¹ Instead, future discussion would focus on prohibitions against certain acts.

Discussion on an interim ban on ASAT testing continued along the same lines as in the past where a differentiation existed between low- and high-altitude tests. The Office of the Secretary of Defense and the Joint Staff remained concerned that a total ban would prevent the development of an effective US anti-satellite capability and preserve the Soviet advantage. Instead, a high-altitude test ban, with the exact definition of *high* to be left to the Soviets, would allow the United States to conduct some low-altitude tests to develop a viable capability and preserve congressional interest in funding ongoing development.

After a second round of negotiations with the Soviets concluded, substantial progress had been made, and both sides appeared willing to agree to an interim ASAT agreement. The agreement would initially be bilateral, protecting the satellites of both signatories as proposed by the Soviets. The US cabinet-level special committee agreed to this proposal but wanted to open the treaty to future multilateral participation under which the satellites of subsequent signatories would also be protected. It also wanted to expand the protection to third-party satellites if a signatory claimed an interest in the object.²²

Carter rejected this position and decided to push for protection for all satellites regardless of the launching nation's signatory status. The Soviets also continued to want freedom to act against illegal space objects performing functions that the Soviets might disapprove of; the cabinet side refused to entertain this concept since it created too many loopholes. By this time, the various cabinet members had also agreed

19. "Summary of Conclusions of a Special Coordination Committee Meeting," subject: ASAT Treaty, 15 February 1978, in *FRUS*, <https://history.state.gov/>.

20. "Telegram from the Embassy in Finland to the Department of State," 20 June 1978, in *FRUS*, <https://history.state.gov/>.

21. "Summary of Conclusions," <https://history.state.gov/>.

22. "Summary of Conclusions of a Special Coordination Meeting," subject: Antisatellite Treaty, 12 March 1979, <https://history.state.gov/>.

to a one-year blanket moratorium on testing with no caveats. With these issues settled, the United States hoped to finalize an initial ASAT agreement before the June 1979 US-Soviet SALT summit.

A third round of negotiations commenced in May 1979. The Soviet delegates insisted on a hostile acts exclusion for attacking threatening satellites. They felt strongly that there would be situations in the future where they might be forced to act against a satellite out of necessity. In addition, they rejected any idea of the agreement protecting all space objects regardless of ownership as they did not want the protection to extend to China's satellites.²³ The Soviet delegation also wished to expand the ASAT test moratorium to cover anything which might damage, destroy, or change a satellite's trajectory. This would cover laser weapons and electronic warfare and might potentially impact shuttle operations. Despite these significant sticking points, the two sides started work on a draft treaty with the goal of having an agreement ready by the upcoming US-Soviet SALT summit.

By the end of May the negotiations were at a critical point, and the earlier points of contention were near resolution. A key breakthrough was an agreement on how to handle hostile acts; the language of compromise offered the "declaration that we will not attack, destroy or displace each other's satellites so long as they are operated in accordance with international law."²⁴ Despite this language, the Soviets continued to quibble over adding more specific language on what constituted behavior not in accordance with international law.

A new challenge was the Soviet insistence that the moratorium on ASAT testing include a halt to space shuttle testing, something the United States was completely unwilling to accept. The Soviets also insisted that the testing moratorium include other forms of ASAT technology beyond satellite interceptors, such as lasers and electronic warfare. That was something the United States was willing to compromise on. Finally, the issue of third-party satellites that a signatory had an interest in continued to be a sticking point. Despite these issues, both sides felt they were close to an agreement in early June 1979. A draft treaty existed with an agreed-upon preamble, and both sides were haggling over a mutually acceptable title.

When Carter and Brezhnev met later in June to sign SALT II the issues above remained unresolved. Carter expressed his desire to sign a partial agreement with the Soviets on an ASAT ban and quickly resolve the issue, but the future of the Space Shuttle in particular remained a sticking point. Soviet reaction was pessimistic as they were unwilling to compromise on their points. With the ASAT treaty left unresolved, the presidential summit ended, though further negotiations were not off the table.

No further formal discussions occurred during Carter's presidency as a number of crises engulfed his administration, despite continued Soviet interest in further negotia-

23. "Telegram from the Embassy in Austria to Telegram the Department of State," 7 May 1979, in *FRUS*, <https://history.state.gov/>.

24. "Memorandum from the President's Deputy Assistant for National Security Affairs (Aaron) to the President's Assistant for National Security Affairs (Brzezinski)," subject: ASAT Negotiations, 30 May 1979, in *FRUS*, <https://history.state.gov/>.

tions. With the Iran hostage crisis, the Soviet invasion of Afghanistan, and the resignation of various cabinet officials, the focus of the waning political capital of the Carter administration was no longer on arms control. Carter asked the Senate to delay consideration of SALT II in January 1980 after the Soviet invasion of Afghanistan, which amounted to withdrawing it from consideration. ASAT talks still made it on the agenda for a cabinet-level discussion in June 1980, but there was no time left for the administration to conclude a meaningful agreement given the obstacles that remained.

After President Ronald Reagan took office, the United States rejected a Soviet proposal to discuss a space weapons treaty presented to the UN General Assembly in August 1981.²⁵ This marked the effective death of the draft treaty on ASAT arms control, though Congress would continue to pressure the Reagan administration especially as part of the debate over the Strategic Defense Initiative and US anti-satellite development.

A key component of Reagan's 1982 *National Space Policy* that met significant congressional opposition was his commitment to proceed with the development of an operational ASAT capability. Also, included in the 1982 space policy was a commitment to consider "verifiable and equitable arms control measures . . . should those measures be compatible with US national security," language that remains meaningfully unchanged in the current 2020 *National Space Policy*.²⁶ Congressional concern over the administration's ASAT development and plans for the Strategic Defense Initiative were strong enough that it demanded in the 1984 National Defense Authorization Act (NDAA) that the administration certify to Congress that it was "endeavoring, in good faith, to negotiate with the Soviet Union a mutual and verifiable ban on antisatellite weapons," before any ASAT test could occur—language that was further reinforced in the 1985 NDAA.²⁷ The administration predictably returned that no new agreements were found to be acceptable and that "difficulties of verification" were a significant obstacle.²⁸

A further report prepared by the Office of Technology Assessment at the request of the House Armed Services Committee explored ASAT technology and various approaches to arms control in great detail. One of the seven core proposals in this report was a form of a high-altitude ASAT ban where space would remain a sanctuary above a designated altitude—5,600 kilometers (km)—within which testing or deployment of ASATs would be prohibited.²⁹ These reports were also accompanied by congressional hearings that challenged the veracity of the administration's position that verification of any type of ASAT ban was too difficult or risky. In a 1984 hearing before the

25. Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Cornell University Press, 1985), 217.

26. Ronald Reagan, National Security Decision Directive Number 42, *National Space Policy* (White House, 4 July 1982), <https://nsarchive.gwu.edu/>; and Donald J. Trump, *National Space Policy of the United States of America* (White House, 9 December 2020), <https://www.space.commerce.gov/>.

27. Department of Defense Authorization Act, 1984, Pub. L. No. 98–94, S. 675, 98th Cong. (1983), sec. 1235.

28. US Congress, Office of Technology Assessment (OTA), *Anti-Satellite Weapons, Countermeasures, and Arms Control* (US Government Printing Office, 1 September 1985), 100, <https://aerospace.csis.org/>.

29. OTA, 138.

Senate foreign relations committee one senator challenged that “the contention that an ASAT ban is unverifiable rests on an unrealistic standard of verification.”³⁰ They pointed out that by the administration’s standards of verification no treaty would ever be signed, and that even though a total ban might be difficult, a partial ban “that only prohibited high altitude, antisatellite weapons” would be an acceptable alternative.³¹

The administration defended itself by arguing that concerns about verification were not simply a pretext for avoiding arms control. From its perspective there were legitimate concerns about verifiability and that even “a small covert supply of ASAT interceptors would be enough to do a disproportionate amount of damage to our space assets.”³² While true at that time this position is becoming less defensible today as the US national security space architecture moves toward a more proliferated resilient structure.

Despite congressional resistance the United States tested an ASAT in September 1985, which was the first and only test of the platform, as Congress effectively halted testing in December that year. Congressional resistance manifested in an ASAT testing moratorium in each subsequent NDAA unless the Soviet Union tested an ASAT weapon.³³ Reagan resented this congressional limitation and argued against it but eventually surrendered to the inevitable, and the Air Force cancelled the program in 1988.³⁴ This marked the end of the US direct-ascent ASAT program. Although the Russian Republic proposed discussing a new ASAT ban in the early 1990s, the United States would continue to remain uninterested in space arms control due largely to the perceived challenges of verification.

Lessons from Carter and Reagan

It is possible that the Carter administration could have overcome the remaining points of contention with the Soviets and reached at least a partial agreement. Three issues remained unresolved: which space objects would be covered by the agreement, what the test suspension involved, and whether space objects that engage in hostile or illegal actions could be excluded. It is likely that a compromise could have been reached on which objects were covered and the details of the test suspension. An exception for hostile acts by satellites would be far more challenging. Adding this provision largely defeated the United States’ original motivation for the treaty—dismantling the Soviet ASAT program. Rather than a comprehensive ASAT ban, the treaty would have instead amounted to an ASAT test ban that limited the development of this category of space weapons going forward. While a laudable goal, it would have placed the United States

30. *Strategic Defense and ASAT Weapons: Hearing Before the Committee on Foreign Relations, US Senate*, 98th Cong. (1984), 1.

31. *Strategic Defense*, 5.

32. *Strategic Defense*, 28.

33. National Defense Authorization Act for Fiscal Year 1987, Pub. L. No. 99–661 (1986), sec. 231.

34. Ronald Reagan, “The U.S. Anti-Satellite (ASAT) Program: A Key Element in the National Strategy of Deterrence,” n.d., Green Collection, Files 1985–1988, Box 3, 1, Ronald Reagan Presidential Library, Simi Valley, CA, <https://www.reaganlibrary.gov/>.

at a distinct disadvantage since the Soviets were far ahead of the United States in testing an operational capability. Any US anti-satellite capability, however limited, would remain untested in comparison to the Soviet program. Even so, it would have limited the possibility of an arms race in space for the foreseeable future.

Several lessons that are applicable to future negotiations can be learned from the Carter administration's efforts to limit ASAT capabilities and the subsequent resistance to Reagan's efforts to develop an ASAT system. First, some aspects of verification that were a significant issue throughout the ASAT negotiations and subsequent discussions may not be as much of a concern today while others are even more so. During the Carter negotiations and later in the Reagan era there was a fear that even a handful of residual undetected ASAT systems could have a substantial impact on military capabilities. With the rise of satellite constellations of hundreds or thousands of satellites, a small undetected capability would no longer have any strategic or tactical significance. When combined with the much improved and more distributed methods of national and commercial space-based intelligence, surveillance, and reconnaissance as well as space situational awareness available today, it would be difficult for an adversary to conceal any significant undeclared capability or conduct unmonitored tests.

Yet the abrogation of the ABM Treaty and the rapid increase in the number of ABM systems mean that it is possible that many of these systems in existence today could be dual-use ASAT weapons, at least for lower-altitude satellites. This means that it is essentially impossible to differentiate between anti-ballistic missile systems and low-altitude ASAT systems. The number of satellites that will make up future constellations still likely renders these weapons less meaningful as it will cost more to build and launch an ASAT to target an individual satellite than the value of the satellite.

The worry over laser ASAT capabilities is also probably a much more significant issue today than during the Carter years, given the inevitable progress of laser technology since the 1970s, though these would suffer from even greater challenges of concealment than a direct-ascent system, as a laser installation capable of reaching into space and damaging satellites is likely to be large. Combined, these factors suggest that a total ban on DA-ASAT systems is not reasonable today; however, the existing test ban by the United States is still viable.

A High-Altitude Ban?

While a comprehensive ban on possessing and developing low-altitude ASATs is not feasible given the potential dual-use nature of ABM systems, a more narrowly focused high-altitude ban is. Echoing the Carter debate over limiting high-altitude ASAT testing while allowing lower-altitude testing, several factors make a high-altitude ASAT ban a possibility. Confusion over dual-use ABM systems would be less of an issue as the mission and capabilities of these systems could not readily be extended above low Earth orbit (LEO). The high energy lasers that troubled the Carter negotiation team would also be less of a concern as distance is an ever-present limiting factor with the transmission of energy. The use of destructive ASAT capabilities in higher orbits would also produce debris that would take generations to reenter the Earth's atmosphere, if ever. The prob-

lem of verification is therefore easier to solve, and the potential downsides of use are higher, which make a high-altitude ASAT ban more pressing and more reasonable.

This of course raises the challenge of defining what constitutes high-altitude. Debris persistence is significant in any orbit, but especially above 600 km. This would then be the lower bound of any high-altitude ban. To ensure there is no confusion over ABM systems functioning as dual-use ASAT systems, the lower bound would need to be still higher—how much higher is uncertain. NASA defines LEO as extending up to 2,000 km, an altitude that is already above the majority of satellites operating in LEO. The upper bound of LEO then is possibly also the upper bound of where a high-altitude ASAT ban could begin.

A high-altitude DA-ASAT ban starting between 600 and 2,000 km combined with an overall test ban at all altitudes could be a real possibility. An agreement along these lines during the Carter administration would have allowed the Soviets to still meet some of their goals of countering potentially threatening or hostile satellites that might be a danger to the land mass of the USSR if they experienced an uncontrolled deorbit. Whether this would have fully placated the Soviets is unknowable, but it certainly would have addressed the concerns within the Department of Defense about the lack of US anti-satellite capability to handle LEO threats while protecting valuable high-altitude systems from active ASAT threats. Of course, to develop a hypothetical LEO anti-satellite system, the United States would have had to pause the moratorium on ASAT testing that the Soviets supported. Whether compromises along these lines would have resolved the Carter impasse over ASAT negotiations is difficult to judge, but those negotiations could serve as the bare outline of an agreement covering terrestrial and direct-ascent systems today.

The existing US pledge to refrain from destructive ASAT testing with a proposal for a ban on the development of DA-ASAT systems capable of reaching above 600 to 2,000 km together present the initial framework for a realizable arms control agreement in space. An agreement along these lines would only be a start as it would not address a myriad of other potential space weapons, but it would address the most common and historically most debris-generating space weapon, further delegitimizing this weapon and discouraging its continued development and proliferation. Space warfare advocates concerned about crippling their own ability to deter attacks by threatening adversary space systems would still be able to attack satellites in LEO using direct-ascent systems or some form of directed energy while also building co-orbital systems for use above a potential 600 to 2,000 km ASAT ban limit.

A high-altitude DA-ASAT ban is far from a panacea for preventing war in space, but it is a feasible and verifiable small step on the path to ensuring future conflict in space is limited in such a way that it preserves the space environment for continued exploration and exploitation by humanity. Æ

BAIKONUR
Space for Potential
Cooperation amid
Adversary Influence

CHRISTOPHER S. KERANEN

The Baikonur Cosmodrome—Kazakhstan’s space launch site controlled by Russia—offers an opportunity for space cooperation as Russia’s space capabilities have declined and China’s influence in Central Asia has grown. This article examines Kazakhstan’s space ambitions, the deteriorating Russo-Kazakh partnership over Baikonur, China’s increasing involvement in the domain, and the geopolitical implications of these shifts. Although there are risks involved, US space cooperation with Kazakhstan can not only secure US interests in Central Asia but also foster global space security. Such cooperation will enable the United States to support Kazakhstan’s space development goals, balance Russia’s and China’s influence, and assert the United States’ peaceful presence in Central Asia.

On 15 July 1975, in the heat of the Cold War with proxy wars raging, the United States and the Soviet Union pulled off an unprecedented feat: the Apollo-Soyuz mission. Astronauts and cosmonauts docked their spacecrafts together 150 miles above Earth, shaking hands in space and proving that even in times of fierce rivalry, cooperation in space could rise above political conflict. Today, space remains a medium for collaboration, as evidenced by the continued US-Russian cooperation on the International Space Station, even amid Russia’s war in Ukraine. For the United States, space cooperation serves as a tool for political influence, diplomatic engagement, and technological leadership on the global stage.

The Baikonur Cosmodrome, once the crown jewel of the Soviet space program, is located at the crossroads of potential international cooperation. Kazakhstan, the inheritor of this historic spaceport, has recently become a custodian of two launchpads that it hopes to use to further its identity as a spacefaring nation and attract international collaboration. Yet the involvement of both Russia and China complicates Kazakhstan’s aspirations. Though facing a declining space industry, the Kremlin remains firmly in control of Baikonur, while the People’s Republic of China’s (PRC) growing interest in space partnerships with Kazakhstan represents a significant shift in the balance of influence in Central Asia. By expanding its civil or commercial space endeavors at Baikonur,

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the United States would not only be testing the boundaries of space cooperation but also investigating the limits of the Russo-Sino relationship in the region.

Amid increased global instability, particularly due to Russia's ongoing war in Ukraine and China's military aggression in the Indo-Pacific, the United States must prioritize space diplomacy as a means of sustaining diplomatic ties that can withstand terrestrial tensions, and Baikonur offers an ideal opportunity for such an effort. This article argues that the United States should explore space cooperation through Baikonur as an avenue of engagement with Central Asia to support Kazakhstan's space ambitions, enhance a peaceful US presence in Central Asia, and counterbalance the growing influence of Russia and China in the region.

Kazakhstan and Russia at Baikonur

Baikonur is a prominent space complex built by the Soviet Union in the mid-1950s on the vast southern steppe of Kazakhstan. The Soviets selected the location to accommodate the massive 6,717-square kilometer complex that would serve as the primary hub of their space program. The location also offered a strategic position far from Russia's borders and accessibility to a railway stop between Moscow and Tashkent.¹ From Baikonur, the Soviets launched Sputnik, the first artificial satellite, in 1957 and the first human to orbit the Earth—Yuri Gagarin aboard Vostok 1—in 1961. After the breakup of the Soviet Union, the cosmodrome fell within the sovereign territory of the Republic of Kazakhstan, which thus inherited a large part of the Soviet space legacy.

Space exploration has since become integral to Kazakhstan's national identity. Although Kazakhstan's space development is tied to its colonial past with Russia, the country has integrated space exploration into its broader nation-building efforts as a tool to assert its independence and national identity.² When Kazakhstan achieved independence in 1991 with the dissolution of the Soviet Union, it staked its claim as a key player in the space community, and the government continues developing that identity on the domestic and international stage, promoting scientific research and space equipment production with international participation.³ Kazakhstan has since created its own national space program, which has been operating its Earth observa-

1. Jacques Villain, "A Brief History of Baikonur," *Acta Astronautica* 38, no. 2 (January 1996), <https://doi.org/>.

2. Ulbolsyn Sandybayeva, "Space as Soviet Heritage and a National Project for Kazakhstan," in *European Proceedings of Social and Behavioural Sciences Social and Cultural Transformations in the Context of Modern Globalism*, ed. Dena Karim-Sultanovich Bataev et al. (Kh. Ibragimov Complex Research Institute of Russian Academy of Sciences, 29 November 2021), <https://doi.org/>.

3. Dana Omirgazy, "Kazakhstan Explores Limitless Potential of Space Industry," *The Astana Times*, 18 April 2023, <https://astanatimes.com/>.

tion satellites since 2015, and has maintained a space partnership with Russia, holding onto its role in the Soviet space program.⁴

Reports indicate that Kazakhstan will receive \$115 million annually from Russia as a lease contract up to 2025, which has been extended to 2050.⁵ Sergey Sopov, the founder and first head of Kazakhstan's national space agency, initiated the lease proposal in the 1990s. The intent was to make the spaceport a center for international cooperation on space expeditions, with the original version of the proposal allowing Russia to rent only part of Baikonur. Sopov notes that Kazakhstan planned to invite Europeans and Americans to launch from the complexes within the cosmodrome that would have fallen under Kazakhstan's control.⁶ Yet the finalized agreement gave Russia control of the entire cosmodrome.

Since Kazakhstan's independence, the Russian government has intended to move its space operations to its home front, yet it retains control over the Baikonur complex and the surrounding city, blocking other international partnerships. In the 1990s, Russian President Boris Yeltsin planned to relocate Baikonur operations to eastern Russia, but that plan was not realized until April 2016 with the first successful launch from Vostochny Cosmodrome, located 120 miles north of the Chinese border in Eastern Siberia.⁷

Today, the Russian Federation still controls access to the entire city that surrounds and supports the cosmodrome and appoints its mayor, despite the fact that Kazakhs constitute the city's majority population.⁸ Sopov contends that Russia's control of the city under the current lease agreement remains the biggest barrier to any international involvement that Kazakhstan seeks.⁹ Russia has thus far ensured that it remains Kazakhstan's only international partner at Baikonur.

Since 2004, the two countries have been working together to upgrade Baikonur's Site 45, a historic set of launchpads and support infrastructure, in what is called the

4. Planet Labs PBC, "Kazakhstan Leverages Planet Data for Agriculture, Resource Management, and Disaster Response," 25 June 2024, Planet, <https://www.planet.com/>; and Nelly Bekus, "Outer Space Tech-nopolitics and Postcolonial Modernity in Kazakhstan," *Central Asian Survey* 41, no. 2 (3 April 2022), <https://doi.org/>.

5. Bagila Bukharbayeva, "Cosmodrome Lease Extended Until 2050," *The Moscow Times*, 12 January 2004, <https://www.themoscowtimes.com/>.

6. Оксана Трофимова, "Как Проходили Переговоры России и Казахстана о 'Байконуре' и Почему Илона Маска Не Догнать [How the Negotiations Between Russia and Kazakhstan on Baikonur Took Place and Why Elon Musk Cannot Be Caught Up]," *inform buro*, 13 May 2023, <https://informburo.kz/>.

7. James Clay Moltz, "Northeast Asia's Space Launch Nationalism," *The Asan Forum* (blog), 12 August 2016, <https://theasanforum.org/>.

8. Оксана Трофимова, "Глава Байконура: Мы стремимся упростить въезд в город [Head of Baikonur: We Strive to Simplify the Entrance to the City]," *inform buro*, 18 October 2023, <https://informburo.kz/>.

9. Трофимова, "Проходили."

Baiterek project.¹⁰ Yet despite Russia's determination to phase out its reliance on Baikonur for its space operations, it is not likely willing to loosen the ties of dependence that bind Kazakhstan to Moscow. In turn, Kazakhstan is inclined to seek new partners for the Baiterek complex as it has continued to face opposition from Russia in the handling of the upgrade.

Russian efforts in the Baiterek project have stagnated in the wake of diverging environmental priorities between the two nations, coupled with problems associated with Russia's aggression in Ukraine in 2014 and 2022. Site 45 is where Russia launched the Zenit series rockets, produced in the Ukraine since the 1980s, and its upgrade was originally intended to accommodate Russian Angara rockets as opposed to the aging Soviet-era Proton rockets.¹¹ Proton rockets are not only expensive, but they use unsymmetrical dimethylhydrazine—called the “devil's venom” by scientists—a highly carcinogenic fuel that contaminates the Kazakh steppe they overfly, leaving behind toxic effects that last for decades.¹² Kazakhstan's opposition to Russia's continued use of the Proton rocket was a central issue during the original Baikonur lease negotiations and a key driver behind the lease's subsequent renegotiation.¹³ Yet Russia continues to launch Proton rockets, with plans to extend their use through 2026.¹⁴ In addition, in 2012, Russia decided to move Angara launches originally meant for Baikonur to Vostochny, leaving the Baiterek project stalled.¹⁵ Russia's 2014 annexation of Crimea further hurt its ability to use Ukrainian-produced Zenit rockets, as it was forced to create a new version of Soyuz rockets that could be built under strict sanctions.¹⁶

Efforts to transfer Baikonur's control to Kazakhstan started as early as 2012.¹⁷ In 2018, the two nations agreed to transfer the responsibility of Site 45 to Kazakhstan.¹⁸ Although Russia relinquished the site platforms, however, Kazakhstan is still bound to develop them for Russia's Soyuz-5 rocket, its new medium-class launch vehicle scheduled for December 2025 launch.¹⁹ Nevertheless, Kazakhstan has been gradually

10. Nicole Wolkov, “Baiterek Rocket and Space Complex to Contribute to Baikonur's Development,” Caspian Policy Center, 19 August 2020, <https://www.caspianpolicy.org/>.

11. Wolkov.

12. Mark Piesing, “The Pollution Caused by Rocket Launches,” *BBC News*, 15 July 2022, <https://www.bbc.com/>.

13. Трофимова, “Проходим.”

14. “Proton Launch Schedule,” Next SpaceFlight, accessed 3 September 2024, <https://nextspaceflight.com/>.

15. Anatoly Zak, “Zenit Rocket Facilities in Baikonur,” RussianSpaceWeb.com, last updated 10 November 2023, <https://www.russianspaceweb.com/>.

16. Anna Gussarova, “The Kremlin Strategy in Baikonur: Putting Kazakhstan's Space Program in a Box?” *Eurasia Daily Monitor*, 29 March 2018, <https://jamestown.org/>.

17. E. Kosolapova, “Kazakhstan and Russia Work on Phased Termination of Baikonur Lease,” *McClatchy - Tribune Business News*, 10 December 2012.

18. Wolkov, “Baiterek Rocket.”

19. John Sheldon, “Kazakhstan's Space Ambitions Hostage to Russian Space Launchers at Baikonur,” SpaceWatch.Global, 5 April 2018, <https://spacewatch.global/>; and “First Launch of Soyuz Rocket Due Dec 24, 2025,” TASS Russian News Agency, 17 August 2023, <https://tass.com/>.

assuming greater responsibility for the cosmodrome amidst ongoing fragmentation and the inherent provisional nature of the lease. Since 2022, Russia has relinquished 234 facilities at Baikonur to the Kazakhstan government that were formerly under the charge of Russia as part of the lease.²⁰

In March 2023, *The Moscow Times* reported that Baikonur had become a point of friction when the Kazakhstan government seized the assets of the Russian space agency Roscosmos, citing \$29.7 million in overdue payments for the Baiterek project that resulted when Western sanctions from Russia's 2022 invasion of Ukraine targeted Roscosmos' suppliers.²¹ Additionally, the sanctions greatly diminished the commercial launch potential for the Soyuz-5, which was a key source of investment revenue for Baiterek.²² The incompatibility of the two nations' visions becomes clear when considering Kazakhstan's aim to foster international cooperation and Russia's move to bolster its own status as a global space power. Kazakhstan's vision for involving other international partners at Baikonur while environmentally respecting its land is hindered by its partnership with Russia. Russia's vision is to eliminate its dependence on Kazakhstan, yet it continues to be the principal operator of Baikonur.

From the start, Kazakhstan and Russia have held divergent views concerning the use of the cosmodrome. After the Soviet Union's fall, Russia needed to retain control of what was arguably its greatest single space asset to continue development in space. For Kazakhstan, as mentioned, Baikonur represented an opportunity for international cooperation and for the country's recognition as a spacefaring nation. Yet Russia's political dominance and security influence over the fledgling post-Soviet independent states in the 1990s did not permit Kazakhstan's competing view of the cosmodrome. Today, the landscape has shifted significantly, with Kazakhstan's regional influence expanding as Russia's diminishes. The agreement granting Kazakhstan management of Site 45 marks the beginning of a shift in control over Baikonur. The window of opportunity for international cooperation at Baikonur will widen if this trend continues.

Baikonur and International Space Cooperation

Two key factors must be considered in Baikonur's potential as a source of international space cooperation. For one, Russia's current status as a space power remains tenuous at best. Secondly, Kazakhstan is an integral part of Russian state security, and Russia has a strong, strategic interest in Kazakhstan's affairs. Any prospective international partners must tread carefully in the current evolving landscape, given the uncertainty surrounding how Russia will perceive and respond to these shifting dynamics.

20. "Россия предложила Казахстану 234 объекта на Байконуре [Russia Offers Kazakhstan 234 Facilities at Baikonur]," *TASS*, 16 March 2024, <https://tass.ru/>.

21. "Казахстан арестовал имущество «Роскосмоса» [Kazakhstan Arrests Roscosmos Property]," *The Moscow Times*, 13 March 2023, <https://www.moscowtimes.ru/>; and Mike Eckel, "Sunset For Baikonur? A Contract Dispute with Kazakhstan Flashes Warnings for Russia's Legendary Spaceport," *Radio Free Europe/Radio Liberty*, 6 April 2023, <https://www.rferl.org/>.

22. Eckel.

Opportunities for international involvement in Baikonur will grow as Russia's space capability continues to decline. A 2023 report measuring launch capacity marks this decline, showing Russia's space operations as fluctuating between a high of 22 launches in 2019 to a low of 12 launches in 2020. Meanwhile, by contrast, the United States has increased its launches every year since 2019 from 21 to 109 launches in 2023, and China has also steadily increased its launch capacity from 18 launches in 2017 to 67 in 2023.²³ Additionally, Vostochny remains a clear example of Russia's stagnation in terms of its status as a space power.²⁴ As of 2019, the development of Vostochny has cost, at a minimum, a staggering \$4.6 billion due to pervasive corruption, material/economic impacts of sanctions, and incentives needed to recruit industry experts to relocate to remote Siberia. Consequently, Russia has lacked the funds to invest in Baikonur's development or collaborate with Kazakhstan on other space capability initiatives.

In contrast, Kazakhstan has continued to develop its space capabilities. For example, it is currently working with France on building its own communication satellites.²⁵ It even purchased Starlink services from US commercial company SpaceX to provide 2,000 of its schools with high-speed internet.²⁶ As Russia struggles to match its launch rate and funding with its space ambitions, the disparity between the two nations' goals continues to grow. This widening gap encourages Kazakhstan to explore partnerships with other countries and commercial entities as it takes on greater responsibility for managing Baikonur.

In addition, the weakening of Russia's regional and global influence challenges such development of international space partnerships. Because space is an integral part of the Kremlin's military strategy, the Russian space program carries the same level of sensitivity as its national security, requiring a cautious approach from foreign actors. Since the end of the Cold War, Russia's status as a great power has deteriorated in several areas, including its economy, trade, technology, and political influence. As one scholar explains, Russia's Soviet-era superpower status and its possible current standing as a global power are today evidenced solely by its nuclear arsenal—"the only Russian asset of security and world status."²⁷ With its growing need for security dominance in the region, Russia may be reluctant to allow external actors to gain influence in Central Asia's space sector. In fact, in the wake of its own declining space capabilities, its aims

23. Jonathan McDowell, *Space Activities in 2023*, 5 January 2024, <https://planet4589.org/>.

24. Moltz, "Space Launch Nationalism"; and Laurence Peter, "Russia Corruption: Putin's Pet Space Project Vostochny Tainted by Massive Theft," *BBC News*, 19 November 2019, <https://www.bbc.com/>.

25. Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan, "Kazakhstan Will Produce Communication Satellites Jointly with the French Airbus Defense and Space," GOV.KZ, 18 May 2023, <https://www.gov.kz/>.

26. Dana Omirgazy, "Starlink Initiative: 2,000 More Schools in Kazakhstan to Receive High-Speed Internet," *The Astana Times*, 19 June 2024, <https://astanatimes.com/>.

27. Alexey Arbatov, "Understanding the US–Russia Nuclear Schism," *Survival: Global Politics and Strategy* 59, no. 2 (2017): 59, <https://doi.org/>.

have shifted from expanding its space program to developing capabilities to compromise Western space programs.²⁸

Furthermore, Kazakhstan remains Russia's closest military ally in Central Asia.²⁹ As recently as January 2022, Russia has deployed troops to Kazakhstan to assist in suppressing violent domestic riots over fuel prices.³⁰ Such dynamics highlight the obstacles Kazakhstan's future international space partners may face as they navigate the complexities of Russo-Kazakh space ties and Russia's attempts to maintain regional and strategic influence.

Given the growing dual-use nature of space assets, even purely civil attempts to assist Kazakhstan would be met by suspicion from Russia. Russia has displayed general distrust toward commercial space endeavors for their potential link to security issues. For example, in early 2024, the Russian Foreign Ministry accused the US Intelligence Community of using "the private sector to serve its military space ambitions."³¹ Russia is not alone in this suspicion as even in free-market countries like the United States, there is a concern among space operators that the boundary between military and civilian uses of space is becoming more difficult to define as commercial satellites proliferate and governments purchase the information collected.³² The dual-use of space capabilities can lead to unease among nations, raising suspicion that seemingly civil endeavors are meant to enhance military capabilities. This situation complicates efforts by any international actor to support Kazakhstan's space program without provoking resistance or antagonism from Russia. Notably, the recent engagement of China, Kazakhstan's other key neighbor, in Kazakhstan's space sector may clarify where Russia perceives the boundaries between acceptable civil cooperation and actions it deems threatening to its security interests.

China's Strategic Interest in Baikonur

China is a growing space power that has shown interest in involving itself in Kazakhstan's space ambitions, particularly at Baikonur. A 2022 US Defense Intelligence Agency report highlighted that "during the past 10 years, China has doubled its launches per year and the number of satellites in orbit."³³ The report illustrates the country's progress

28. Bruce McClintock and Melusine Lebet, "Russian Space Strategy and Capabilities: A Tale of Doctrine," in *The Sky Is Not the Limit: Geopolitics and Economics of the New Space Race*, ed. Alessandro Gili (Italian Institute for International Political Studies, 2024).

29. Dmitri Trenin, *Post-Imperium, A Eurasian Story* (Carnegie Endowment for International Peace, 2011), 127, <https://doi.org/>.

30. Olzhas Auyezov, "Russia Sends Troops to Put Down Kazakhstan Uprising as Fresh Violence Erupts," Reuters, 6 January 2022, <https://www.reuters.com/>.

31. "Russia Warns United States: Use of SpaceX for Spying Makes Its Satellites a Target," Reuters, 20 March 2024, <https://www.reuters.com/>.

32. David Roza, "Experts Warn of Blurring Line Between Military, Commercial Satellites," *Air & Space Forces Magazine*, 27 July 2023, <https://www.airandspaceforces.com/>.

33. 2022 *Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion* (Defense Intelligence Agency, 2022), 8, <https://www.dia.mil/>.

by explaining that China has launched three space stations into orbit and placed rovers on the moon and Mars. In June 2024, Kazakhstan reportedly signed a joint statement and 30 documents of interstate agreements with the PRC to include a memorandum outlining Kazakhstan's participation in the Chinese International Lunar Research Station project. In the joint statement, China's ministry of foreign affairs stated that it plans to "explore the possibility of commercial use of the two sides' space launch sites."³⁴ Kazakhstani news sources report that the PRC also promised a \$13.7 million grant to develop Kazakhstan's space industry.³⁵ China is rapidly increasing its space capabilities and is clearly posturing for a future space partnership with Kazakhstan.

Given China's self-sufficient space program, there are several reasons why it would partner with Kazakhstan in space capability development. Space cooperation with Kazakhstan is another channel for China to extend its rapidly evolving soft-power influence in Central Asia. In 2016, foreshadowing the space agreements formalized in June 2024, the PRC introduced the concept of the Space Information Corridor—dubbed the "Space Silk Road"—as part of its Belt and Road Initiative, which it positioned as the space technology and application pillar.³⁶ This initiative has since served as a vehicle for China to broaden its global influence through cooperative agreements with other nations.

Kazakhstan is China's largest economic trading partner in Central Asia, and in 2023, the total value of trade from the five Central Asian states with China was more than twice what it was with Russia.³⁷ Days before Kazakhstan signed the space cooperation documents with the PRC, it ratified its agreement with China made a year earlier to jointly improve the Trans-Caspian International Transport Route, the "Middle Corridor" which joins China and Europe through Kazakhstan, the Caspian Sea, Georgia, and Turkey.³⁸ That same month, to further develop the route, the PRC signed an agreement to pay over half the price for the planned China–Kyrgyzstan–Uzbekistan railway.³⁹ Soft-power influence is likely driving China's recent interest in Kazakhstan's space development.

In addition to soft-power influence, China is likely seeking future launch site options abroad as it foresees potential problems in its uptick of space launches. A Beijing-based

34. Andrew Jones, "Kazakhstan Joins China's ILRS Moon Base Program," *SpaceNews*, 5 July 2024, <https://spacenews.com/>; and "Over 30 Interstate Documents Signed During Chinese President's Visit to Kazakhstan," *interfax*, 3 July 2024, <https://interfax.com/>.

35. Fatima Kemelova, "Kazakhstan Sets to Implement Ambitious Projects with China, Iran," *The Astana Times*, 5 July 2024, <https://astanatimes.com/>.

36. Mingyan Nie, "Asian Space Cooperation and Asia-Pacific Space Cooperation Organization: An Appraisal of Critical Legal Challenges in the Belt and Road Space Initiative Context," *Space Policy* 47 (2019): 224, <https://doi.org/>.

37. Temur Umarov, "What Does Xi Jinping Want from Central Asia?," *Carnegie China*, 5 July 2024, <https://carnegieendowment.org/>.

38. "Kazakhstan Ratifies Agreement with China to Develop Trans-Caspian Int'l Transport Route," *interfax*, 1 July 2024, <https://interfax.com/>.

39. Yunis Sharifli, "Beijing Revives China–Kyrgyzstan–Uzbekistan Railway," *Eurasia Daily Monitor*, 17 July 2024, <https://jamestown.org/>.

company has already begun building a spaceport in Djibouti for launch access.⁴⁰ One regular commentator on China's space activities reports that China already operates five inland spaceports and possesses sea launch capabilities.⁴¹ Yet it will have to continue expanding its launch options—a measure that comes at the high cost of increased rocket debris falling to Earth and impacting China's densely populated areas—to keep up with its rapid satellite production, mass production of its Long March rockets, and ambitions for increased commercial launches.⁴² Furthermore, three different Chinese companies are building to compete with SpaceX's Starlink, each attempting to put up megaconstellations of over 10,000 satellites.⁴³

The completion of a Chinese-led international railway agreement will greatly increase the potential of Baikonur as an option for their launches. The China–Kyrgyzstan–Uzbekistan railway will link China to Baikonur once it reaches Tashkent. China's most advanced Long March 12 rockets, designed for commercial launch platforms, are transported via railway.⁴⁴ Baikonur's nearby launch platforms could help to alleviate the challenge of an increasing bottleneck at China's spaceports in the future.

China's space cooperation in Kazakhstan tests Russia's tolerance for outside security influences, since China's civil and commercial space ambitions are tied directly to its military ambitions. The key drivers behind China's rapid advancements in space capabilities during the early 2000s were closely aligned with bolstering its military power.⁴⁵ Its anti-satellite kinetic weapon test in January 2007 that destroyed one of its inactive weather satellites revealed to the international community the nation's true intentions behind its space activity. As one expert points out, although China's civil manned spaceflight program and international efforts like lunar research serve to alleviate international concerns and distract from PRC intentions of military operations in space, the military remains the “dominant force influencing China's space policy.”⁴⁶

Its commercial space initiatives remain fundamentally state-controlled, differing only in sources of funding.⁴⁷ Such efforts stop short of fully commissioning private space development, reflecting this desire to diversify funding sources while retaining centralized, government control over the industry. If Moscow is concerned that

40. “Preparing for Launch,” *The Economist*, 21 January 2023.

41. Andrew Jones, “China Completes New Commercial Launch Pad to Boost Access to Space,” *SpaceNews*, 5 January 2024, <https://spacenews.com/>.

42. Yong Xiong and Nectar Gan, “Suspected Chinese Rocket Debris Seen Falling over Village After Launch, Video Shows,” *CNN*, 24 June 2024, <https://www.cnn.com/>.

43. Rachel Cheung, “The Clash of Constellations,” *The Wire China*, 2 June 2024, <https://www.thewirechina.com/>.

44. Andrew Jones, “China to Debut New Long March Rockets in 2024,” *Space.com*, 1 March 2024, <https://www.space.com/>.

45. Roger Handberg and Zhen Li, *Chinese Space Policy: A Study in Domestic and International Politics* (Routledge, 2009), 159, <https://doi.org/>.

46. Erik Seedhouse, *The New Space Race: China vs. the United States* (Praxis, 2010), 12, 40, <https://doi.org/>.

47. Lucie Sénéchal-Perrouault, “Chinese Commercial Space Launchers: Historical Perspective; Policy Framework,” *Space Policy* 66 (1 November 2023): 101572, <https://doi.org/>.

commercial and civil involvement from other countries at Baikonur could introduce dual-use capabilities or ties to foreign militaries, any Chinese space involvement would reveal the boundaries of its tolerance. China's governmental and military control of space endeavors may create potential for geopolitical friction as its reach exceeds its borders. Yet it could also establish a precedent for the limits of Russian-accepted international involvement at Baikonur.

Space cooperation is another way for China to carefully intensify its influence in Central Asia while navigating preexisting geopolitical tensions with Russia. Russia's invasion in Ukraine incited sanctions that derailed China's trade with Europe through Russia. China's trade interests then had to pivot toward the Trans-Caspian International Transport Route through Central Asia.⁴⁸ Since Russia's invasion, President Xi Jinping has been more outspoken as a supporter of Central Asian autonomy. In 2022, during Xi's first official visit abroad after the start of the COVID-19 pandemic, he stated to the Kazakhstani press, "No matter how the international situation changes, we will continue to resolutely support Kazakhstan in protecting its independence, sovereignty and territorial integrity . . . [and] categorically oppose the interference of any forces in the internal affairs of your country."⁴⁹ In 2024, Xi repeated his statement of support at the Shanghai Cooperation Organization meeting.⁵⁰ Although both countries share leadership in the organization, which promotes regional security, Russia remains wary of China's growing dominance, as it threatens to further undermine Russia's influence in the region.⁵¹

The Russo-Sino relationship is complicated and requires historical analysis beyond the scope of this article. Nevertheless, it is clear that although China and Russia have demonstrated their cooperative stance through joint military exercises, the prospect of a formal military alliance remains highly unlikely.⁵² As one study contends, power is shifting in the region, but China's and Russia's regional interests overlap rather than collide as much as Western media may wish to think.⁵³ Such interests are concurrent, and whether or not China's interests dominate the region, it will

48. Natalia Konarzewska, "China Backs Kazakhstan Against Russian Threats," *The Central Asia-Caucasus Analyst*, 12 January 2023, <https://www.cacianalyst.org/>.

49. Paul Bartlett, "Xi Vows to Back Kazakh 'Sovereignty' in Central Asia Power Play," *Nikkei Asia*, 22 September 2022, <https://asia.nikkei.com/>; and also see Amy Gunia, "Why Xi Began His First Trip Since the Pandemic in Kazakhstan," *TIME Magazine*, 14 September 2022, <https://time.com/>.

50. "Китай и Казахстан: Общее Стремление к Новым Горизонтам — Председатель КНР Си Цзиньпин [China and Kazakhstan: A Common Aspiration for New Horizons – President of the People's Republic of China Xi Jinping]," Kazinform International News Agency, 2 July 2024, <https://www.inform.kz/>.

51. Wen-Chih Chao, "The Political Economy of China's Rising Role in the Shanghai Cooperation Organization (SCO): Leading with Balance," *Chinese Economy* 55, no. 4 (August 7, 2022): 300, <https://doi.org/>.

52. "Asia," in *The Military Balance 2023* (International Institute for Strategic Studies, 2023), 210.

53. Umarov, "Xi Jinping."

make little difference.⁵⁴ In fact, its economic interests have overlapped with those of other international interests in many other countries, which has enabled the Belt and Road Initiative's success. Thus, while China's economic influence in Central Asia will continue to synergize with Russia's security dominance, it is arguably in space where the two interests will clash.

Despite the risks and challenges China faces in engaging in space cooperation with Kazakhstan or in particular at Baikonur, it still views the endeavor as a valuable opportunity. Yet given the connection between China's military aspirations and its civil and commercial space activities, a commercial space presence at Baikonur would place its interests at odds with Russia's ambition to remain the dominant security force in Central Asia. In short, economy and security will intersect in space endeavors.⁵⁵

US Interests in Kazakhstan

The 2022 *US National Security Strategy* outlines US diplomatic goals in Central Asia to "advance climate adaptation, improve regional energy and food security, enhance integration within the region, and build greater connectivity to global markets."⁵⁶ A partnership specifically with Kazakhstan's space program could directly contribute to US security strategy in the region.

If Kazakhstan had a reliable and advanced independent space program, it could become the preferred provider of space services for all other Central Asian countries, fostering greater regional integration and advancement. The United States could strengthen Kazakhstan's space program by helping to develop advanced remote-sensing capabilities to monitor climate change and improve food security, directly supporting regional climate adaptation and resource management. The National Aeronautics and Space Administration's (NASA) food security program, for example, leverages remote-sensing technology to improve food security by monitoring vegetation health, water availability, water quality, and air quality globally.⁵⁷

Western commercial space companies like OneWeb and SpaceX have already established agreements with the Kazakhstan government to enhance connectivity by providing satellite broadband to remote parts of the country.⁵⁸ Satellite imagery enables experts to monitor climate phenomena, such as shrinking ice caps, shifting

54. Temur Umarov and Alexander Gabuev, "Is Russia Losing Its Grip on Central Asia?," *Foreign Affairs*, 30 June 2023, <https://www.foreignaffairs.com/>.

55. Gahyun Helen You, "The Final Frontier: Outer Space Security & Governance," *Foreign Policy*, 16 September 2024, <https://foreignpolicy.com/>.

56. Joseph R. Biden Jr., *National Security Strategy of the United States of America* (The White House, 2022), 39, <https://bidenwhitehouse.archives.gov/>.

57. National Aeronautics and Space Administration (NASA) Earth Sciences Division 610, "Food Security," NASA, accessed 26 December 2024, <https://science.gsfc.nasa.gov/>.

58. See Dana Omirgazy, "Kazakhstan Tests Eutelsat-OneWeb to Expand Internet Coverage to Remote Areas," *The Astana Times*, 23 October 2024, <https://astanatimes.com/>; and "Starlink Initiative: 2,000 More Schools in Kazakhstan to Receive High-Speed Internet," *The Astana Times*, 19 June 2024, <https://astanatimes.com/>.

migration patterns, fluctuations in plant populations, and other environmental changes. Additionally, US support could help Kazakhstan establish a competitive commercial launch industry, strengthen its integration into global markets, and enhance regional connectivity, positioning Kazakhstan to deliver essential space services to its Central Asian neighbors.

While sharing remote-sensing technology carries risks due to its dual-use nature, and competitiveness in commercial launches is a distant goal, the more significant benefit is the long-term partnership those efforts would build between Kazakhstan and the United States. As noted by one analysis, the West lacks a long-term strategy for Central Asia, focusing instead on short-term objectives like counterterrorism and military operations in Afghanistan. Instead, the West needs a comprehensive approach with measurable goals that emphasizes a continued presence without relying on numerous military bases.⁵⁹ Collaborating with Kazakhstan to enhance its space capabilities also aligns with a 2023 RAND report's recommendation to adopt a "less-hardline approach" in a region that avoids empowering adversaries, while also addressing a potential friction point in the Russo-Sino relationship.⁶⁰ By prioritizing a long-term partnership with Kazakhstan through space cooperation, the United States can advance its broader diplomatic and strategic goals in Central Asia, enhancing stability and strengthening relationships without relying on military escalation or short-term objectives.

Risks are inevitable with increasing US influence in Central Asia, but space cooperation offers a means to mitigate those risks while maintaining effectiveness. Kazakhstan has several strategic relationships with Russia and China through the Shanghai Cooperation Organization, the Commonwealth of Independent States, the Collective Security Treaty Organization, and other cooperative ventures. As discussed earlier, Russia's response to such influence remains unpredictable, especially given the growing dual-use nature of space technologies, which raises concerns about the potential for Western military involvement. Yet according to the 2021 Space Priorities Framework, the United States plans to "engage diplomatically with strategic competitors in order to enhance stability in outer space."⁶¹ Emphasis on strengthening Kazakhstan's organic space capabilities is a careful approach that is crucial to minimizing any destabilizing effects of a US-Kazakhstan space agreement. While this analysis does not exhaustively explore all the pros and cons of US engagement in Central Asia, it argues that if the region is a strategic priority, space cooperation in Kazakhstan remains a valid and effective approach.

US involvement in Kazakhstan's space development could risk prompting Russia and China to set aside their potential friction in this domain and unite against such an

59. Jennifer D. P. Moroney, "Western Approaches to Security Cooperation with Central Asian States: Advancing the Euro-Atlantic Security Order in Eurasia," in *Security Dynamics in the Former Soviet Bloc*, ed. Graeme P. Herd and Jennifer D. P. Moroney (Routledge, 2003), 182.

60. Miranda Priebe et al., *Future U.S. Peacetime Policy Toward Russia: Exploring the Benefits and Costs of a Less-Hardline Approach* (RAND Corporation, 17 May 2023), <https://www.rand.org/>.

61. "United States Space Priorities Framework," The White House, press release, 1 December 2021, <https://bidenwhitehouse.archives.gov/>.

effort. This, however, is unlikely due to the political costs it would impose on both countries. The Kremlin would have to decide whether to view PRC involvement at Baikonur as a threat to its influence or accept Kazakhstan's right to pursue a multi-vector foreign policy in space, which could pave the way for US participation.⁶² Any of China's objections to US space cooperation in Kazakhstan could draw unwanted international attention to its own controversial efforts to expand its space influence, such as its development of a spaceport in Djibouti, which takes advantages of gaps in international space regulations.⁶³

Since Kazakhstan's space ambitions are inextricably tied to its national identity, it would likely be willing to accept US assistance in growing its space capabilities. Any resulting anti-Western opposition shared between Russia and China would strain their individual relationships with Kazakhstan, testing the country's multi-vector foreign policy. Kazakhstan's space aspirations would thus be set in opposition to the interests of its neighbors, potentially resulting in a significant expenditure of their political capital.

Conclusion

The historic Apollo-Soyuz joint mission was in planning three years before the end of the Vietnam War. Today, NASA is cooperating with Russia's Roscosmos to launch Americans on two Russian Soyuz rockets from Baikonur through 2025.⁶⁴ While legal restrictions limit the sharing of space technology between the United States and China—in particular, NASA and the White House are prohibited from engaging in bilateral agreements or coordination with China in space exploration without explicit congressional approval—the potential collaboration with Kazakhstan at Baikonur could foster transparency and strengthen the future of space exploration.⁶⁵ The United States must prioritize space diplomacy to maintain diplomatic relationships capable of superseding the growing global instability driven by Russia's war in Ukraine and the escalating situation in the Indo-Pacific. Though Kazakhstan maintains strategic connections to Moscow and Beijing through various international agreements, space cooperation offers an opportunity for the United States to enhance diplomatic relations, showcase global leadership in space exploration, and create lasting opportunities in Central Asia.

At a minimum, the United States could focus on developing Kazakhstan's civil space program outside of Baikonur. Future opportunities could also include establishing a commercial space launch agreement at the Baiterek complex—creating a foothold for launch capabilities and deepening relations with all Central Asian partners. The success

62. Zhanibek Arynov, "Is Kazakhstan's Multi-Vector Foreign Policy Threatened?," *Horizons: Journal of International Relations and Sustainable Development*, no. 21 (2022).

63. Benjamin Silverstein, "China's Space Dream Is a Legal Nightmare," *Foreign Policy*, 26 December 2024, <https://foreignpolicy.com/>.

64. John Uri, "45 Years Ago: Soyuz and Apollo Launch - NASA," NASA, 15 July 2020, <https://www.nasa.gov/>; and "Events," NASA, accessed 2 September 2024, <https://www.nasa.gov/>.

65. Department of Defense and Full Year Continuing Appropriations Act, Pub. L. No. 112-10, 125 Stat. 28, <https://www.congress.gov/>.

of US efforts will ultimately depend on global space governance and geopolitical factors. If the United States seeks to engage more deeply in Central Asia, space cooperation with Kazakhstan offers a promising avenue. Further research will refine an actionable, specific strategy for extending US involvement in Kazakhstan's space program, but recognizing the potential benefits is the first critical step. Æ

MITIGATING CYBER VULNERABILITY

A Proposal for an Independent Cyber Force Within the DAF

MARCO CATANESE

As the United States confronts the challenges of intensified competition with China and other peer adversaries, its focus on exquisite platforms potentially overlooks the increasing cyber vulnerability of US forces, resulting in a poorly organized and resourced cyber force vis-à-vis China.¹ With its relatively small size, synergies with the US Space Force, and innovative culture, the Department of the Air Force is the ideal organization to house a larger and independent cyber force that would address current threats and develop unique cyber doctrine and education.

China's kinetic and nonkinetic forces have dramatically increased in size and capability, posing a broad threat to the United States and its Allies.² These forces, coupled with China's heightened aggression—such as prepositioning destructive malware on United States critical infrastructure in case of a conflict—form the impetus for the Department of Defense to continue optimizing for great power competition.³ Such efforts are wide-ranging, including reoptimizing core capabilities and

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1. The author would like to thank Dr. C. J. Horn, Dr. Heather P. Venable, and Major Julia Catanese for their help and contributions to this article.

2. Robert Haddick, *Fire on the Water: China, America, and the Future of the Pacific*, 2nd ed. (Naval Institute Press, 2022), 25.

3. *Department of the Air Force [DAF] Posture Statement Fiscal Year [FY] 2024, Hearing Before the Senate Armed Services Committee on the Posture of the Department of the Air Force in Review of the Defense Authorization Request for FY 2024 and the Future Years Defense Program [Posture Statement]*, 118th Cong. (2023), (statements of Secretary of the Air Force Frank Kendall, Chief of Staff of the Air Force Charles Q. Brown Jr., and Space Force Chief of Space Operations B. Chance Saltzman), 2–3, <https://www.armed-services.senate.gov/>; *The CCP Cyber Threat to the American Homeland and National Security, Hearing Before the Select Committee on Strategic Competition Between the United States and the Chinese Communist Party United States House of Representatives on the CCP Cyber Threat to the American Homeland and National Security*, 118th Cong. (2024) (statement of Jen Easterly, director of the Cybersecurity and Infrastructure Security Agency, US Department of Homeland Security), 2, <https://selectcommitteeonthecpp.house.gov/>; and Secretary of the Air Force Public Affairs, "Air Force, Space Force Announce Sweeping Changes to Maintain Superiority amid Great Power," US Air Force (USAF), 12 February 2024, <https://www.af.mil/>.

organizational structures and developing exquisite weapon systems to better compete with China.⁴ Yet, these efforts potentially overlook the increasing cyber vulnerability of the United States forces.

In fact, based on the testimony of each service secretary to the Senate Armed Services Committee, none of the services' top modernization priorities are cyber-related.⁵ Recently, however, the services have made some strides with improving their cyber postures. The Air Force has elevated Air Forces Cyber into a standalone service component command.⁶ The Navy has released a new cyber strategy, and after prompting from Congress, it created dedicated separate cyber roles for its officers and enlisted personnel.⁷ By early 2024, the Army and Marines had accepted the US Government Accountability Office's recommendation to add active-duty service obligations for Interactive On-Net training, a lengthy and expensive advanced cyber training.⁸ Yet these efforts by the services are not fully assuaging congressional concerns, leaving the United States with its currently poorly organized and resourced cyber force.⁹

With no service adequately prioritizing this issue, Congress directed in the Fiscal Year 2025 National Defense Authorization Act (NDAA) that the Defense Department evaluate the need for an independent cyber force "as a separate Armed Force in the Department of Defense dedicated to operations in the cyber domain."¹⁰ This assessment would be performed by the National Academies of Science, Engineering, and Medi-

4. Ronald O'Rourke, *Great Power Competition: Implications for Defense—Issues for Congress*, R43838 (Congressional Research Service [CRS], 28 February 2024), 9, 10, 27, <https://crsreports.congress.gov/>.

5. *DAF Posture Statement FY 2025*, 118th Cong. (2024), (statements of Secretary of the Air Force Frank Kendall, Chief of Staff of the Air Force David W. Allvin, and Space Force Chief of Space Operations B. Chance Saltzman), <https://www.armed-services.senate.gov/>; *Department of the Army Posture Statement FY 2025*, 118th Cong. (2024), (statements of Secretary of the Army Christine E. Wormuth and Chief of Staff of the Army Randy A. George), <https://www.armed-services.senate.gov/>; and *Department of the Navy Posture Statement FY 2025*, 118th Cong. (2024), (statement of Secretary of the Navy Carlos Del Toro), <https://www.armed-services.senate.gov/>.

6. Mark Pomerleau, "What Will the Elevation of Air Forces Cyber Look Like?," *DefenseScoop*, 5 April 2024, <https://defensescoop.com/>; and "Rapid Loss of Talent Contributing to DOD [Department of Defense] Cyber Shortfalls: Pentagon's Chief Weapons Tester," *DefenseScoop*, 23 January 2023, <https://defensescoop.com/>.

7. Justin Katz, "Navy Publishes First Cyber Strategy, Prioritizing Defense of 'Information Ecosystem,'" *Breaking Defense*, 21 November 2023, <https://breakingdefense.com/>; and Mark Pomerleau, "After Prodding from Congress, Navy Creates Dedicated Cyber Work Roles to Boost Readiness," *DefenseScoop*, 28 June 2023, <https://defensescoop.com/>.

8. Brenda S. Farrell et al., *Military Cyber Personnel: Opportunities Exist to Improve Service Obligation Guidance and Data Tracking*, GAO-23-105423 (US Government Accountability Office [GAO], 21 December 2022), <https://www.gao.gov/>.

9. See, for example, Mark Pomerleau, "What Will the Elevation of Air Forces Cyber Look Like?," *DefenseScoop*, 5 April 2024, <https://defensescoop.com/>; Pomerleau, "Rapid Loss"; and Justin Katz, "Navy Publishes First Cyber Strategy, Prioritizing Defense of 'Information Ecosystem,'" *Breaking Defense*, 21 November 2023, <https://breakingdefense.com/>.

10. National Defense Authorization Act (NDAA) for FY 2025, Pub. S. no. 118–159 (2024), 377, <https://www.congress.gov/>; and see, for example, Greg Hadley, "Is a Cyber Force Next? Lawmakers Want Independent Study," *Air & Space Forces Magazine*, 30 May 2024, <https://www.airandspaceforces.com/>.

chine. The draft included a proposal for an outside organization to evaluate the feasibility of an independent cyber force. The fiscal year 2024 Senate version of the NDAA included a similar proposal but it was removed after pushback from the Defense Department; the 2025 proposal has encountered similar pushback.¹¹ In arguing against the creation of a new cyber force, DOD leaders and others rationalize that US Cyber Command (CYBERCOM) has not been allowed enough time to utilize its new budgetary authorities to drive changes and that with no evidence an independent cyber force will be a more effective option, moving all cyber forces to a new service would be detrimental to the parent services.¹²

This article contends that the most effective way to remedy the cyber shortfall is to create a dramatically larger and independent cyber force to address current threats and develop unique cyber doctrine and education. Such a change would not necessarily be costly, as costs in cyber are inherently lower than other defense expenditures. In fiscal year 2024, such expenses were allocated to be \$13.5 billion, or just 2 percent of the DOD budget.¹³

Additionally, such a cyber force should be created within the Department of Defense. Recent analyses have covered the debate on whether such a new force should be housed within the Defense Department or external to it, with one analysis supporting the latter camp offering alternatives “better suited to the unique demands of cyber,” such as modeling a cyber service after the US Coast Guard or the US Public Health Services Commissioned Corps.¹⁴ Yet while the creation of a cyber force outside the Department of Defense may improve the ability of the federal government to respond to domestic cyberattacks, it is neither cost effective nor beneficial in terms of timeliness, given the urgent need for cyber capabilities in the current strategic environment.

This article further contends that the Department of the Air Force (DAF) would be the best department to house a new cyber force due to its synergies with the US Space Force and the DAF’s relatively small size and innovative culture. The Cyber Force, like the Space Force, would be relatively small and agile and would mesh well with the highly technical branches of the Air and Space Force.¹⁵

11. Martin Matishak, “Pentagon Gives Thumbs-down to Cyber Service Proposal in Defense Bills,” *The Record from Recorded Future News*, 27 September 2024, <https://therecord.media/>.

12. See for example, Mark Pomerleau, “Many Believe It’s Time for an Independent Uniformed Cyber Service. Here’s What It Could Look Like,” *DefenseScoop*, 15 May 2023, <https://defensescoop.com/>; and Alan Brian Long Jr. and Alex Pytlar, “An Argument Against Establishing a U.S. Cyber Force,” *DefenseScoop*, 11 July 2024, <https://defensescoop.com/>.

13. Mark Pomerleau, “US Cyber Command Releases First Full Budget,” *DefenseScoop*, 13 March 2023, <https://defensescoop.com/>.

14. Michael Kreuzer, “A Better Cyber Service,” *War on the Rocks*, 4 January 2024, <https://warontherocks.com/>; see also Pomerleau, “Many Believe”; and Erica Loneragan, Todd Arnold, and Nick Starck, “The Case for a Prospective US Cyber Force,” *War on the Rocks*, 22 May 2024, <https://warontherocks.com/>.

15. David Barno and Nora Bensahel, “Why the United States Needs an Independent Cyber Force,” *War on the Rocks*, 4 May 2021, <https://warontherocks.com/>.

Creating a new service under the DAF does not mean that every service's cyberspace operations forces and capabilities should be transferred to the DAF. Rather, only each service's cyber warfare personnel and capabilities that they currently provide to CYBERCOM's Cyber Mission Force (CMF) should be transferred. This article thus envisions a cyber force comprising initially of the existing personnel and capabilities transferred from the services with plans to rapidly grow the force to better posture the United States for offensive and defensive operations in peer competition, crisis, and conflict. This would overcome one of the main arguments against an independent cyber force as the services and agencies would retain most of their cyber workforce.

Information Dominance in the United States and China

Although both China and the United States view information dominance as essential to future warfare, only China has reoriented and prioritized its cyber-related military forces.¹⁶ After Desert Storm, China identified that information dominance would be critical in any future conflict.¹⁷ Later in the 1990s, China emphasized “network-centric warfare” and started organizing cyber units, which by the 2000s were conducting espionage and cyberattacks.¹⁸ China has routinely used cyberattacks over the last 10 years to steal military technology and conduct economic espionage, resulting in an economy and military roughly equivalent to the United States.¹⁹

China's emphasis on information and cyber warfare is further demonstrated by its 2015 military reorganization, which established a Strategic Support Force that elevated the Chinese cyber force as one department within that unit along with its space force.²⁰ In 2024, China reorganized its forces again, dividing the Strategic Support Force into separate information support, cyber, and space forces, all directly subordinate to the Central Military Commission.²¹ Initial analysis suggests the division was implemented to improve President Xi Jinping's visibility into each force.²² In any case, these efforts further China's goal for “intelligitized warfare”—or “the

16. Thomas L. Cantrell, “JADC2 Culture at the Operational Level of War,” *Air & Space Operations Review* 2, no. 1 (2023): 45, <https://www.airuniversity.af.edu/>; *Military and Security Developments Involving the People's Republic of China 2023: A Report to Congress Pursuant to the National Defense Authorization Act for Fiscal Year 2000, as Amended* (DOD, 2023), 40, 93, <https://media.defense.gov/>; and “Command History,” US Cyber Command, accessed 11 December 2023, <https://www.cybercom.mil/>.

17. Michael V. Smith, “Are We Gaining or Losing the High Ground of Space?” (lecture, Air Command and Staff College, 11 December 2023).

18. Desmond Ball, “China's Cyber Warfare Capabilities,” *Security Challenges* 7, no. 2 (2011), <https://www.jstor.org/>; and Jonathan Racicot, “The Past, Present and Future of Chinese Cyber Operations,” *Canadian Military Journal* 14, no. 3 (2014), <http://www.journal.forces.gc.ca/>.

19. *Military and Security Developments*; and Robert D. Blackwill and Jennifer M. Harris, *War by Other Means: Geoeconomics and Statecraft*, 1st Harvard paperback ed. (Belknap Press, 2017).

20. Caitlin Campbell, *China's Military: The People's Liberation Army (PLA)*, R46808 (CRS, 4 June 2021), <https://crsreports.congress.gov/>; and *Military and Security Developments*, 93.

21. Nectar Gan, “Xi Shakes Up China's Military in Rethink of How to ‘Fight and Win’ Future Wars,” *CNN*, 27 April 2024, <https://www.cnn.com/>.

22. Gan.

expanded use of AI and other advanced technologies at every level of warfare²³—and its belief that information technologies are a key vulnerability of the United States.²³ As such, China is investing in capabilities to attack systems used in command and control and logistics.²⁴

The United States also perceives information dominance as vital but has yet to make the requisite organizational structure changes or investments to reflect the new strategic environment. In the late 1990s and the early 2000s, the United States initiated a series of organizations to conduct defensive and offensive operations. CYBERCOM was then established in 2010 as a sub-unified command and later in 2018 as a unified combatant command. Today CYBERCOM is largely the same size and has the same structure as projected in the early 2010s.²⁵

Information connectivity is the core of Joint All-Domain Command and Control, which plans to interconnect existing and new systems—including the B-21 Raider—to deliver transformational capabilities in all domains using meshed sensor-to-shooter networks.²⁶ If the United States recognizes that information and cyber are essential to its core capabilities and acknowledges that China believes it can exploit that vulnerability, then it is logical that the United States would dramatically increase capabilities to defend and attack in cyberspace.²⁷ Yet, it has pursued only limited investments due partially to other priorities such as the Global War on Terror but also to service parochialism, with the services prioritizing their domain or mission ahead of other services or the Joint force.²⁸ This in turn has restricted the number and quality of personnel assigned to the cyber mission. A separate cyber force will be essential to ensure the United States can compete with China in the cyber domain.

The Cyber Mission Force cannot counter China with the low quantity of forces with mixed readiness levels currently provided by the services. In 2012, three years before China created its cyber force under its Strategic Support Force, the United States created CMF with an authorized force of 133 teams and 6,200 personnel.²⁹ It took six years for the CMF to reach full operational capability of 5,000 military and civilian personnel in 133 teams, and today the force has about 6,200 personnel with mixed readiness levels.³⁰ At the same time that the CMF declared full operational capability, CYBERCOM was elevated to a unified combatant command.³¹ In 2022,

23. *Military and Security Developments*, VIII.

24. *Military and Security Developments*.

25. “Command History.”

26. Cantrell, “JADC2 Culture,” 44.

27. “Command History.”

28. S. Rebecca Zimmerman et al., *Movement and Maneuver: Culture and the Competition for Influence Among the U.S. Military Services* (RAND Corporation, 2019), <https://www.rand.org/>.

29. “Command History.”

30. “Command History”; and Mark Pomerleau, “Senate Armed Services Committee Looks to Tackle Cyber Mission Force Readiness—Again,” *DefenseScoop*, 11 July 2023, <https://defensescoop.com/>.

31. Cantrell, “JADC2 Culture,” 44.

CYBERCOM announced that over the next few years the CMF would increase 11 percent to 147 teams.³²

Yet even though the number of teams has increased, improving readiness levels remains a challenge.³³ Some cyber officers allege that official readiness statistics are inflated, with proficient cyber operators double-counted to show that CMF teams are at full-strength when they are in fact filled at only 67 to 75 percent capacity.³⁴ The Navy in particular has had difficulty with readiness; yet in early 2024, training was improved and Congress mandated the Navy create specific cyber roles for enlisted personnel and officers.³⁵

Clearly, the size of the CMF has not kept pace with threat actors—individuals or groups who pose a threat to cybersecurity—nor the increase in missions assigned. Since 2012, China and others such as Russia, North Korea, Iran, and nonstate actors have expanded their cyber capabilities.³⁶ In addition to the greater number of threat actors, the CMF has recently been increasingly tasked to conduct missions not traditionally assigned to the military, including supporting election security and securing the defense industrial base.³⁷ Given the greater number and capability of cyber threat actors, the additional missions required of the CMF, and the exponential growth of internet connectivity and devices, the United States logically should have significantly increased the number of its cyber forces and associated readiness to counter these threats, but unfortunately it has not.³⁸

While the services have recently claimed they are now committed to intensifying efforts to improve the readiness and capacity of cyber forces, it is unlikely that their parochial practices would suddenly end and they would shift significant resources and personnel to the cyber domain when they assert they are currently ill-equipped to confront China in their own domain.³⁹ China's cyber force cyber operators outnumber the CMF almost 10:1 and are assessed as very capable; the additional increase in the

32. Martin Matishak, "Cyber Command Reshuffles Force Expansion Due to Navy Readiness Woes," *The Record*, 14 June 2023, <https://therecord.media/>.

33. Erica Lonergan and Mark Montgomery, *Cyber Force: A Defense Imperative* (Foundation for Defense of Democracies Press, March 2024), 6, <https://www.fdd.org/>.

34. Lonergan and Montgomery, 23.

35. Mark Pomerleau, "Following Reforms, Navy Seeing Cyber Mission Force Readiness Improvements," *DefenseScoop*, 22 February 2024, <https://defensescoop.com/>.

36. Lloyd J. Austin III, *2022 National Defense Strategy of the United States Including the 2022 Nuclear Posture Review and the 2022 Missile Defense Review* (DOD, October 2022), 6.

37. "Cyber Panel" (Air Command and Staff College, Maxwell AFB, AL, 5 December 2023).

38. Amy B. Zegart, *Spies, Lies, and Algorithms: The History and Future of American Intelligence* (Princeton University Press, 2023).

39. Haddick, *Fire on the Water*, 145; and Mark Pomerleau, "Prospective Service Chiefs Pledge to Address Cyber Mission Force Readiness Concerns of Congress," 15 September 2023, <https://defensescoop.com/>.

CMF to 147 teams will improve the ratio only to 9:1.⁴⁰ Although quantity does not always lead to operational success, defending against or attacking an opposing force of the same quality that is nine times larger is not conducive to success. Although it may improve readiness in some areas, recent efforts that have provided CYBERCOM with the enhanced budget authority akin to a special operations command will not result in changes to its capacity, because the services have still retained control over manpower and a majority of the cyber-related funding.⁴¹

The Case for a DAF Cyber Force

Today, the only warfighting domain that does not have a separate service is cyber.⁴² Only an independent cyber force will provide the requisite autonomy to develop service-unique doctrine, education, and training to compete against China.

One benefit of a separate cyber force is that there will be a single organization that will prioritize that mission as much as the other services prioritize their own. Currently, the services have not promoted officers with technical competency to senior levels, with only 5 out of 45 general officers working cyber jobs having any technical experience.⁴³ An independent cyber force could promote personnel based on cyber competency rather than Army, Air Force, Space Force, Marine, or Navy experience.⁴⁴ It could also standardize training and incentives to develop and retain the right personnel; for example, an independent cyber force could provide more bonuses to personnel who have a higher number of certifications or greater technical proficiency.⁴⁵ CYBERCOM, with enhanced budget authority, could set the training standards; however, in the end, the services would be the ones that promote and retain cyber personnel based on their own domain-specific requirements. Thus, only as an independent service can a cyber force advocate to increase its size dramatically and readiness levels accordingly.

Additionally, a separate cyber force can develop service-centric doctrine, strategy, and professional military education to create leaders who have an innate understanding of cyber operations and who can best employ them. This stance echoes historical arguments for an independent Air Force from the 1920s, when leaders advocated that only an air-minded person could best implement airpower.⁴⁶ Such perspectives, coupled with the belief that the United States was losing its qualitative edge in space, led

40. Pomerleau, “Cyber Command”; Meredith Roaten, “JUST IN: China Flexes Cyber Strength in India,” *National Defense*, 3 March 2021, <https://www.nationaldefensemagazine.org/>; and Mark Pomerleau, “Russia and China Devote More Cyber Forces to Offensive Operations Than US, Says New Report,” *C4ISRNet*, 15 February 2022, <https://www.c4isrnet.com/>.

41. Lonergan and Montgomery, *Cyber Force*, 11, 12.

42. Lonergan and Montgomery, 7.

43. Lonergan and Montgomery, 20.

44. Lonergan and Montgomery, 6, 14; and Jeffrey Couillard, “Beyond USCYBERCOM: The Need to Establish a Dedicated U.S. Cyber Military Force,” *Cyber Defense Review* 9, no. 1 (Spring 2024): 68.

45. Lonergan and Montgomery, *Cyber Force*.

46. William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military* (University of Alabama Press, 2009), 221.

to the Space Force's creation.⁴⁷ With the looming threat of war with China, the United States cannot afford to wait until after a conflict to justify an independent cyber force, as it did with the Air Force in 1947.⁴⁸

While a separate cyber department would be ideal, political objections to establishing additional bureaucratic overhead would likely call for the creation of a cyber force under an existing department.⁴⁹ Wisconsin Representative Mike Gallagher, the former chairman of the House Armed Services Committee's cyber, innovative technologies, and information systems subcommittee, has expressed hesitancy to create extra bureaucracy without a clear cyber benefit.⁵⁰

As argued, the DAF would be the best department for this new force due in part to its small size—the smallest number of forces across the services. Even with its recently created Space Force and a notional cyber force of 30,000 personnel—which would be five times the current CMF size—a DAF cyber force would still represent an active-duty force smaller than either the Department of the Army or the Navy by more than 82,500 personnel and 144,800 personnel, respectively.⁵¹ As mentioned earlier, such a cyber force would be initially comprised of the 6,000 personnel and capabilities transferred from the services, with plans to rapidly grow the force. The services and agencies would thus retain most of their cyber workforce, since only 2.6 percent of the over 225,000-strong DOD cyber workforce would be transferred.⁵²

Some have argued that the Department of the Army would be a logical fit for a cyber force since it has only one service; for a busy congressperson, that is a simple and easy argument to understand.⁵³ Others have noted that Army officials have been making the right decisions regarding cyber, and the Army provides capable cyber forces like the Air Force and a majority of the resources.⁵⁴ Yet, even though the Army comprises only one service, it is the largest service with 445,000 active-duty members.⁵⁵ Additionally, while the Army has focused on cyber in recent years, its efforts center on the integration of cyber and electronic warfare to support land

47. Smith, "High Ground."

48. William P. Head, "The Berlin Airlift: First Test of the US Air Force," *Air Power History* 68, no. 3 (Fall 2021): 23, <https://www.jstor.org/>.

49. Margaret A. Best et al., *Defense Efficiency Initiatives: Observations on DOD's Reported Reductions to Its Headquarters and Administrative Activities* (GAO, 24 September 2018), <https://www.gao.gov/>; and Jaspreet Gill, "Lawmaker 'Definitely' Considering Value of Independent Cyber Force but Wants More Study," *Breaking Defense*, 10 February 2023, <https://breakingdefense.com/>.

50. Gill.

51. NDAA for FY 2025, 189.

52. DOD News, "DOD Releases Plan for Implementing Cyber Workforce Strategy," DOD, 3 August 2023, <https://www.defense.gov/>.

53. Military Cyber Professionals Association (MCPA), "HammerCon 2023: US Cyber Force Panel (Schafer, Cleary, Franz, and Montgomery)," 18 May 2023, uploaded 13 June 2023, YouTube video, 47:25, <https://youtu.be/>.

54. MCPA.

55. NDAA for FY 2025, 89.

operations.⁵⁶ In fact, the top priority for the Army's Cyber Center of Excellence is an electronic warfare systems pack for tactical Army units.⁵⁷ The Army's tactical focus on integrating cyber and electronic warfare thus seeks to support the land domain versus strategic cyber operations. While the Air Force has announced it is now also building tactical cyber capabilities to support air superiority, it has not identified this effort as its main cyber priority.⁵⁸

While size is one aspect that warrants placing the cyber force in the DAF, a flexible and innovative culture is another factor where the Air Force comes out ahead. Culturally, the Air Force is the best department for a cyber force. Despite some initial growing pains, the addition of the Space Force demonstrates the Air Force has already shown it can foster an innovative culture. On the other hand, the Army and Navy both tend to adhere to a sense of orthodoxy and set of beliefs that their respective domains are the most important, with the Army maintaining the centrality of the land domain since its founding in 1775, and the Navy seeing itself as an institution older than the United States.⁵⁹ Conversely, from 2005 to 2021, the Air Force mission statement included air, space, and cyberspace, demonstrating the importance the service has ascribed to the cyber domain.⁶⁰ The DAF also was one of the first services to recognize the importance of cyber, creating a separate dedicated career field in 2010, almost four years before the Army did.⁶¹ Air Force culture also emphasizes technical competence and flexibility, traits that experts argue would be well-suited for a cyber force.⁶²

Additionally, as former Secretary of the Air Force Frank Kendall has testified, the DAF has given wide latitude to the Space Force to create a modern talent management framework that includes eliminating episodic physical fitness testing.⁶³ Similar to the Space Force, experts also believe that new talent management policies will be required to recruit cyber force personnel who may not fit the traditional view of what a service member

56. Lauren C. Williams, "Preparing for Electronic Warfare Is the Army's Top Cyber Priority in 2024," *Defense One*, 22 March 2024, <https://www.defenseone.com/>.

57. Williams.

58. Mark Pomerleau, "'This Is Overdue'—Air Force Creating Tactical Cyber Capabilities to Ensure Air Superiority," *DefenseScoop*, 23 May 2024, <https://defensescoop.com/>.

59. Zimmerman et al., *Movement and Maneuver*, xiv, xv; and Oriana Pawlyk, "Air Force Drops 'Space,' 'Cyber' from Mission Statement as Space Force Gains Momentum," *Military.com*, 8 April 2021, <https://www.military.com/>.

60. Zimmerman et al., xv; and Joshua Dewberry, "Air Force Unveils New Mission Statement," *Nellis AFB (website)*, 8 April 2021, <https://www.nellis.af.mil/>.

61. Susan Griggs, "New Officer Course Boosts Cyberspace Transformation," *Air Education and Training Command*, 16 June 2010, <https://www.aetc.af.mil/>; and Federal News Radio Custom Media, "Army to Recruit Next Generation of Cyber Workers Through New Career Field," *Federal News Network*, 18 September 2014, <https://federalnewsnetwork.com/>.

62. Zimmerman et al., *Movement and Maneuver*, 77; and Lonergan and Montgomery, *Cyber Force*.

63. *DAF Posture Statement FY 2024*, 8.

should look like.⁶⁴ Thus, the DAF would culturally be the best fit for the proposed cyber force, allowing it the freedom to innovate a new force construct.

Conclusion

China is developing cyber capabilities that, if left unchecked, will allow it to gain a competitive advantage in the cyber domain, negating any advantages the United States may have in other domains, including those created by improved kinetic strike capabilities.⁶⁵ All of the planned upgrades to kinetic systems will likely be integrated into Joint All-Domain Command and Control that only present additional vulnerabilities if they are not defended.⁶⁶ The current approach that increases the Cyber Mission Force by a modest 11 percent but keeps cyber professionals subordinate to their own respective services will not result in the force required to confront a well-equipped and well-trained force that is nine times larger, no matter what changes are made to readiness or cyber strategy. Only an independent cyber force can leverage service parochialism to its benefit in order to dramatically increase its size and innovate new doctrine and education. A separate department would likely best employ those capabilities, but political pushback on creating additional bureaucratic overhead would force the service to be created under a current department. Clearly, the Department of the Air Force is the best choice. Æ

64. Henry L. Sims, "Enacting the U.S. Cyber Force: The Key to Winning the Great Cyber Competition with China" (thesis, Naval War College, 23 February 2023), 10, <https://apps.dtic.mil/>.

65. John A. Tirpak, "Kendall: Ratio of Fighters to Bombers May Shift Toward Bombers in the Future," *Air & Space Forces Magazine*, 2 May 2023, <https://www.airandspaceforces.com/>.

66. Tirpak.

THE CONCEPTS OF MASS AND SURPRISE IN FUTURE AIR WARS

ALESSANDRO PODESTÀ

While contemporary air tactics seem to necessitate an approach firmly rooted in the conventional principle of mass, the advent of new technologies and the availability of increasingly effective non-kinetic capabilities call into question the efficacy of such an approach against today's dense integrated air defense systems and the current force composition. Through an analysis of the concepts of mass, surprise, and technological innovation in airpower theory and the case study of the First Gulf War, this article argues that to prepare for future conflict with peer adversaries, Western air forces need a paradigm shift toward utilizing advanced, low-observable weapon systems supported by comprehensive all-domain non-kinetic effects, ensuring air superiority by neutralizing the enemy's targeting capabilities.

Securing air superiority in potential future conventional conflicts among peer adversaries is the primary strategic objective for the air forces of Western nations. Following the dissolution of the Soviet bloc, the free Western powers maintained a significant advantage derived from a considerable capability disparity. Yet, over the past two decades, Russia has directed substantial resources toward narrowing this technological disparity while concurrently expanding its operational experience, thereby fostering the development of novel systems now proliferating among numerous aligned actors. At the same time, China has made notable technological strides, enhancing its integrated air defense system (IADS) and thereby compelling the United States and its Allies to reassess the operational landscape under the rubric of anti-access/area denial (A2/AD).¹ The new A2/AD construct represents a challenging obstacle for Western powers because it now includes stealth fighters, some of the world's most advanced air-to-air and surface-to-air missiles, and multi-spectral sensors to track airborne targets.²

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1. Alessandro Podestà, "The Concepts of Mass and Surprise in Future Air Wars—Literature Review" (master's thesis, Kenney Airpower Strategy Seminar [KASS], Air War College [AWC], 2024).

2. Mark A. Gunzinger, Lawrence A. Stutzriem, and Bill Sweetman, *The Need for Collaborative Combat Aircraft [CCA] for Disruptive Air Warfare* (Mitchell Institute for Aerospace Studies, 16 February 2023), 3, <https://mitchellaerospacepower.org/>.

How can the United States and its Allies generate effects inside such dense A2/AD environments with these premises?

In 2023, the US Air Force formulated the *Air Force Future Operating Concept* in response to this strategic stalemate.³ This framework promotes a strategic posture focused on the innovative concept of operations known as agile combat employment (ACE).⁴ This approach envisions the employment of “joint force in pulses” as a pivotal course of action.⁵ Airmen will achieve victory by applying “pulsed airpower,” the deliberate concentration of airpower in specific temporal and spatial domains to create strategic windows of opportunity that the broader force can leverage to achieve operational objectives.⁶ Yet the dimensions of the pulse, both in breadth and depth, have yet to be rigorously defined within scholarly discourse and declassified literature.

Contemporary tactics necessitate an approach firmly rooted in the principle of mass, intending to maximize the impact exerted by the Joint force within the pulse and bolster its survivability by overwhelming technologically sophisticated enemy defenses through saturation. Nonetheless, it is imperative to evaluate whether this approach is optimal. Considering the advent of new technologies and the availability of increasingly effective non-kinetic capabilities, one must question whether the conventional strategy of force packaging remains suitable for operating within densely fortified environments. Furthermore, force composition must be considered. Is mass still dominant in force composition, or are alternative factors, such as technology and surprise, gaining preeminence in contemporary operational paradigms?

This article questions the efficacy of the conventional approach of employing force packaging—even in pulses—against dense, modern IADS to overwhelm and saturate enemy defenses. Instead, it argues a paradigm shift toward utilizing advanced, low-observable weapon systems supported by comprehensive all-domain non-kinetic effects is needed. This combination is expected to effectively breach A2/AD structures, ensuring air superiority by neutralizing the enemy’s targeting capabilities.

By examining the significance of mass and surprise in the context of traditional Western war culture and analyzing airpower theory’s original approach to these concepts, this article offers a new perspective on the issue of force composition. Through the case study of the First Gulf War, the article extracts essential principles for defining optimal force composition in future air warfare scenarios, focusing on the pivotal role of technological innovation in reshaping the nature of aerial combat. These principles, paired with emerging capabilities stemming from advancements in combat domains, form a perspective through which Western air forces can meet the challenges of future air warfare.

3. *Air Force Future Operating Concept Executive Summary* (Department of the Air Force [DAF], 6 March 2023), 1, <https://www.af.mil/>.

4. *Agile Combat Employment*, Air Force Doctrine Note (AFDN) 1-21 (Curtis LeMay Center for Doctrine Development and Education [LeMay Center], 23 March 2022), 1, <https://www.doctrine.af.mil/>.

5. “Agile Combat Employment,” Jones Auditorium, Air War College, 18 October 2023.

6. *Future Operating Concept*, 1.

A Different Approach to Warfare

The current strategic environment requires a shift from strategies centered on mass over mass toward approaches that prioritize force multipliers, indirect strategies, and strategic maneuvering. The former approach is perhaps best elucidated in Carl von Clausewitz's *On War*, which encapsulates nearly 2,000 years of Western military tradition, emphasizing force and mass as the decisive keys to conflicts. Clausewitz notes that "each side is driven to outdo the other, which sets up an interaction," emphasizing the highest and simplest law of strategy is "keeping one's forces concentrated . . . to be very strong; first in general, and that at the decisive point."⁷ Surprise, although considered a "universal desire" and "the means to achieve superiority," is more applicable at the tactical level and increasingly difficult to achieve at higher levels of warfare.⁸ Clausewitz notes that "the greater the scheme of preparations, the smaller the chances to achieve surprise," stating that "it does require favorable conditions, which are not often present, and can rarely be created by the general."⁹

Currently, the arsenals of the Western world need more critical mass. Forces are outnumbered, and reserves are scarce and continuously depleted by secondary priority scenarios.¹⁰ Furthermore, future conflict with Russia or China will subject the West to the "tyranny of distance." In such a situation of numerical, physical, and geographical disadvantage, responding to force with force and concentrating mass against mass is an ineffective, flawed strategy, because the attrition resulting from such a large-scale confrontation would be unsustainable for Western democracies and their Allies in Asia. Therefore, the West must seek alternative solutions to meeting force with yet more force.

One potential approach is to adopt a strategic mindset similar to China. Strategies traditionally adopted by Chinese armed forces echo the need to create a critical mass capable of challenging Western dominance in conflict—certainly in terms of numbers if not intrinsic capabilities.¹¹ Sun Tzu's *Art of War* clearly states that in war one ideally should seek a military solution through nonmaterial "force multipliers" that will facilitate victory with minimal use of force.¹² The leader at war strives to create situations where "the force applied is minute but the results enormous."¹³ Sun Tzu advocates as force multipliers a strong emphasis on intelligence, the strategic employment of deception and diversionary tactics to attain surprise, the adoption of an "indirect approach,"

7. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton University Press, 1976), 585, 204; and Michael I. Handel, *Sun Tzu and Clausewitz: The Art of War and On War Compared* (US Army War College, 1991), 24, <https://apps.dtic.mil/>.

8. Clausewitz, 198.

9. Clausewitz, 200, 210.

10. Gunzinger, Stutzriem, and Sweetman, *CCA*, 3.

11. Yu Tiejun, "The Western Master and Bible of War: Clausewitz and His *On War* in China," in *Clausewitz Goes Global: Carl Von Clausewitz in the 21st Century*, ed. Reiner Pommerin (Carola Hartmann Miles-Verlag, 2011), 43.

12. Handel, *Sun Tzu*, 3, 24.

13. Sun Tzu, *The Art of War*, trans. Ralph Sawyer (Westview, 1994), 85.

and the utilization of psychological methods to diminish the adversary's resolve for combat and strategic maneuvering.¹⁴

This approach can be exemplified by amplifying the asymmetric advantage evoked by the US Department of Defense's so-called "third offset strategy"—formulated in 2014 in response to China's and Russia's military advancement—which seeks capabilities to offset a peer adversary's superior combat mass and proximity to the battlespace.¹⁵ Similar but expanded proposals are offered by the new "Offset-X," a "technology-centered, competitive defense strategy that lays the groundwork for maintaining or re-gaining our military-technological superiority over all potential adversaries," based on "lessons learned" from past offset strategies and US socioeconomic and technological strengths.¹⁶ The proposed required capabilities deriving from technology and innovation can produce outcomes aimed at mitigating the numerical superiority inherent in the competitors. Emphasis should be placed on quality over quantity when determining force composition, and technology can also ensure surprise.

Mass, Surprise, and Technology in Early Airpower Theory

To transition to this particular approach, it is essential to examine the concepts of mass, surprise, and technological innovation and their significance in air warfare as elucidated by early airpower theorists.

Mass and Surprise in Douhet's Command of the Air

Italian Army General Giulio Douhet's work provides an initial framework for understanding the concepts of mass, surprise, and the pivotal role of technology. As the first recognized airpower theorist, Douhet articulated the necessity for an independent air force to operate in mass, executing surprise attacks.¹⁷ As per surface commanders, air commanders should perpetrate attacks in mass because piecemeal attacks were counterproductive, given the inherent capabilities of the aerial means.¹⁸ That is the core of Douhet's theory because it permits the command of the air: "To gain command of the air is to be able to attack with impunity any point of the enemy's body."¹⁹ Here, mass refers to the capability to assemble aircraft in concentrated formations over critical enemy vital centers in the aerial dimension. Command of the air enables the maneuvering of this mass to deliver unexpected blows to the adversary, leveraging the rapidity

14. Handel, *Sun Tzu*, 25.

15. Gunzinger, Stutzriem, and Sweetman, *CCA*, 4.

16. Justin Lynch et al., *Offset-X: Closing the Deterrence Gap and Building the Future Joint Force* (Special Competitive Studies Project, May 2023), 1, <https://www.scspp.ai/>.

17. Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (Air University Press [AUP], 2019), 45, <https://www.airuniversity.af.edu/>.

18. Phillip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Meilinger (AUP, 1997), 14, <https://media.defense.gov/>.

19. Meilinger, 4.

of these mass strikes; Douhet considered it essential to victory.²⁰ Historical examples support his thesis, demonstrating that control of the air is often a decisive factor in the outcome of conflicts, enabling more effective and flexible application of military power across all domains.

The element of surprise is made possible by the aircraft's speed relative to the ground forces and by the ubiquity—namely, the ability to be in different places in short periods—of aerial assets, allowing them to move swiftly between different locations.²¹ Yet technological advancements, such as the introduction of the radar, have altered the dynamics of air warfare, posing challenges to achieving surprise. The concept is worth mentioning, although disputed, that air assets can reach their targets uncontested by attacking several targets simultaneously in mass formations at high altitudes, thanks to the aircraft's speed and range, a capability that aligns with the contemporary concept of “parallel operations.”²²

As Douhet emphasizes, technology plays a crucial role in enabling such simultaneous operations against multiple targets at both strategic and tactical levels. He credited technology's decisive power as the solution to the trench warfare brutality witnessed in World War I. Douhet's theories on strategic bombardment are thought to have first influenced Brigadier General Billy Mitchell and then consequently formed the theoretical basis of the US Army's Air Corps Tactical School (ACTS).²³

Technology for the ACTS

The ACTS theorists played a pivotal role in shaping the evolution of aerial warfare doctrines during the interwar period of the twentieth century. Their insights heavily influenced the strategic outlook of air forces during World War II and laid the groundwork for establishing the US Air Force as an independent service branch. Central to their doctrine was the concept of air superiority achieved through offensive airpower, with an emphasis on the role of bomber aircraft. They advocated for the mass deployment of bombers to execute “vigorous aerial assaults” aimed at undermining enemy morale and incapacitating their societal infrastructure.²⁴

This strategy targeted population centers, supply systems, and other rearward objectives deemed critical to an adversary's resilience. Echoing the principles set forth by Douhet, ACTS theorists proposed the development of a new type of aircraft: the long-range, four-engine bomber named the *flying fortress*. This technologically advanced platform was envisioned to operate unescorted and in concentrated formations, delivering precision strategic bombing against enemy targets. Those ideas were encapsulated

20. Meilinger, 10.

21. Meilinger, 9.

22. Meilinger, 15.

23. Meilinger.

24. Peter Faber, “Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower,” in *Paths of Heaven*, 216.

in a series of concepts in 1932: “Massed air strike forces can penetrate air defenses without unacceptable losses and destroy selected targets.”²⁵

Furthermore, the ACTS elaborated on the concept of unescorted high-altitude precision daylight bombardment, which involved targeting critical nodes within an adversary’s industrial-economic infrastructure or “spider web.”²⁶ This strategy aimed to expedite victory by crippling the enemy’s ability to sustain war efforts through targeted attacks on vital industrial hubs. Emphasizing long-range bombing appeared to offer the prospect that the next war could be won more quickly and decisively than the last through innovative technology.²⁷

While they did not advocate for the use of psychological warfare tactics such as gas bombs against civilian centers, the theorists formulated a doctrine emphasizing high-altitude, daylight, precision, and formation bombing of industrial targets.²⁸ The pinnacle of their envisioned aerial force was the B-17 Flying Fortress, capable of executing formation bombing runs with impunity, projecting power through massed aerial assaults.²⁹ In essence, the ACTS theorists leveraged technological innovation to operationalize Douhet’s principles of surprise and mass and to actualize the capability of precision bombing, envisioning a future where airpower would decisively shape the outcome of conflicts through strategic bombing campaigns. The element of surprise arises from the impossibility of counteraction, while mass derives from the capacity to concentrate force; however, afterward, technology played another pivotal role in changing the character of the air war.

The Evolution of Mass and Surprise

The notion of mass encapsulates the cumulative impact of numerous aircraft with their bomb loads, emphasizing the capability to aggregate effects by concentrating aircraft in the air.³⁰ Importantly, as long as these effects can be achieved, the massing of aircraft becomes optional, even though having command of the air enables it.³¹ In past military campaigns, achieving desired effects required a focus on mass, influenced by strategic thinking traced back to Clausewitz’s concept of the center of gravity and prevailing technological capabilities.

Two considerations contributed to departing from this paradigmatic approach: one related to targeting considerations and the other to technological advances. In the late 1980s, John Warden’s “Five Rings Model” advanced a shift in targeting philosophy,

25. Faber, 217.

26. Faber, 186.

27. Karl P. Mueller, “Air Power,” in *International Studies Encyclopedia*, vol. 1, ed. Robert A. Denemark, web-only reprint (Wiley-Blackwell, 2010), RAND, 2, <https://www.rand.org/>.

28. Philip S. Meilinger, “Winged Defence: Answering the Critics of Airpower,” *Royal Air Force Air Power Review* 5, no. 4 (Winter 2022): 41, <https://www.raf.mod.uk/>.

29. Faber, “Interwar,” 216.

30. Meilinger, “Douhet,” 15.

31. John Andreas Olsen, ed., *Air Commanders*, 1st ed. (Potomac Books, 2013), 377.

prioritizing the identifying of targets based on their potential political effects rather than purely physical destruction.³² Nearly two decades later, David Deptula then elaborated and expanded on these concepts: “Crucial principles defining parallel warfare are how time and space are exploited in terms of what effects are desired, and for what purpose, at each level of war—the essence of effects-based operations.”³³ Focusing on an attack’s effects rather than on the target’s destruction starkly contrasts with the AirLand Battle doctrine, which was widely embraced within the US Air Force’s Tactical Air Command community. This doctrine, prevalent in the late 1980s, primarily envisioned a war of attrition centered on achieving air superiority by targeting Soviet airfields, forces, and supplies.³⁴

Technological innovation is the other factor that contributed to moving from the concept of mass forces to the focus on effects. One of the most noteworthy technological improvements was the introduction of precision-guided weapons. In 1996, historian Phillip Meilinger theorized that these weapons “redefined” mass: “Precision-guided munitions drastically reduced the need to back up the bombs required to strike a specific target. Given an IADS, the sorties necessary to achieve the same effects on the target diminished considerably.”³⁵

A clear example, most probably the first in history, of this new paradigm shift was the May 1972 bombing of the “Dragon’s Jaw” bridge in Thanh Hoa, North Vietnam, where four flights of four F-4 Phantoms destroyed the bridge after hundreds of ineffective sorties, thanks to the utilization of precision-guided munitions in combat. US Air Force technicians estimated that 33 times as many unguided bombs would have been required to achieve the same result.³⁶ Such astonishing results led to an initial shift in force composition; now smaller numbers of fighters could exert more significant influence over larger areas.³⁷

The First Gulf War in the Evolution of Aerial Warfare

Although its outcomes in the air were somewhat predetermined by the disparity between the involved air forces and equipment, the First Gulf War can be considered as the most compelling demonstration of this change in force composition due to new technologies’ potential and innovative power.³⁸ In the execution of the air war, force concentration was still the predominant trend in force composition but only following

32. John Andreas Olsen, *Strategic Air Power in Desert Storm* (Frank Cass, 2003), 85.

33. David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Aerospace Education Foundation, 2001), 5, <https://www.airandspaceforces.com/>.

34. Olsen, *Strategic Air Power*, 83.

35. Phillip S. Meilinger, “Ten Propositions Regarding Airpower,” *Air & Space Power Journal* (1996), <https://www.airuniversity.af.edu/>.

36. Barrett Tillman and Stephen Coonts, “First Laser Bombs Bust the Dragon’s Jaw,” *Invention & Technology* 27, no. 1 (Summer 2021), <https://www.inventionandtech.com/>.

37. Mueller, “Air Power,” 4.

38. Meilinger, “Douhet,” 24.

waves of independent, small, undetected assets. On the first night of the war, low-observable platforms made possible by the new and secret stealth technologies were the keystones of coalition attacks against the Iraqi air defense system, leadership, and communications targets, even in heavily defended areas.³⁹ Throughout the war, the F-117 Nighthawk stealth fighter, the Tomahawk Land Attack Missile, and the Conventional Air-Launched Cruise Missile launched by B-52s served the coalition by disabling the enemy defenses, thus offering otherwise unattainable freedom of action.⁴⁰ In the past, air forces fought defenses and accepted losses on their way to the target or rolled those defenses back. In the Gulf War, the coalition could strike Iraqi air defenses immediately with unprecedented accuracy.⁴¹

Moreover, stealth platforms attacked with complete surprise and were nearly impervious to Iraqi air defenses.⁴² It was what Douhet had precisely predicted.⁴³ Specifically, his formula for victory—gaining command of the air, neutralizing the enemy’s strategic centers of gravity, and maintaining the defensive on the ground while conducting the offensive in the air—underpinned coalition strategies, made possible thanks to new technologies.⁴⁴

A New Effects-Based Approach

Force composition was, therefore, adapted to exploit those innovations. The process of adaptation, though, has not been immediate. During the planning phases for the first strikes over Iraq, then-Lieutenant Colonel Deptula and his team initially treated the F-117, a highly secretive aircraft at the time, as per old historical force packaging paradigms and aimed to maximize damage on hardened targets. Specifically, since the F-117 could carry two precision-guided munitions, intelligence allocated them against only two critical command and control (C2) centers, utilizing then all of the 16 available F-117s.⁴⁵ Deptula reasoned that one weapon per air defense target could render them ineffective, allowing the remaining F-117s to target a broader range of objectives and potentially delivering a decisive blow to the adversary.

Applying this concept led to a significantly different air campaign than previous wars, as demonstrated during the first night of the Gulf War. Deptula’s team outlined a master attack plan comprising 152 discrete targets, including Iraqi army forces and surface-to-air missile sites for the initial 24-hour period, a remarkable departure from

39. Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (US Government Printing Office, 1993), 224.

40. Keaney and Cohen, 224.

41. Gunzinger, Stutzriem, and Sweetman, *CCA*, 12.

42. Keaney and Cohen, *Gulf War*, 224.

43. Meilinger, “Douhet,” 24.

44. Meilinger, 1.

45. John Andreas Olsen, ed., *Airpower Pioneers: From Billy Mitchell to Dave Deptula*, 1st ed. (Naval Institute Press, 2023), 377.

past practices, with more targets designated for attack in a single day than those struck by the entire Eighth Air Force throughout 1942 and 1943 combined.⁴⁶

This shift toward a more effects-based approach marked a significant evolution in the conduct of air warfare. The planners and commanding officers had comprehended the unparalleled advantages of stealth and surprise, relying on technological and training superiority. For the type of air war it was intended to conduct, based on “parallel attacks” and a strategy of “decapitation,” they emphasized the “time-compressed convergence of technology and strategy” as the key to success.⁴⁷ The air war was successful in achieving air dominance, but modern literature raises doubts, particularly when analyzing airpower’s actual contribution to the overall outcome of the war. For example, one foreign policy expert contends that “air power contributed to the coalition’s effort, but the air campaign was neither sufficient nor necessary for the very one-sided victory.”⁴⁸

A crucial reason to avoid physical concentration of mass is that force postured in mass is highly vulnerable to attacks.⁴⁹ The tactical airpower theory, valid for ground forces, can be easily translated and applied to air forces: forces are highly vulnerable to air attack when they are concentrated in mass before maneuvering and while they maneuver.⁵⁰ Therefore, this principle also applies to amassing and maneuvering forces in pulses, as they will be vulnerable to attacks.

Technology Pivotal for Success

The amalgamation of mass as a concert of effects, surprise as an inexorable prerequisite, and innovation as the primary driving force emerge as the three paramount elements to consider when formulating an effective force posture. Technology changed the character of the air war. Considering also the importance given to technology by US Air Force General Charles Albert Horner, commander of the US and Allied air operation during Operation Desert Storm, a focus on future capabilities is now required to make a valid parallel with the past.⁵¹

A New Force Composition

The First Gulf War prompted a meticulous examination of operational methodologies and doctrines as well as of technological advancements and associated tactics. Notably, enemy air defenses’ unforeseen downing of an F-117 stealth bomber during

46. Deptula, *Effects-Based Operations*, 2.

47. Olsen, *Strategic Air Power*, 111.

48. Daryl G. Press, “The Myth of Air Power in the Persian Gulf War and the Future of Warfare,” *International Security* 26, no. 2 (Fall 2001): 7; and see Robert Anthony Pape, *Bombing to Win: Air Power and Coercion in War* (Cornell University Press, 1996), 253.

49. Deptula, *Effects-Based Operations*, 19.

50. Phil M. Haun, lecture, 5 February 2024, KASS, AWC; and *Tactical Air Power and the Vietnam War: Explaining Effectiveness in Modern Air Warfare* (Cambridge University Press, 2023), 202.

51. Olsen, *Air Commanders*.

Operation Allied Force in 1999 underscored the evolving nature of aerial warfare.⁵² The rapid progression of stealth and counter-stealth technologies emphasizes the necessity for continuous adaptation, potentially exerting constraints on the composition and availability of military forces in forthcoming conflicts.

Force Multipliers and the Required Technological Advantage

The lessons learned can be paired with enabling emerging capabilities in combat domains, which can guarantee asymmetric technological offset. These capabilities are the new generation weapon systems, new C2, and increased non-kinetic support through space and cyberspace domains. Each asymmetric advantage in capabilities follows a spiral pattern of escalation, with the anticipation of countermeasures to emerging technologies. As evidenced by historical precedent, the dynamic equilibrium of military capabilities has perpetually evolved through a cyclical process of challenge and response.⁵³

Consequently, within the current resource framework, envisioning a force predominantly reliant on low-observable aircraft, bombers, and sophisticated cruise missiles poses a formidable challenge because they may not become available in the required numbers for years.⁵⁴ This challenge is particularly magnified when confronting the imperative of engaging a diverse spectrum of targets across all levels of warfare, necessitating a proportional deployment of required capabilities. In such circumstances, the principle of mass assumes paramount significance because it is intended as a numerical strength/combat force dimension essential for effectively engaging the multitude of targets rather than concentrating solely on the numerical saturation of adversary defenses.

Indeed, the configuration of military forces presents a formidable challenge for Western powers. The imperative of sustaining preeminence by possessing cutting-edge capabilities in adequate quantities to offset any competitor's force and capability imposes an enduring burden on resources and time. Such an imperative, coupled with the acknowledgment of the "tyranny of costs," is inevitable if global preeminence is to be maintained. Emphasizing technological advancements, non-kinetic support, and innovative tactics will result in more economically and technically feasible solutions. These approaches are more cost-effective and attainable compared to the traditional mindset of amassing forces to counteract opposing masses, particularly in light of the foreseeable challenges of the future.

The Imperative of Breaching A2/AD Defenses

Another imperative is to recognize that the most significant operational challenge lies in effectively infiltrating that mass within the A2/AD system.⁵⁵ Even if stealth technology is hard to maintain and gives a time-limited advantage, it must represent the base

52. Olsen.

53. John Andreas Olsen, ed., *A History of Air Warfare*, 1st ed. (Potomac Books, 2010), 153.

54. Gunzinger, Stutzriem, and Sweetman, *CCA*, 4.

55. Harry Foster, Bob Martinage, and Jim Thomas, *Toward a New Targeting Approach for Great Power Competition* (Telemus Group, 2019), 2.

for future weapon systems. Those platforms will represent the asymmetric air superiority capabilities and include fifth- and sixth-generation aircraft complemented by a family of uncrewed collaborative combat aircraft (CCA).⁵⁶ Fifth-generation fighters will represent the backbone of the force composition, but in about a decade, the new sixth-generation platforms will contribute to the winning fight. Systems like the American Next Generation Air Dominance or the allied Global Combat Air Programme will dominate the sky, bringing the new “family of systems” (or “system of systems”) philosophy into combat: this new concept embraces crewed platforms teamed with uncrewed air combat aircraft, the connectivity systems between those platforms, the sensors that support them, the suite of weapons the platforms can carry, and more.⁵⁷ This innovative fighter’s concept will incorporate cutting-edge technologies that have the potential to revolutionize combat tactics, and most importantly, it will possess the agility to adapt to evolving technologies and threats swiftly, keeping pace with the competitors.⁵⁸

While sixth-generation fighters will bring new stealth capabilities, longer ranges, and larger payloads to the fight, CCA with autonomy and artificial intelligence/machine learning (AI/ML) technologies will act as force multipliers in terms of combat utility and cost-effectiveness. CCA or “loyal wingmen” will bring to the fight more weapons for achieving air superiority, together with new integrated sensors, which will permit the crewed platform to stay at range, diminish the overall mission and force risk, and increase the density of weapons and sensors to be projected into highly contested environments.⁵⁹ As per current doctrine, air superiority will be achieved in windows of opportunity in which new platforms like the B-21 Raider will bring destructive power to achieve the effects inside those windows. This is not merely an arms race to achieve precision through mass but a vital effort to deliver the necessary effects precisely where and when they are needed.

C2, Space, and Cyber Effects as the Non-Kinetic Cover for the Force

To battle manage the joint force, Western powers need a new C2 system to maximize their capabilities and efficiently coordinate their technological advantages. Initiatives such as the US DOD Joint All-Domain Command and Control (JADC2) or the NATO Cross-Domain Command exemplify proactive steps in this direction.⁶⁰ The

56. Gunzinger, Stutzriem, and Sweetman, *CCA*, 21.

57. DAF, “Operational Imperatives,” infographic, 2023, <https://www.af.mil/>; and “Global Combat Air Programme (GCAP),” Leonardo (website), accessed 28 March 2024, <https://www.leonardo.com/>.

58. *Air Force, Force Structure and Modernization Programs, Hearing Before the Senate Armed Services Committee Subcommittee on Airland*, 118th Cong. 10 (2023), <https://www.armed-services.senate.gov/>.

59. Gunzinger, Stutzriem, and Sweetman, *CCA*.

60. *Department of the Air Force Posture Statement Fiscal Year 2022, Hearing Before the Committees and Subcommittees of the United States Senate and the House of Representatives* 117th Cong. 9 (statements of Acting Secretary of the Air Force John P. Roth, Chief of Staff of the Air Force General Charles Q. Brown Jr., and US Space Force Chief of Space Operations General John W. Raymond), <https://www.af.mil/>; and Paolo Giordano, “Next Generation Command and Control,” NATO Allied Command Transformation, 6 December 2023, <https://www.act.nato.int/>.

goal is to “gain and maintain information and decision advantage against global adversaries throughout the competition continuum.”⁶¹ This will be possible when aircraft, spacecraft, and cyber nodes seamlessly share and connect data, increasing a commander’s ability to control the fight while complicating an enemy’s ability to defend themselves.⁶² Notably, the JADC2 strategy states that “JADC2 provides an approach for developing the warfighting capability to sense, make sense, and act at all levels and phases of war, across all domains, and with partners, to deliver information advantage at the speed of relevance.”⁶³

Once the force is allocated and ready to be managed, non-kinetic effects aimed at negating the enemy’s targeting will provide adequate cover for the Joint force. Significant contributions are anticipated from the space domain, which is now acknowledged as a warfighting arena incorporating the principles of Joint warfare.⁶⁴

Peer competitors, notably China, have conducted extensive analyses of US military reliance on space and its implications for warfare strategy.⁶⁵ As a result, they are actively developing and deploying a comprehensive range of counterspace capabilities to exploit vulnerabilities within the US space infrastructure, with the objective of preemptively and offensively extending conflict into space.⁶⁶ This militarization of space by both China and Russia serves to diminish the military efficacy of Western allies while contesting their freedom of action within this domain.⁶⁷ Among the capabilities acquired by these nations are anti-satellite weapons (ASAT); alternative constellations of positioning, navigation, and timing satellites; mobile jamming devices; multiple ground-based directed energy weapons as well as new communication; intelligence, surveillance, and reconnaissance; and electronic warfare satellites.⁶⁸ They intend to exploit space as a facilitator domain for their joint military operations.⁶⁹

In response, the United States and its Allies must aim to leverage their technological edge, deploying similar capabilities to “cover” the pulsed joint force in the so-created windows of opportunity. While the specifics of US military capabilities in the space domain remain undisclosed for security reasons, plausible conjectures can be made. These include possessing co-orbital ASAT and direct-ascent ASAT missile capabilities; operational electronic warfare systems such as the Counter Communica-

61. *Summary of the Joint All-Domain Command & Control (JADC2) Strategy* (Department of Defense [DOD], March 2022), 2, <https://media.defense.gov/>.

62. Justin Reynolds, “Multi-Domain Command and Control Is Coming,” US Air Force, 25 September 2018, <https://www.af.mil/>.

63. *JADC2 Strategy*, 3.

64. *2020 Defense Space Strategy Summary* (DOD, June 2020), <https://media.defense.gov/>.

65. Jiemin Hou, “Offensive Defense: People’s Liberation Army Logic of Preemption in Space,” *Æther: A Journal of Strategic Airpower and Spacepower* 1, no. 4 (2022), <https://www.airuniversity.af.edu/>.

66. Hou, 5; and *Defense Space Strategy*, 1.

67. *Defense Space Strategy*, 1.

68. *2022 Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion* (Defense Intelligence Agency [DIA], March 2022), <https://www.dia.mil/>.

69. DIA, 9.

tions System, capable of uplink jamming against geostationary communications satellites (though no public evidence exists currently of space-based directed-energy weapon capability); the capability to jam and interfere with global navigation satellite services signals, ground-based high-energy lasers for counterspace applications, and low-power laser systems for dazzling and potentially blinding Earth observation imaging satellites; as well as a robust and redundant space situational awareness infrastructure.⁷⁰ Negating the enemy's space contribution to long-range fires and enabling allied space capabilities for beyond-line-of-sight targeting is a crucial goal of the US Space Force, along with the ability to counter the enemy's targeting of the stealth Joint force.⁷¹ The US Defense Department is committed to creating a robust and capable Space Force to "enable national, joint, and combined operations in any domain through sustained, comprehensive space military advantages."⁷² This resolute commitment aligns well with the proposed force posture based on effects aimed to negate the enemy's targeting against the Joint force.

Furthermore, contemporary warfare recognizes cyberspace as a pivotal domain due to its ubiquitous presence across all societal domains, including military operations.⁷³ China and Russia have already emphasized cyberspace's offensive potential, considering it a significant component of integrated warfare and employing it to support military operations against space-based assets. Targeting examples include network-based command, control, communication, computers, intelligence, surveillance, reconnaissance (C4ISR); ground sites; infrastructure supporting space operations; logistic networks; and commercial activities.⁷⁴ Given these criticalities, it is clear that in the initial phase, significant efforts should be focused on enhancing cyber defense mechanisms and system resilience. Achieving this goal would mark a significant accomplishment by allowing the resumption of routine operations.

Subsequently, if the capacity to sustain offensive operations is achieved, leveraging residual efforts and resources will enable the ability to undertake offensive operations, representing a complete restoration of strategic advantage. Effects deriving from offensive cyberspace operations (OCO) are increasingly recognized for their potential to yield strategic outcomes.⁷⁵ At the operational level, coordinating OCOs alongside joint force maneuvers is essential for creating advantageous windows of opportunity. This coordination demands sophisticated technological capabilities, substantial time investment, meticulous intelligence gathering, comprehensive planning, and collaborative efforts among various joint force components.

70. Brian Weeden and Victoria Samson, eds., *Global Counterspace Capabilities: An Open Source Assessment* (Secure World Foundation, April 2023), <https://swfound.org/>.

71. Brigadier General Jacob Middleton, question and answer session to Seminar 4, AWC, 26 March 2024.

72. *Space Strategy Summary*, 2, 7.

73. Aggelos Chorianopoulos, "Next War Battlefields: Earth, Space or Cyberspace?," Karve (website), 9 January 2024, <https://www.karveinternational.com/>.

74. DIA, *Challenges*.

75. Jacquelyn Schneider et al., *Ten Years In: Implementing Strategic Approaches to Cyberspace*, Newport Papers (US Naval War College Press, 2020), 26, <https://digital-commons.usnwc.edu/>.

Nevertheless, the impact of such coordination can be decisive, serving as a force multiplier for conventional military operations.⁷⁶ Pursuing cross-domain effects during large-scale combat operations is then a paramount objective for the joint force.⁷⁷ For instance, OCOs can target enemy air defenses, facilitating air strikes. Additionally, they can contribute to the erosion of the enemy's overall capability, impeding their ability to mount a cohesive defense. Indirect cyberattacks, such as communication disruptions or manipulation of enemy operation timing, can instigate confusion and delays, thereby undermining the efficacy of the combined enemy's defense. Communication disruptions and other forms of interference exacerbate organizational friction within adversary entities, undermining their operational efficiency against the joint force's operations in pulses.⁷⁸

A similar conceptualization of employing the joint force in future air wars can be found in the following case study. As stated, ACE has not yet defined the pulses for operating the Joint force in an academic and unclassified context.⁷⁹ To address this gap and delineate the future force composition, Deptula proposes implementing a "combat cloud" to integrate diverse capabilities into a unified "weapons system." This combat cloud will then conduct disaggregated, distributed operations across an entire operational area. Massed, non-stealthy strike packages will evolve into more distributed force packages, with increased low-observable features and greater reliance on automated systems.⁸⁰ Cyber and space effects enable the realization of disaggregated and distributed operations and amplify them through predominantly non-kinetic capabilities.

Negating the Enemy's Targeting: The Aim Beyond Saturation

As early airpower theorists speculated, the centrality to airpower of the concepts of mass of effects—kinetic supported by non-kinetic—and surprise will persist in future conventional air wars against peer competitors. In addition, the paramount role of technology cannot be understated in the effort to delineate the future winning joint force. The case study of the First Gulf War and the relative dissertation on how to conduct the war and choose the most effective targeting have shown that mass must be intended as a collective of effects, while superior technology employed in a multidomain approach will augment and guarantee surprise.

The strategic deployment of airpower in pulses, which creates strategic windows of opportunity for the joint force, becomes crucial in an evolved scenario where Western supremacy has been contested in recent years. Low-observable, new-generation weapon systems will constitute the pulse and synergically unify effects. The overarching objective

76. Schneider et al., 81.

77. *2023 Department of Defense Cyber Strategy* (DOD, 2023), 10.

78. Schneider et al., *Ten Years In*, 86.

79. *Future Operating Concept*, 1.

80. David A. Deptula, "Evolving Technologies and Warfare in the 21st Century: Introducing the 'Combat Cloud,'" Mitchell Institute for Aerospace Studies, 16 September 2016, 3, <https://mitchellaerospacepower.org/>.

of posturing airpower should be to negate effective targeting by the adversary, avoiding complications in targeting or creating dilemmas.⁸¹ Such options would expose the joint force to potential targeting by the adversary, a scenario that must be prevented.

Steering clear of a force posture oriented toward saturation, air forces in future conflicts should aim for “invisibility,” achievable through a combination of technological reach, non-kinetic support, and advanced tactics. Specifically, new non-kinetic effects in the space and cyberspace domains will support the new-generation weapon systems—which will constitute the necessary physical mass—covering their posture in pulses and generating windows of opportunities for the joint force.

This article advocates for a posture focused on “circumventing or overcoming A2/AD complexes” instead of attempting to roll them back as an initial response, utilizing a legacy massed push of airpower.⁸² To avoid saturation in force posturing, Western air forces should prioritize asymmetric capabilities aimed at disrupting competitor forces rather than engaging in a futile attempt to outmatch them in sheer force.⁸³

To achieve success in upcoming conventional conflicts against peer adversaries, Western air forces should consider the following recommendations:

- Invest in advanced technologies, prioritizing funding and development of low-observable, new-generation weapon systems (constituting the mass) and non-kinetic capabilities, especially in the cyber and space domains (enabling surprise);
- Continue to develop a multidomain approach to integrate capabilities across domains to enhance surprise and effectiveness of the joint force;
- Emphasize asymmetric warfare, focusing on disrupting adversary forces and avoiding direct, force-on-force engagements; and
- Keep on enhancing pulse operations to create windows of opportunity and maintain operational flexibility.

These guiding principles will lay the foundation for success in future wars, where airpower remains pivotal. Æ

81. John Warden, lecture, KASS, AWC, 19 March 2024.

82. Foster, Martinage, and Thomas, *New Targeting Approach*, 2.

83. Gunzinger, Stutzriem, and Sweetman, *CCA*, 21.

DEFENDING AND DOMINATING THE AIR LITTORAL

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Controlling the air littoral requires not only specialized equipment but also tailored doctrine and close coordination among US forces occupying both sides of the domain divide as well as the transition space to the sea to meet operational objectives. It is a Joint problem, and protecting American forces will require a commensurate level of effort and Joint solutions. The US military must break out of its service parochialism and address domain challenges from a Joint perspective that builds on a littoral mindset for tactical, operational, and strategic advantage. Lessons learned in Russia's war in Ukraine yields recommendations for the area air defense commander, tasked with defeating the threat of air-borne systems, to protect service members operating in the air littoral.

From the charnel houses of Ukraine to the South China Sea, militaries everywhere are rapidly coming to the realization that they can lose a war in the air below 10,000 feet. This space, described by some as the *air littoral*, represents a highly dynamic, increasingly congested and contested subregion of the air domain.¹ Like its maritime counterpart, effective operations in the air littoral require not only specialized equipment but also tailored doctrine and close coordination between the friendly forces which occupy both sides of the domain divide. Without achieving this, forces in both domains operate at risk and may fail to meet their operational objectives, increasing the likelihood of a strategic defeat.

Forces operating astride the air littoral, whether airborne or surface-based, have a vested interest in its security and control. While the persistent presence of ground forces in large-scale combat operations makes the Army acutely sensitive and vocal about its exposure to air attack, the air component is likewise at risk from the proliferation of sophisticated surface-to-air missiles operating in this space as well as airborne

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1. Kelly A. Grieco and Maximilian K. Bremer, "Contesting the Air Littoral," *Æther: A Journal of Strategic Airpower and Spacepower* [Æther] 3, no. 3 (2024), <https://www.airuniversity.af.edu/>.

asymmetric threats that seek to deny the Air Force sanctuary at its air bases and in the skies. Furthermore, the limited number of fifth-generation fighters with advanced stealth capability implies that the vast majority of the Air Force's assets will either be sidelined or will operate at a disadvantage, attempting to create freedom of maneuver by leveraging the congested littoral in an effort to avoid detection and targeting through terrain masking.

The Navy and Marine Corps are similarly threatened from the air littoral in its relation to the sea, with the added complication that those services must also address a treacherous subsurface transition space as well. Thus, control of the air littoral is not solely an Air Force problem any more than it is not only an Army, Navy, or Marine Corps problem: it is a Joint problem.

In discussing the nature of littoral regions, this article highlights lessons that can be derived from the comparison between the air littoral and the maritime littoral to improve command and control (C2) and operations in this environment and how to build a littoral mindset to deal constructively with the challenges faced in a dynamic region. An analysis of Russia's current war in Ukraine ascertains how each side's efforts to exploit the seam in the air/ground divide has resulted in an intractable deadlock broken only through joint integration and combined arms. The Joint community must therefore better integrate air littoral operations and develop the specialized equipment and processes necessary for success in the near and long term.

The New Challenge of the Air Littoral

It should be stated that control of the air littoral has not always been a prerequisite for air superiority and the advantages it brings. Historically, manned aircraft and the relatively unsophisticated and imprecise nature of munitions allowed this space to be controlled from above or below. Yet after more than a century of flight, which has observed a near-constant struggle between manned-airborne platforms and air defense for control of the open skies, the battle overhead has entered a new and highly lethal phase which has brought the contest closer to Earth than it has been since the dawn of the jet age.

What has changed? Simply put, an asymmetric threat, driven by technological innovations in robotics, miniaturization, and mass production, has expanded the scope and scale of the fight for air superiority into more of the available airspace. Within the air littoral at present, this asymmetric threat comes from the proliferation of unmanned aerial systems (UAS) and loitering munitions. The threat from these systems is multifaceted.

First, they present persistent intelligence, surveillance, and reconnaissance (ISR), which supports the enemy's kill web by rendering the battlefield targetable by other systems to the depth these sensors are employed. Second, by design or modification, they have the ability to deliver lethal and non-lethal effects at remarkably low cost. Lastly, these systems may enhance enemy command and control by expanding line-of-sight communications far beyond what would be achievable from the terrestrial layer. Notably, in terms of defending friendly troops in the air littoral, the characteristics of these

systems bear a striking resemblance to the threat posed by improvised explosive devices during the Global War on Terror in terms of their ubiquity, lethality, and return on investment. This suggests that protecting American forces will require a commensurate level of effort and Joint solutions.

This dilemma has progressively worsened as their success on the battlefield has led to improvements yielding much greater range, lethality, and maneuverability than earlier generations. As these systems are airborne, defeating this threat is a task that falls to the area air defense commander (AADC), who as Joint doctrine states is appointed by the Joint Force commander and is “responsible for the defensive counterair operations, which include the integrated air defense system of the joint operations area.”² This Joint mandate does not speak to whether the threats are small or whether they happen to operate in an area that is inconvenient and inherently hazardous. The expectations of the AADC are unconstrained by depth, duration, or level-of-war.

The expanding scope of this mission in the contemporary operating environment has called into question how the Air Force qualifies the term *air superiority*, not only from outside of the service but also from its own top leadership.³ This multifaceted dilemma for the AADC creates two distinct fights, with one focused on the air littoral—increasingly dominated by UAS and cruise missiles—and a second focused on the more traditional fight at higher altitudes with manned fighters/bombers, ballistic missiles, and emerging hypersonic threats. The Air Force cannot address both dilemmas simultaneously, which is why the Army’s air and missile defense commander is normally appointed as the deputy area air defense commander (D/AADC).

The mission of the AADC is a Joint function which requires Joint solutions, and new roles and capabilities must be developed and integrated to provide protection for the military. These solutions require that the military break out of its service parochialism and address these domain challenges from a Joint perspective. The fusion and exercise of activities from both the D/AADC and AADC are key to protecting US service members operating in the littoral.

Operations in littoral regions are historically challenging for Joint integration—done poorly, they create opportunities that the enemy can exploit for tactical, operational, and strategic advantage. But they are not without solutions. As the military looks to firm up US multidomain dominance, it should remember that control of any domain does not depend solely on the forces best designed and postured to operate in that domain but also on the contributions and support of the Joint force whose reinforcing and complementary

2. *Joint Air Operations*, Joint Publication (JP) 3-30 (Chairman of the Joint Chiefs of Staff [CJCS], 25 July 2019, validated on 17 September 2021).

3. David Barno and Nora Bensahel, “Drones, the Air Littoral, and the Looming Irrelevance of the U.S. Air Force,” *War on the Rocks*, 6 March 2024, <https://warontherocks.com/>; Chris Gordon, “Air Force Must Rethink How to Achieve Air Superiority, Chief Says,” *Air & Space Forces Magazine*, 29 February 2024, <https://www.airandspaceforces.com/>; James B. Hecker, “Air Superiority: A Renewed Vision,” *Æther* 3, no. 3 (2024), <https://www.airuniversity.af.edu/>; and Chris Gordon, “Small Drones Force New Thinking on Air Superiority, Slife Says,” *Air & Space Forces Magazine*, 31 July 2024, <https://www.airandspaceforces.com/>.

efforts provide the means and methods to mitigate structural gaps of any one service. Nowhere is this more evident or important than at the domain periphery.

The Nature of Littoral Regions

Within the Joint community, members of the maritime component generally cringe when they hear other components speak about littoral regions not associated with the sea. From their vantage point this is understandable—control of the maritime littoral is one of the hardest tasks they pursue and one which they have dedicated themselves to mastering for the entirety of their existence. Over the years, they have met this challenge with varying degrees of success, evolving organizations, materiel, doctrine, and tactics to address the growing complexity of the land-sea environment. Though this is a never-ending endeavor and there have been setbacks—most notably the ill-fated example of the littoral combat ship—there has been genuine and continuous effort by the Department of the Navy to figuratively bridge the land-sea divide to enable the operations of Soldiers and Marines ashore from the Navy afloat.⁴ Understanding the nature of the traditional littoral region is therefore useful in applying its concepts to other domains.

The *US Marine Corps Supplement to the DOD Dictionary* defines *littoral* in terms of its relation to the sea, stating that it is a “zone of military operations along a coastline, consisting of the seaward approaches from the open ocean to the shore, which must be controlled to support operations ashore, as well as the landward approaches to the shore that can be supported and defended directly from the sea.”⁵ Thus, conceptually, the littoral is a domain boundary, characterized by a state of constant flux and being acted upon, defended, and supported by at least two services. From a ground-based perspective, this would be akin to maneuver control measure boundaries between adjacent units, shifting constantly and dramatically, while each unit coordinates C2 to provide uninterrupted mutual support and defense across the divide.

This is complex—even within a single service using the same approaches and methods of C2—and history is littered with examples where gaps and seams have afforded enemies epic opportunities for exploitation. Based on this reality, to state that the air littoral dividing the land and air domain is as dynamic and complex as the maritime littoral—with its subsurface considerations and environmental states—is an oversimplification and simply not accurate. Still, by characterizing the littoral in more broad terms, as a main transitional space, the lessons and thought processes of managing the maritime littoral can be informative, particularly since at just over 100 years old, the Air/Land Integration problem is still relatively young when one considers that military theorists have worked to perfect amphibious operations for several millennia.

4. Joaquin Sapient, “The Inside Story on How the Navy Spent Billions on the ‘Little Crappy Ship,’” *Pro-Publica*, 7 September 2023, <https://www.propublica.org/>.

5. *Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms*, MCRP 5-12C (Department of the Navy, as amended through 10 September 2020), II-45, <https://www.marines.mil/>.

For example, it should not be overlooked that the complexities of the maritime littoral have essentially forced the US Navy to formally consider dividing itself into two different organizations broadly recognized as the blue-water Navy and the green-water Navy—with equipment, doctrine, and C2 to support operations in coastal waters—while maintaining sea control and power projection in the broad ocean areas.⁶ Beginning in the 2000s, the Navy pursued such efforts to make this distinction more pronounced. Reenvisioning what air superiority looks like going forward, US military planners may consider this bifurcated model, with corresponding macro-airspace and micro-airspace requiring different tools and techniques to achieve the requisite level of control and dominance.

Building a Littoral Mindset

Beyond concerns of structure, procedure, and design, there are philosophical considerations that need to be addressed to approach the problem of the air littoral from a more Joint mindset. While not always perfect, and assisted by a unified departmental chain of command, the green-water Navy functions in the littoral because of the trust built between its forces and the Marine landing force it supports. This mutual understanding is sometimes absent in the relationship between the Army and the Air Force because the Army does not always view the surface of the Earth as a domain boundary.

Yet it is just that—requiring coordination no different from moving one ground unit into another ground unit's area of operations. Within the multidomain operating concept the Army delivers effects and executes operations in multiple domains with integration sometimes a secondary concern to expediency when it comes to enhancing landpower.⁷ That this approach is justified, based on the scale of activities in the land domain, that the preponderance of the enemy's forces exists in the land domain, and that most wars have historically been decided in the land domain, do not negate the corrosiveness of this mindset on mutual trust and cooperation between the services. The unfortunate result of this is that when challenges emerge in the air littoral, such as UAS and loitering munitions, the Air Force and the Army conveniently point to each other to solve their collective problem.⁸

Mutually agreed upon and practical procedural solutions like the coordination level and coordinating altitude may help define the edges of the littoral, but they do

6. Wayne P. Hughes Jr. et al., *The New Navy Fighting Machine: A Study of the Connections Between Contemporary Policy, Strategy, Sea Power, Naval Operations, and the Composition of the United States Fleet*, NPS-OR-09-002-PR (Director of Net Assessment, Office of the Secretary of Defense, 2009), <https://calhoun.nps.edu/>; and Wayne P. Hughes, "Build a Green-Water Fleet," *Proceedings* (June 2018), <https://www.usni.org/>.

7. *Operations*, Field Manual (FM) 3-0 (Headquarters, Department of the Army, 22 October 2022), <https://armypubs.army.mil/>.

8. Greg Hadley, "Army Air and Missile Defense Growing to Meet Air Force Demand," *Air & Space Forces Magazine*, 15 October 2024, <https://www.airandspaceforces.com/>; Ken Klippenstein, "American Base in Jordan Where Drone Killed 3 U.S. Troops Dogged by Inadequate Air Defenses," *The Intercept*, 6 February 2024, <https://theintercept.com/>; and Barno and Bensahel, "Drones."

not obviate Joint roles and responsibilities which persist throughout the totality of the air domain, and they certainly do not regulate the actions of the enemy along that divide. The area air defense commander is still the AADC below the coordination level—and may just have to rely more on the D/AADC, a Soldier with Army assets, to take on that particular problem set.

Air superiority and its maintenance are thus the responsibility of all airspace users, just as land dominance cannot be achieved if adjacent formations do not fulfill their responsibilities on the other side of a unit boundary. Arriving at a common understanding about operations in the air littoral requires increased dialogue between the services and an appreciation for what each service brings to the fight in the transition space and how it will be integrated to mutual benefit. To build the requisite trust, the components must increase support for each other's exercises to attain more repetitions and sets each year working together in the littoral. If this does not occur through the expansion of Joint airspace training, schooling, and academics, it will most certainly occur on the battlefield with a much harsher teacher.

The Ukrainian Air Littoral and the Lessons of Kursk 2024

Russia's war with Ukraine continues to provide valuable insights into future warfare, especially in the air littoral. There are three main areas that can be highlighted as particularly relevant to success; they are component integration in support of joint combined arms maneuver, protection, and mass. To understand why these principles are so important one needs to briefly focus on the environment in which the combatants are operating.

On the ground, the battlefield in Ukraine is littered with integrated air defense systems that can both detect and destroy airborne assets at extended ranges.⁹ In the surface-to-surface fight, long-range shooters exist at a density that the United States has not experienced in modern warfare.¹⁰ In the electromagnetic spectrum, electronic warfare (EW) is being used extensively for attack, defense, and targeting on both sides. Two years into the war, above the air littoral, aerial combat—that is, dogfighting—is relatively rare. At high altitude, aside from the notable exception of the two Russian A-50s that were brought down in early 2024, neither side appears to want to contest the area over Ukraine, preferring to operate from sanctuary at reduced effectiveness.¹¹ Far more aircraft are being destroyed on the ground at their airbases than are being shot down.

Meanwhile, war in the air domain is raging below 10,000 feet, with fixed-wing and rotary-wing assets regularly falling prey to man-portable air defense systems

9. Christopher Koeltzow, Brent Peterson, and Eric Williams, *F-16s Unleashed: How They Will Impact Ukraine's War* (Center for Strategic and International Studies [CSIS], June 2024), <https://www.csis.org/>.

10. Vikram Mittal, "Artillery Is Still the King of Battle in the Russia-Ukraine War," *Forbes*, updated 17 July 2024, <https://www.forbes.com/>

11. Phelan Chatterjee, "Ukraine Says It Has Downed Second Russian A-50 Spy Plane in Weeks," *BBC News*, 23 February 2024, <https://www.bbc.com/>.

(MANPADS) and sharing space with a plethora of loitering munitions and UAS which seem to be filling an ever-expanding set of roles.¹² This UAS mission set now spans traditional ISR and bomber missions to pursuit/fighter missions, and most recently, incendiary attacks.¹³ The lack of air superiority on either side has impacted the ability of the combatants to engage in traditional fire and maneuver and prevented them from successfully pursuing a war of annihilation, driving both sides to a grinding attrition-based model. This has generally been the status quo across much of the country, except where targeted planning, coordination, and synchronization of combined arms have broken this stalemate.

Such was the case at Kursk, where in August of 2024, Ukraine demonstrated what could be accomplished by pulsing joint integrated combat power into the air littoral to establish local air superiority through combined arms, making notable use of electronic warfare and air defense in close coordination with micro-airpower.¹⁴ Unlike previous efforts, this attack was highly focused and coordinated, and targeted a seemingly forgotten part of the line in eastern Ukraine following an extensive intelligence preparation of the operating environment that included a detailed analysis of enemy frequencies and collection capabilities.

This is a major lesson. Beyond the vertical dimension, the air littoral obviously has a breadth to it as well. Despite the massive number of troops on both sides, large-scale combat operations in Ukraine significantly stretched the ability of the combatants to defend such a wide frontage. At many places along the line, defenders are relatively thin and susceptible to isolation, connected only by interlocking fields of fire and drones providing overhead ISR to truncated kill chains. At Kursk, the Ukrainians proved that the battlefield was not yet quite as transparent as many believed and successfully masked their movements and intentions by systematically downing the picket line of Russian early-warning and ISR drones through EW, short-range air defense, and air-to-air drone combat.¹⁵ After rapidly massing forces and positioning air defense and EW assets in the breach to prevent the refill of Russian sensors and enemy drones, Ukrainian forces punched a hole in the Russian line and drove deep.

12. Isabel van Brugen, "Ukraine Shoots Down Russian Su-25 Jet in MANPADS Strike," *Newsweek*, 28 August 2024, <https://www.newsweek.com/>.

13. Brad Lendon, "Ukraine's 'Dragon Drones' Rain Molten Metal on Russian Positions in Latest Terrifying Battlefield Innovation," *CNN*, updated 7 September 2024, <https://www.cnn.com/>; Jason Bellini, "Dogfighting Drones Open a New Chapter in Ukraine's Aerial War Against Russia," *Scripps News*, 3 September 2024, <https://www.scrippsnews.com/>; "The Battle Between Drones and Helicopters in Ukraine," *The Economist*, 4 September 2024, <https://www.economist.com/>; and Jason Sherman, "Drone-on-Drone Combat in Ukraine Marks a New Era of Aerial Warfare," *Scientific American*, 20 February 2024, <https://www.scientificamerican.com/>.

14. Erica Nitschke, "Ukraine's Week-Old Incursion into Russia Has Embarrassed Putin. How Will It Affect the War?," *Portland Press Herald*, 13 August 2024, <https://www.pressherald.com/>.

15. Matthew R. Arrol, Jason C. Slider, and Milford Beagle, "The Graveyard of Command Posts: What Chornobaivka Should Teach Us About Command and Control in Large-Scale Combat Operations," *Military Review* (May–June 2023), <https://www.armyupress.army.mil/>; and David Hambling, "Could Small Drones Really Replace Artillery?," *Forbes*, 17 August 2023, <https://www.forbes.com/>.

In a model of multidomain operations, the Ukrainians effectively penetrated the Russian bubble of protection, disintegrated Russian C2, and exploited the gap created by rapidly pushing forces and capability into the void. Part of the exploitation phase of this offensive since has included massive drone swarms that have targeted Russian airfields in what can best be described as concentrated offensive counterair from the air littoral.¹⁶

While component integration enabling combined arms maneuver will hold the secret to breaking the stalemate, Ukraine is also teaching the West that the protection warfighting function is paramount to ensuring the military retains the combat power necessary for exploiting success. To achieve this, the area air defense commander must support and comprehensively employ both active and passive protection measures. The ability to protect friendly forces requires a layered approach to ensure the Joint force understands the whole air and missile defense picture. Integrated air defense design, down to the micro-level which nests both ground-based air defense assets and aerial-based air and missile defense, will allow commanders to better understand risk to force and risk to mission. To assist, leaders in the land domain must develop a deeper understanding of defensive counterair—which often consumes the availability and loadout of multirole aircraft—and acknowledge that the resources required to provide defensive counterair will limit assets available for air interdiction or close air support missions. Simultaneously, the force must be prepared for the temporary loss of air littoral control and emphasize the importance of passive measures as well.

This concern impacts a variety of areas. It affects the way the United States commands and controls its forces and drives the Joint force to move from static tactical operations centers to more mobile, hardened, or austere hiding-in-plain-sight C2 options; this is a trend that has also been seen in Ukraine.¹⁷ It increases the importance of terrain management, to enable distributed operations and facilitate the survivability of systems, lines of communications, and sustainment nodes. It increases the need for discipline in masking signatures and physically hardening position areas. For the air component, beyond C2, this implies positioning forces to maximize survivability and changing their operating concept to a more expeditionary approach along the tenets of agile combat employment.¹⁸ Ukraine has taught the United States and its Allies that only through adopting a protection-based mindset will the Joint force be successful in the congested/contested air littoral.

The final lesson of Ukraine involves the concept of mass as a principle of warfare. Western militaries are often enamored with joint long-range fires, in the belief that

16. Martin Fornusek and the Kyiv Independent News Desk, “Drone Swarms Play Key Role in Ukraine’s Kursk Incursion, Times Reports,” *The Kyiv Independent*, 17 September 2024, <https://kyivindependent.com/>.

17. Siegfried Ullrich and Sean Moriarty, *Lessons Learned from the Ukrainian Territorial Defense Forces: Command Post Survivability*, ed. Zack Shelby (Center for Army Lessons Learned, 6 February 2024), <https://www.army.mil/>.

18. Benjamin Hagart, “Artificial Intelligence and Agile Combat Employment,” *Military Review* (May–June 2024), <https://www.armyupress.army.mil/>.

precision and range will accomplish operational objectives more efficiently without having to resort to brute force and mass in the intimate close fight. Historically, however, the will and resilience of America's enemies to the limited quantities of operational and strategic fires available suggest that the ability to clear airspace and fire massive amounts of conventional artillery and mortars is what wins wars and that activity profoundly impacts the air littoral.¹⁹ In this context, quantity has a quality of its own, and mass delivers both a physical and a psychological effect that should not be discounted.²⁰

What is somewhat new in Ukraine is that mass and precision appear to be combined through the ubiquity of low-cost drones and loitering munitions which offer a high return on investment. If loitering munitions, drones, and specifically drone swarms are ascendant as an additive form of mass alongside artillery, which appears to be the case, it makes sense to deliver that mass as efficiently and continuously as possible.²¹ The congested air littoral may create conditions that cause difficulty for long-range assets, but the necessity always exists to close with and destroy the enemy in the last 100 yards. Therefore, in delivering mass within the air littoral, in all its forms, the Joint force must consider how to optimize the space available to deliver the desired effect.

This article has listed a couple of examples of clear takeaways that can be derived from the evolution of operations in the Ukrainian air littoral. These lessons should inform how the United States tackles its own Joint challenges in this space going forward.

Recommendations for the Joint Force: Dominating in the Air Littoral

This article thus recommends some of the ways to turn these observations into practical solutions to improve Joint performance in the littoral space. Control of the air littoral is a counterair mission in a subregion of the air domain. One could consider the counterair framework in the air littoral as micro-offensive counterair and micro-defensive counterair. Like all counterair missions, they are inherently Joint and interdependent. What is being observed in Ukraine, and especially in the Kursk operation, is the rapid tailoring of these traditional concepts with specialized subdomain specific equipment, improvised C2, and tactics and techniques proliferated through organizational learning. As the US Joint Force looks at the air littoral supremacy challenge from a doctrine, organization, training, materiel, leadership and education, personnel, and facilities standpoint, the doctrine is largely already there—one need only to apply it to a new environment and consider its implications.

Other recommendations to organizational, materiel, doctrine, and training aspects of air littoral-focused operations are as follows. Organizationally, counterair operations

19. Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914–1945* (Princeton University Press, 2009); and Mittal, “Artillery.”

20. Sergio Miller, “The Russian Army Death Cult,” *Wavell Room*, 16 May 2024, <https://wavelldroom.com/>.

21. Hambling, “Small Drones.”

in the littoral are going to affect the theater air-ground system, and this phenomenon is already playing out in certain areas.²² For example, in the US Central Command area of responsibility, the 4th Battlefield Coordination Detachment (BCD)—the Army organization purpose-built for air-land integration at the theater level—has stood up a counter UAS cell to support operations in the region and increase coordination at the air operations center between Army forces and the Joint Force air component command on efforts in the air littoral.²³ Despite not being staffed or designed for this mission, 4th BCD is doing this out of necessity.

Building on this idea, a reasonable recommendation for the area air defense commander would be to expand this concept into other elements of the tactical air control system, the air component's contribution to the theater air-ground system. One possibility might be to expand the control reporting center which often acts as a regional air defense commander to manage the air littoral fight in a region. Staffing and equipping this organization with the ability and mandate to focus on, coordinate, and synchronize micro-offensive counterair/micro-defensive counterair would facilitate unified AADC command and control at echelon. Alternatively, on the Army air-ground system side of the theater air-ground system, this could occur at the division Joint air-ground integration center or at the corps, the echelon intended to facilitate convergence. Returning for a moment to the maritime littoral example, this approach would be not unlike establishing a brown-water Air Force and a metaphorical commander of the air littoral force to manage it.

In the material space, the evolution of manned flight in warfare seems to be repeating itself in the unmanned arena as militaries around the world seek to dominate the air littoral. What started as UAS providing ISR capabilities, with the widespread use of RQ-2s in the Gulf War, progressed to bomber-like capabilities and has now evolved, democratized, and proliferated to the point where first-person view and pursuit/fighter drones are now being improvised in Ukraine and purpose-built elsewhere.²⁴ These new air-to-air drones will be instrumental to fulfill the sweep mission of micro-offensive counterair and were already employed in this approach in the lead-up to Kursk.

Furthermore, a new generation of systems that are being referred to as launched effects—which include the Raytheon Coyote and Anduril's Altius-700 and Roadrunner vertical takeoff and landing systems—represents a natural evolution to control the air littoral and offers an array of multi-mission, single-use, or recoverable air- and

22. "Appendix A: Theater Air Ground System," in *Multi-service Tactics, Techniques, and Procedures for Theater Air Ground System*, Army Technical Publication (ATP) 3-52.2/Marine Corps Reference Publication (MCRP) 3-20.1/Navy Tactics, Techniques, and Procedures (NTTP) 3-56.2/Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.17 (Air Land Sea Space Application Center, 22 August 2024), 53, <https://armypubs.army.mil/>.

23. Col Johannes Castro, commander, 4th Battlefield Coordination Detachment, personal discussions with Matthew Arrol on counter unmanned aircraft systems, 6 May 2024.

24. "Pioneer RQ-2A UAV," National Air and Space Museum, accessed 11 October 2024, <https://airandspace.si.edu/>.

ground-launched versions.²⁵ Not every solution needs to be high-end and expensive; the Ukrainians are having success hunting drones from propeller-driven aircraft, indicating that there may be broader missions for low-end aircraft like the AT-802 Sky Warden or new air-to-air roles for Army attack aviation in high intensity conflict.²⁶

Regardless, both services astride the air littoral need to invest in these types of capabilities. Given the breadth of the battlefield and the air littoral in large-scale operations, the ground force cannot defend everywhere in strength. To avoid the experience seen in Ukraine, the air component needs to leverage its flexibility, versatility, and persistence to seed launched effects in areas where ground forces are thin. Furthermore, within the framework of Combined Joint All Domain Command and Control, launched effects and future drone forces need flexibility within an open C2 architecture to allow them to be controlled by a wide variety of Joint C2 nodes and the ability to be used in an aggregated fashion as swarms or as individual sentinels.²⁷ Additionally, this sensing capability needs to be tailored and layered to the airborne threat in the littoral where targets are often too small to be observed with traditional radar. The Ukrainians are having some initial success with a low-cost federated sensor net, which the West could learn from and build on.²⁸

Doctrinally, the Joint force should also consider how it characterizes the multidomain aspects of the air littoral environment to ascertain what the level of air superiority actually is in that subdomain. In doing so, the Joint force should ask certain questions to define the level of control: What is the relative combat power, density, and correlation of drone forces within a given area? What is the electromagnetic environment like? How diverse are the signals? What is the level of air defense integration, and how deep and diverse is the defense design? What is the quality of enemy troops in the area?

Additionally, Joint and multi-service doctrine should articulate roles and responsibilities for the coordinated employment of launched effects, EW employment, and robotic air-to-air combat at various altitudes within the air littoral. Not everything requires governance, but the military must optimize its resources to align the best shooters, sensors, and C2 nodes.

25. "Coyote," Raytheon RTX (website), accessed 11 October 2024, <https://www.rtx.com/>; Anduril Industries, "Altius-700m Hits All Targets in Successful Test of Largest Loitering Munition on the Market," Anduril, 14 March 2024, <https://www.anduril.com/>; and Ashley Roque, "Anduril Unveils VTOL Roadrunner-Munition for Aerial Defense, One US Customer Buying In," *Breaking Defense*, 1 December 2023, <https://breakingdefense.com/>.

26. David Axe, "Ukraine Is Mobilizing More Propeller Planes to Shoot Down Russian Drones, World War I Style," *Forbes*, 8 July 2024, <https://www.forbes.com/>; and "Sky Warden" ISR Strike Aircraft," L3Harris® Fast. Forward., accessed 11 October 2024, <https://www.l3harris.com/>.

27. Brandi Vincent, "What's Next for the New CJADC2 Minimum Viable Capability," *DefenseScoop*, 26 February 2024, <https://defensescoop.com/>.

28. Tyler Rogoway and Howard Altman, "Ukraine's Acoustic Drone Detection Network Eyed by U.S. as Low-Cost Air Defense Option," *The War Zone*, 24 July 2024, <https://www.twz.com/>.

Lastly, the Joint force needs to continue to refine its subdomain awareness and progress its methods of control within the littoral from reliable but inefficient procedural methodologies to more refined machine learning and artificial intelligence (AI)-based models that blend positive control with predictive techniques. One such project to accomplish this is the Defense Advanced Research Projects Agency Air Space Total Awareness for Rapid Tactical Execution software suite, an automated flightpath planning capability which uses AI to accelerate the creation of safe air route alternatives by rapidly ingesting environmental and user-generated data and quickly producing optimized mission planning products.²⁹ This, and C2 enhancements like it, will be critical to achieving an information and operational advantage against America's adversaries in the air littoral of the future.

Finally, there is no substitute for experience, and as previously stated, the military must train Jointly for the air littoral before operating in it in combat. The nature of future threats in the air littoral will inherently be Joint, and both Army and Air Force leaders should train future commanders for these threats, with courses like the Joint Air Operations Command and Control Course and the Echelons Above Brigade Air-space Course.³⁰

On the Army side, there has been extensive work done to better prepare for the air littoral by incorporating UAS and drone swarms at the major maneuver centers like the National Training Center. That good work in the dirt should continue at the tactical level. Unfortunately, that opportunity has not been fully embraced in major command post exercises at the operational level, where convergence opportunities reveal themselves and can be exploited. While the Army must do more to address the environment in its corps warfighters, the Air Force especially needs to more accurately represent the fight in the air littoral at its premiere C2 event, Blue Flag, where achieving air superiority still equates to sweeping the skies of the enemy's manned aircraft—which, while necessary, is not sufficient on the modern battlefield. In order to practically control the air littoral, the Joint Force air component commander/AADC must have the tools, techniques, and procedures to gain awareness of that space and direct actions within it. Only in conjunction with Blue Flag will incorporating air littoral considerations into a force-on-force event like Red Flag yield persistent and integrated results. This requires greater involvement from Army partners in these activities.

Together the Joint force needs to do a better job of replicating this environment and putting stress on the AADC and the D/AADC to illustrate the consequences of failure in this subdomain. This may mean that the Joint force has to adjust its simulations and models to better represent the complexity, congestion, and lethality of the airspace below 10,000 feet. Only by doing this will the United States be able to experi-

29. "Air Force, Army Battle Labs Work with DARPA on ASTARTE, New C2 Capability," US Air Force, 31 August 2023, <https://www.af.mil/>.

30. 505th Command and Control Wing Public Affairs, "505th Training Squadron," USAF, 19 September 2023, <https://www.af.mil/>; and "Army Joint Support Team (AJST)," US Army CAC, accessed 11 October 2024, <https://usacac.army.mil/>.

ment with and show the utility of new organizational designs and doctrine aimed at achieving a competitive advantage against a near-peer adversary unable to visualize, train, and wargame in this environment.

Conclusion

If it is true that America and its Allies could lose a war in the air littoral, then its corollary—that they could win a war in the air littoral—is also true. If the Joint force protects its seams and dominates the transition space between the surface and where traditional airpower has historically operated, then it can deliver operational and strategic effects in both the land and air domain. This requires working together to provide appropriate command and control through the establishment of organizations designed to focus on the unique attributes of this subdomain. It further demands that the Joint force adapt tactics, techniques, and procedures to execute Joint counterair operations at the micro-level and continue to develop and field materially low-cost/high-volume solutions designed to integrate into a kill web that will function at scale and deliver a positive return on investment.

If the military is able to do this, it may spare America the attritional stalemate that has plagued Russia's war in Ukraine and return combined arms maneuver to the battlefield, just as Ukraine was able to do at Kursk in early August 2024. Establishing superiority in the air littoral will enable information advantage, mask friendly intentions, and achieve tactical surprise, allowing the United States and its Allies to act decisively and converge effects to deliver the operational objectives sought.

While the focus here was on the immediate threats to air superiority and the way and means by which the area air defense commander and their Joint team could establish control in the air littoral, it is important to pause before closing to consider the next logical implications of littoral regions outside of the maritime and air domain previously discussed.

If the evolution of asymmetric threats into the air littoral is any indication, then it is reasonable to expect that future asymmetric threats will similarly appear at the periphery of other domains. For example, the ongoing development of high-altitude capabilities simultaneous with the increased utilization of satellites in persistent low Earth orbit would suggest that the next fight may be over the space littoral with the air domain. The criticality of the space domain makes this a fight the Joint force can ill afford to lose and one in which the air component may be the supporting command to the space component.

Alternatively, at some point in the future, at the opposite end of the spectrum from space, the military may have to concern itself with defending against bioweapons and nanotechnology that threaten friendly forces at the molecular level. Fortunately, the fight over the molecular littoral will be consigned to science fiction for the foreseeable future—but it is another area that requires monitoring from a science and technology standpoint.

As the United States moves forward in this strategic environment of great power competition, the Joint force should be mindful of the precept that its past success on

the battlefield entitles it to nothing in the future. Control in every domain will be fought over and contested relentlessly by America's enemies, who will study its victories, seek to exploit its hubris, and take advantage of any seam they can find to undermine the Western way of war and exact costs in an effort to inflict a strategic defeat. The United States must be prepared to meet them in whatever domain or subdomain they choose, negate their asymmetric threats, seize the initiative, and leverage its experience in Joint and multidomain operations to deny, degrade, and defeat them in a war of annihilation. Æ

Arms Control at a Crossroads: Renewal or Demise?

Edited by Jeffrey A. Larsen and Shane Smith. Lynne Rienner Publishers, 2024, 331 pp.

As recently as January 2022, the 1985 joint declaration by then-Soviet leader Mikhail Gorbachev and US President Ronald Reagan that “a nuclear war cannot be won and must never be fought” was affirmed by Russian President Vladimir Putin, President Joseph Biden, and the leaders of China, France, and the UK—all who represent nuclear powers and hold permanent seats on the UN Security Council.¹ Only a month later, however, Russia’s full-scale invasion of Ukraine led to Putin’s announcement that Russia would suspend its participation in New START, the treaty between the United States and the Russian Federation that limits all Russian deployed intercontinental-range nuclear weapons. With that treaty set to expire in 2026, and agreements like the Conventional Armed Forces in Europe Agreement being suspended by participating states in the aftermath of the invasion, *Arms Control at a Crossroads* asks this question: Does arms control have a future? Editors Jeffrey Larsen and Shane Smith admit that the “prognosis appears grim” (1).

The editors bring academic and policy practitioner experience to their timely and important work. Larsen, a research professor at the Naval Postgraduate School and president of Larsen Consulting Group, has worked at NATO and at Science Applications International as a senior policy analyst. Smith, the director of the Air Force Institute for National Security Studies and associate professor of political science at the Air Force Academy, previously served as a senior fellow at the National Defense University and in the Office of the Secretary of Defense.

Larsen and Smith have compiled a work with 16 separate analyses from experts in the policy, research, and academic worlds. Within the framework of the questioning of the future of arms control and what will be required for it to remain viable, the contributors cover the topic in four parts: foundations and context of arms control, perspectives of the major powers, arms control domains, and the way ahead—the longest of which is the discussion of domains.

The meatiest of the four parts covers the arms control domains, serving not just as a refresher on the issues of nuclear weapons, proliferation and disarmament, and chemical and biological weapons, but the history and status of arms control monitoring regimes. Notably included in this portion of the work is the discussion of emerging technologies, conventional and novel weapons, and the idea of space and cyber-space arms control.

The sections on emerging technologies and conventional weapons are especially laudable considering Russia’s war in Ukraine. Where arms control is often thought of as solely the domain of nuclear weapons, the conflict has shown why buildups of conventional weapons on a border and the need for monitoring new weapons and technology—or old ones used in previously unseen ways—still matter. While increasing

1. “Joint Statement of the Leaders of the Five Nuclear-Weapon States on Preventing Nuclear War and Avoiding Arms Races,” The White House, 3 January 2022, <https://bidenwhitehouse.archives.gov/>.

nuclear rhetoric and an expiring New START will call for discussing the future of nuclear arms control, NATO and other Western governments are already working to address the need for the future of conventional and emerging arms control. A section discussing cooperative security as arms control by other means is especially insightful.

While perspectives of the United States, Russia, and China are covered, and sections on the return of geopolitics and cooperative security address the roles and actions of presumed or acknowledged nuclear states somewhat, the only—albeit small—area for improvement would be further discussion on the role other current or potential nuclear states will have in the future of arms control, how issues like Israel-Saudi normalization may impact arms control going forward, or how the United States' and Russia's obligations under the Nuclear Non-Proliferation Treaty and America's solidarity with NATO will be affected. As one analysis suggests, if New START expires without replacement, America will face uncertainty not only with Russia but also with its nuclear nonproliferation strategy and solidarity with NATO.²

Arms Control at a Crossroads is well worth the read for those seeking to understand better the greater arms control landscape surrounding the issue. Newcomers to the topic will become well-versed in the foundations and various domains, and practitioners will be spurred to better understand the geopolitical perspectives and think about new ways forward. At a manageable 331 pages, including references, acknowledgments, and contributor biographies, the book is highly readable for non-experts while being engaging to those with advanced knowledge of the subject. Larsen and Smith remain hopeful that “political leaders will one day again see the utility and value of arms control as a primary tool for managing competition” (2). Stating that arms control is “not quite” dead, Larsen and Smith have curated a compelling case for why, and more importantly how, that could be (1).

Lieutenant Colonel Jason Baker, USAF

Space Policy for the Twenty-First Century

by Wendy N. Whitman Cobb and Derrick V. Frazier. University of Florida Press, 2024, 344 pp.

Space Policy for the Twenty-First Century blends political science, science and technology, international relations, and history. The book is a much-needed review of space policy when the domain is seeing growth and a surge in apprehension and excitement. It describes the historical path that the United States and other prominent nongovernmental and governmental actors have taken to arrive at the crucial point for shaping space policy for the century.

Authors Wendy Whitman Cobb and Derrick Frazier, both professors at the School of Advanced Air and Space Studies, are prominent strategists in their field and have well-established backgrounds in the space domain. They argue that there is a constant ebb and flow of actors, including the National Aeronautics and Space

2. Vince Manzo, *Nuclear Arms Control Without a Treaty? Risks and Options After New Start* (Center for Naval Analyses, 2019), <https://www.cna.org/>.

Administration, the US military, commercial entities, international actors, other US government agencies, and of course, Congress and the president. Throughout space policy, historical events, national security, and the rise of independent actors—such as private space companies like SpaceX and Blue Origin—have shaped, or in some cases not, how policy is determined, and all actors are vying for influence within the space policy realm. The historical precedent established by the Soviet Union and the United States in the Cold War formed a large part of space policy in the past. Yet in the future, the United States' leadership role in space may be challenged, not only by other state actors but also by influential commercial actors who may not necessarily have democracy in mind.

The book's thesis is well supported by historical examples illustrating how the United States and Soviet Union handled early space policy with each other and within their governments. The authors detail every actor within the US government and the implications for space policy, their interactions, and the decisions made throughout history that impacted today's space policy. The book offers significant strong points regarding these actors and their choices as well as how outside influences shaped them—all written in a way that enables a space policy novice to understand the web of entanglement that characterizes its development. Presidents, the national security apparatus, citizen interest, the geopolitical and commercial environment, and democracy all figure into the United States' space policy approach.

Finally, prominent outside actors, like Russia and China, are highlighted throughout the book in critical moments that helped shape US policy, including during cooperation and competition events. The authors' assessment implies that the current US space policy is led by diverse actors who desire different outcomes. The United States may struggle to align these actors to continue leadership in the space domain. Additionally, the United States is at a critical period in some key areas of the space domain, such as satellite technology and space exploration, where commercial entities rather than the US government are in a position to establish space norms. For example, commercial actors such as SpaceX are in a position in some disciplines to establish norms.

For this reason, the United States must come to a more comprehensive policy that addresses these actors and their use of space for commercial activities, one that does not necessarily limit their activities but rather retains space as a cooperative domain for all people of Earth and that approaches future US space activities from a democratic government-led angle versus a commercial one. Such a policy must also balance the risks of US competitors with such activities without surpassing US leadership of space politically, conventionally, and commercially. Finally, the obvious limitation of this space policy analysis is the classified nature of all national security programs, which restricts some of the insight that the authors can provide. Yet this does not detract from their analysis, and the broad picture provided to the average reader does not change.

Given the disarray of current US actors and policymakers for space and the lack of a unified and clear direction in space policy, this book accomplishes quite a feat in dissecting the entire space policy apparatus, from the president down to nongovernmental organizations. *Space Policy* is certainly worth reading for policymakers, national security

actors, historians, space enthusiasts, and space domain operators. It does an excellent job of ensuring that the reader—no matter their field—understands the policy system, foundational international relations theories, and actors. Actors within the space discipline will understand how their field of work is shaped and how we as a civilization have arrived at this point. Excerpts from this book should almost certainly be foundational reading for US Space Force Guardians operating within the space domain.

Still, the book would benefit from a more effective use of acronyms. Throughout the book, acronyms are used quite liberally, sometimes without definition—for example, acronyms that appear early in the book reappear without explanation many chapters later, which can be confusing to readers.

More significantly, although the book provides insight into the many different space actors other than the United States, given China's current rise in the space domain, it would benefit from a longer touch on China in the final "Major Issues" chapter. Contemporary actions by China are described but are not detailed. This is partly understandable given the classified nature of such operations; however, as the authors are undoubtedly aware, there is a swath of unclassified information on China's actions in space. For example, China's major space policy endeavor, the Spatial Information Corridor—part of its Belt and Road Initiative—is not mentioned.

Ultimately, I wholeheartedly recommend *Space Policy for the Twenty-First Century* and appreciate its efforts to consolidate space policy for the greater national security apparatus.

Master Sergeant Patrick G. Pineda, USSF

Pax Economica: Left-Wing Visions of a Free Trade World

by Marc-William Palen. Princeton University Press, 2024, 309 pp.

The connection between a state's economic ideals, its integration into the world economy and international institutions, and the likelihood of interstate war remain central points of contention in the study of international relations. Marc-William Palen's *Pax Economica* reminds readers that the intellectual debate on these topics long precedes the economic institution-building of the post-World War II era and that these dialogues have had many different and sometimes unlikely torchbearers.

Palen aims to "challenge a wide scholarship that has tended not to look earlier than the 1930s and 1940s to understand the origins of post-1945 economic globalization" (11). In so doing he pushes against the historical consensus as he sees it that "Cold War lenses have blurred the historical depiction of modern left-wing radicalism, displacing the economic peace movement from its previously prominent position" (11). *Pax Economica* is successful in this regard as it presents a rich Venn diagram of overlapping free trade, anti-imperial, and peace interests among some surprising sectors of American and European society between roughly 1840 and 1940.

Palen begins by setting the context in which his book's subjects operated, namely that century of widespread economic nationalism. The American System, so-named by Alexander Hamilton and most forcefully encouraged by German-US economist

Friedrich List, promoted protectionist trade policies and domestic internal improvement projects to advance domestic industries and best exploit colonial markets. These ideas were emulated outside of the United States; France, Germany, Japan, Russia, and the Ottoman Empire all adopted policies much more reminiscent of American protectionism than the free trading of Britain. But the narrative is not only one of trade preferences. Palen recounts an accompanying mindset of “militarism, jingoism, war, and imperial expansion” (50).

Having established the narrative’s antagonist as the American System and protectionist ideas of List and company, Palen tells his story through a self-admitted “motley crew of left-wing free traders,” devoting chapters to liberal radicals, socialists, feminists, and Christians. Readers learn of the seminal role of English free-trade advocate Richard Cobden, the namesake of the 1860 Cobden–Chevalier Treaty, which aimed to improve British and French relations through peace movements in several countries. The book introduces readers to the strange bedfellows of Manchester School liberalism and socialist internationalists. It leads them into the transnational history of feminist peace movements and their connection with free trade ideals. And it traces the origins of the Christian peace movement linking free trade, antislavery, and pacific ideals. Each chapter covers these characters and their changes through a century of political change from the 1840s to the conclusion of World War II.

Ideas occupy a central role in Palen’s work, and it is not always clear how much he intends them to be seen as influential on subsequent actors or reflective of those actors’ otherwise inherent political preferences. The narrative tilts toward the former, showing how ideas grow and how actors emulate, for example, List’s positions on trade protectionism. But ideas do not exist in a vacuum, and it is perhaps an irony in places where economic nationalism takes hold that it is the perception of the interests of a nation’s subset that drives economic nationalism. In this sense one might wonder why certain economic narratives, whether Cobden’s or List’s, take hold among different sectors of society, an investigation that lies outside of Palen’s work.

The eclectic collection of Palen’s protagonists demonstrates both the book’s key historiographic contribution and also the limits of such a narrative. One walks away from Palen’s account with a fuller picture of some of those who carried the globalist banner during a time of widespread economic nationalism and trade protectionism. Readers gain a considerable appreciation for the connective tissue between otherwise disparate groups as the individual chapters show a strong intellectual tradition that cuts across vastly different cleavages within society. In its assembly of such a “motley crew,” however, the boundaries of Palen’s analysis are not entirely clear. Palen has identified groups with something to say about free trade, anti-imperialism, and peace, and in so doing casts the narrative around cosmopolitanism and internationalism. But where these analytical boundaries begin and end is not entirely clear.

On this note several other recent publications add context to Palen’s diverse cast of characters. Eric Helleiner’s *The Contested World Economy: The Deep and Global Roots of International Political Economy* (Cambridge University Press, 2023) and its excellent predecessor, *The Neomercantilists: A Global Intellectual History* (Cornell Univer-

sity Press, 2021), offer a greater comprehensive view of the intellectual history of free trade and protectionism in the modern era. In a similar vein Glory M. Liu's *Adam Smith's America: How a Scottish Philosopher Became an Icon of American Capitalism* (Princeton University Press, 2022) demonstrates some of the intellectual debate over and regional dynamics of trade protectionism in nineteenth-century America, a debate Palen largely glosses over in his characterization of the American System.

While *Pax Economica* does not provide a comprehensive intellectual history of free traders in the late nineteenth and early twentieth centuries, that is not the book's aim. Readers interested in gaining insights into the left-wing groups noted above or the different facets of the long debate regarding the connection between economic integration and war will find rich veins to mine in Palen's book. The book concludes with a chapter pulling the historical analysis into the present, demonstrating that a facility in the history of free-trade narratives provides a deeper understanding to debates that continue to recur today.

Sean Braniff, PhD

Unwinnable Wars: Afghanistan and the Future of American Armed Statebuilding

by Adam Wunische. Polity Press, 2024, 224 pp.

Unwinnable Wars captures the United States' exasperation with its two-decades-long struggle at armed statebuilding in Afghanistan. Author Adam Wunische, an instructor at George Washington University's Elliott School, served in Army Intelligence and as an analyst for the Central Intelligence Agency (CIA). Wunische's thoughtful critique forces the reader to question the wisdom of reconstructing the Afghan state through military intervention, or what the US military terms "stability operations" (16). Yet Wunische seeks to understand not just "what went wrong in Afghanistan" but also why such operations "never go right" (ix). His central argument is that as the United States decides to engage in such efforts, overwhelming "uncontrollable forces and preexisting conditions" determine the outcome. That is, as armed state-building could not be won in Afghanistan, every other failed attempt at such operations has occurred because the same preexisting structural factors create "overdetermined," inescapable conditions (8).

US operations in Afghanistan from 2001 to the end—when twenty years of blood and treasure were erased in nine shattering days—provide the overarching backdrop for a sociological and structural review of these preexisting factors. While some are ancient in origin, like inaccessible geography or the powerful constructs of race, ethnicity, and religion and the complex dynamics that come with them, other factors—like socioeconomic underdevelopment and interest asymmetry—create conditions that an intervening force cannot unravel.

The book then tackles the effects of time on various actors. This section moves beyond the argument of announced timetables and investigates time as a distinct concept unavoidably connected to all factors. Unfortunately, time favors the reality of those occupied, an understanding the book best captures in the proclamation of one Taliban fighter: "You have the watches; we have the time" (47).

The book then delves into dilemmas that all intervening forces must contend with. Wunische points out that statebuilding for the intervening state is not an existential endeavor, yet the subjugated group is constantly threatened by extinction. The resulting difference in will is often underestimated.

The final piece of groundwork examines the paradoxical nature of intervention itself. Perhaps the most obvious but frequently missed dilemma is dependency. Once an intervening force is introduced, the supported side becomes dependent, thus exacerbating interest asymmetry. The new government needs the United States and its money, and this dependency actively undermines progress. The longer the intervening force stays, the more damage is done. But here is the rub: leaving also inflicts grave damage because the new government is essentially a shell, having relied on US money and institutions instead of building a foundation for itself. The result in the case of Afghanistan was a government that collapsed in just over a week after two decades of statebuilding. Thus, as the book argues, the only way to avoid this trap is to not intervene in the first place.

Throughout these assertions, Wunische uses historical examples of US military intervention from early 1900s operations in Haiti to post-World War II statebuilding efforts. He also uses contemporary and ongoing efforts to show how the foundations for overdetermined failure or success exist in all such armed stabilizing attempts.

After establishing the overdetermined factors, Wunische transitions from a review of the past and presents a framework so policymakers may avoid future mistakes. Critically, he does not articulate the factors as problems to be solved but rather as criteria to judge the probable outcome of armed state-building and, therefore, US intervention in the first place. What starts with a desire to understand ends with the revealed purpose of convincing readers of the need to practice restraint and strategic patience, and perhaps to encourage nonintervention.

Unwinnable Wars is an applied case study in structural realism that provides depth to theory and evidence to abstraction. The author presents evidence from public statements of leading officials, data from the Special Inspector General for Afghanistan Reconstruction report, and arguments from leading international relations theorists. He also challenges current literature and common beliefs by diving deeper into the historical record. He directly disputes sources such as former CIA analyst and National Security Council staffer Paul Miller and retired US Army General David Petraeus, former CIA director and commander of US and NATO forces in Afghanistan, who have argued that the United States needed to do more to succeed. Critically, Wunische dismisses arguments that point to current single causal factors of a particular policy or military strategy and ignore the interaction of variables and systems. He refutes leading counterfactual ideas, showing they all miss the underlying determinates.

In presenting a comprehensive framework, *Unwinnable Wars* thus presents and tests its theory against ongoing and recent crises. While it challenges policymakers to understand where the United States would get the most for its effort—although no operations are winnable if the same overdetermined factors are present, intervention may be possible in some areas depending on policy aims—it does not deride indi-

viduals for their choices. Wunische understands that all players are trapped by structures and system pressures.

Unwinnable Wars should be on the nightstand of every policymaker, politician, and strategist. It presents the most comprehensive understanding of fundamental elements that overdetermine the success or failure of armed statebuilding. If there is a gap in theory, it is only in categorization. Is empire-building a form of armed statebuilding? Did the United States' expansion westward and destruction of Native Americans constitute stabilizing operations? Wunische cautions against empire-building, implying that it is morally fraught. Although he will likely receive little pushback on that claim, the question remains: If a country is willing to colonize another, can that overcome the overdetermined factors outlined in the book? Or perhaps that line of questioning only illustrates the author's point: the "cult of action" runs deep in US culture and doctrine and tempts policymakers to believe they can figure out a way to make such efforts work (182).

Ultimately, Wunische's evidence-based framework may help future generations make better decisions about the United States' actions in the global arena. *Unwinnable Wars* provides the simple wisdom that perhaps the best choice is never initiating armed state-building.

Lieutenant Colonel Michael Kissinger, USAF

The Return of Great Powers: Russia, China, and the Next World War

by Jim Scitutto. Dutton, 2024, 368 pp.

In *The Return of Great Powers*, Jim Scitutto provides the insight and perspective one would expect from such a highly connected US journalist. He previously worked for the State Department in Beijing and is currently CNN's chief national security correspondent. He is also the bestselling author of *The Shadow War* (Harper, 2019). His latest book provides gripping and firsthand insight into modern geopolitics and warfare.

Scitutto argues that great power competition has accelerated in the aftermath of Russia's illegal invasion of Ukraine. He contends that the new world order includes three great powers: the United States, Russia, and China. Hardening division between these great powers has "upended the post-Cold War global order and replaced it with a new, less stable one" (xi).

The book covers various interrelated topics of benefit to those interested in great power competition and twenty-first-century military affairs. Firstly, Scitutto enables his reader to understand in more depth Russia's war in Ukraine and the implications of the war for the great powers. Secondly, he describes the challenges of twenty-first-century warfare, the response of NATO and Europe, the potential for nuclear escalation, and China's connections to Russia. Finally, he addresses the potential for Taiwan to become the next flashpoint in great power warfare.

Scitutto describes the Russian invasion as "a 1939 moment" with global ramifications for the United States and its Allies (xiii). In an absorbing firsthand account, he gives insights from senior Central Intelligence Agency, Pentagon, and NATO contacts.

He shares with readers his conversations with Ukrainian civilians before and after the invasion—gathered while he was living in a hotel in Kyiv as Russian tanks rolled over the border—which provide superb insight and a perspective that may resonate with many in Taiwan today as they confront aggression from China.

Sciutto assesses that Russia's invasion of Ukraine signified the beginning of the post-Cold War "new world disorder," asserting that if Russia is allowed to succeed, it would likely incentivize aggression by other nefarious states (310). He illustrates this point with a quote from Estonian Prime Minister Kaja Kallas: "You can't walk away with more than you had before. Otherwise, it's incitement to aggression" (310). Sciutto describes Russia's war in Ukraine as a "real-world experiment in great power warfare" (28). The invasion has undoubtedly energized NATO and European countries. More importantly, this new energy will have made Beijing assess the implications of any plans to take Taiwan. As a result of Russia's war with Ukraine, the United States is certainly keen to ensure it "reasserts deterrents" (76).

Sciutto also tackles the challenges of twenty-first century warfare. The discussion with NATO Secretary General Jens Stoltenberg and former NATO Supreme Allied Commander Admiral James Stavridis brings this issue to life. Both officials highlight the combination of today's complex technology with trench warfare, tanks, and artillery. Their analysis illuminates Ukrainian successes as well as challenges, including the rapidly changing battlefield and Ukraine's ability to adapt to such changes through technological innovation. The book also highlights important lessons on defense industrial capacity, noting that Western support for Ukraine has revealed serious global supply chain issues.

With much ground to make up following the peace dividend after the Cold War, Sciutto analyzes the response of NATO and European nations. While one European NATO admiral is optimistic about increased European defense spending, an Estonian defense official is less enthused, stating "Russia put Europe to sleep in the 1990s . . . and it is struggling to wake up" (123). Sciutto questions whether Russian President Vladimir Putin would attack NATO and receives equally contrasting responses. Again, this concern is real for the Baltic countries but not a significant one for US senior officials.

The author explains that the 2022 NATO conference in Madrid changed the dynamic between NATO and China. The NATO Strategic Concept articulates that "the deepening strategic partnership between the People's Republic of China and the Russian Federation and their mutually reinforcing attempts to undercut the rules-based international order run counter to our values and interests" (61–2). Yet Sciutto's conversations with the NATO secretary general do not explicitly link China to the ongoing situation in Ukraine, and only Sciutto—not Stoltenberg—refers to Russia as a great power.

In 2022, US intelligence reported that Russia was preparing for the potential use of a nuclear weapon on the battlefield in Ukraine. Sciutto provides a firsthand account of US officials as they actively planned for a US response. Sciutto claims that "the degree of US concern and the seriousness of contingency planning—has not been reported in such detail before" (197). The use of nuclear weapons would inevitably make it a

great power conflict, and this potentially explains why he regards the war in Ukraine as “a 1939 moment.”

Sciutto then establishes the links between China, Russia, and the war in Ukraine. He argues that Western involvement has expanded the war into a proxy war among the great powers. The middle powers are also beginning to align, and there is concern about vertical and horizontal escalation—or the potential use of weapons of mass destruction and the introduction of NATO to the conflict, respectively.

Shortly before the Russian invasion on February 4, 2022, China and Russia “released a joint statement declaring that China and Russia’s bilateral partnership was greater than a traditional alliance and that their friendship would know ‘no limits.’”¹ Sciutto outlines the thinking of US officials concerned about the prospect of China assisting Russia in rearming militarily and boosting its capability on the Ukrainian battlefield. The United States believed that “China was considering the provision of ‘lethal support’ to Russian for its invasion, to complement the nonlethal aid it had already been sending” (76–7). This evolved into Chinese lethal support to Russia becoming a red line for the United States. It also led to US intelligence reports being made public to warn the global community that China was actively considering providing lethal support to Russia.

But if China has not provided Russia with lethal aid, why does Sciutto regard Ukraine as the first great power proxy war of the new unstable world order? He argues that “Chinese leaders hoped to prolong the war in Ukraine in order to distract and weaken the US and its allies so as to make it less capable to respond to a potential Chinese invasion of Taiwan” (80).

Sciutto thus shifts his focus to Taiwan, which has undoubtedly been observing this geopolitical exchange since the invasion of Ukraine. Sciutto visited the country to speak to senior serving and retired Taiwanese military officers and assess whether Taiwan would likely become the next flashpoint in great power warfare. US Chairman of the Joint Chiefs of Staff General Mark Milley said in an interview with Sciutto, “The historical record tells us that when the condition obtains, when a revisionist power and a status quo power meet and they have irreconcilable core vital national security interests, historically, most of the time it ended up in armed conflict” (50). This refers to the bipolar relationship between the United States and China rather than the ongoing situation in Ukraine. Still, Milley’s study of history has led him to conclude that ongoing geopolitics make “great power war more likely rather than less likely” (50). The author asserts that many lessons from Ukraine have benefited Taiwan, potentially more than China. His inference is that lessons must be acted upon to bolster deterrence and avoid Milley’s prediction coming to fruition.

Yet although Sciutto’s insight from senior officials, politicians, and generals on the front line of geopolitics provides a fascinating perspective, his assessment of Russia as a great power is open to challenge. Russia has significant nuclear capability, but it is an

1. Patricia M. Kim, “The Limits of the No-Limits Partnership: China and Russia Can’t Be Split, but They Can Be Thwarted,” *Foreign Affairs*, March/April 2023, 28 February 2023, <https://www.foreignaffairs.com/>.

economic minnow in comparison with the United States and China. That said, there can be no doubt that Russia's war in Ukraine provides a compelling example of why it is necessary to deter future aggression.

The Return of Great Powers is nevertheless a book that readers interested in modern geopolitics or military affairs would find interesting. In providing lessons for future conflicts and exploring the implications of a Chinese military invasion of Taiwan, Sciutto covers the complex range of intertwined geopolitical challenges now facing the Western world.

Group Captain Timothy Brookes, Royal Air Force

Cold War 2.0: Artificial Intelligence in the New Battle Between China, Russia, and America

by George S. Takach. Pegasus Books, 2024, 432 pp.

In analyzing the challenges faced by democracies today, George S. Takach's *Cold War 2.0* argues that four key accelerator technologies—artificial intelligence (AI), semiconductor chips, quantum computing, and biotechnology—may very well determine whether democracies or autocracies win the next cold war, which he believes is currently underway. Takach, a Canadian attorney with over 40 years of experience in technology law, contends that innovation through technological advancements allows societies to move forward and establish their global dominance. Democracies led by the United States need to decouple the four modern accelerator technologies from their autocratic competition or they risk facing a new hegemonic order led by China with Russia on its coattails.

Takach begins his 14 chapters with his thoughts on how national powers utilize technology. He then ties this into a historical overview of the Cold War—identified as Cold War 1.0—and finally concludes with his analysis on how Russia failed to innovate and develop technology toward the end of the war, resulting in its dependence on foreign countries for tech components. He specifically points out in later chapters how Russia currently lacks semiconductor chip manufacturing capabilities. This has compelled Russia to find creative ways to bypass sanctions—which it currently accomplishes through the increased import of household appliances, such as washing machines. Russia then salvages the chips from the appliances, and the chips are then utilized in drones throughout Russia's war against Ukraine.

The book then takes a deep dive into China's learning from Russia's past mistakes over the years. China's technological innovation, though behind most western and neighboring countries like Japan, Taiwan, and South Korea, has accelerated its global power. Takach ultimately labels China as the main antagonist in Cold War 2.0.

When discussing China, Takach focuses on its current domestic and international actions as China's leader Xi Jinping sets his sights on leading the world under China's rule. Most recently, Xi changed the law to stay in power indefinitely. Takach also shows how Xi's measures within China seek to control its citizens, demonstrating its return to a closed society focused on the preservation of the Chinese Communist Party. For example, he presents cases on how China utilizes AI for population control

through the suppression of free speech. Internet censorship prevents Chinese citizens from searching online for topics that the country deems critical of the communist regime. China has also developed and implemented social credit scores that impact everything from loans to job applications. If a citizen crosses the street outside of the crosswalk or questions the local authorities, surveillance linked with AI automatically reduces a person's social hierarchy status, which further reduces any of their perceived freedoms. The book also points to the human rights abuses against the Muslim Uyghur minority in Xinjiang, drawing parallels with George Orwell's disturbing vision of a dystopian future.

Disobeying the law or speaking out against China leads to serious consequences for its citizens as well as for other countries. As Takach points out, the outlook for improving international relationships with China is grim. States critical of China can face repercussions through means of economic coercion, such as the trade war Beijing initiated against Australia when the latter questioned China's role in the COVID-19 pandemic. While censorship restricts China's population from questioning its government's actions internally, the great propaganda machine itself retaliates against other countries critical of its policies, wreaking havoc on these countries' economies. The book provides numerous examples of China's unfair practices, reinforcing Takach's argument that a new cold war has already begun as well as raising questions about why more has not been done to counter such efforts.

Cold War 2.0 then examines the semiconductor chip industry and analyzes which countries have manufacturing capabilities, demonstrating how globally interconnected and fragile the industry is. Takach argues that democracies dependent on Taiwan's technology need to stand up against China. Details on trade deficits between China and Taiwan suggest why China would seek to control it beyond its geopolitical and strategic reasons. In 2022 Taiwan sold \$156.5 billion more to China than it purchased from China, thus representing China's largest trade deficit. The United States has attempted to slow China's semiconductor industrial growth and bring more manufacturing stateside.

Such restrictions faced by China are estimated to have put it 10 to 20 years behind the democratic world, thus compelling China to place significant investments in quantum computing. Now being developed, quantum computing offers technology described as being even faster than the world's most powerful super computers. Used in something such as encryption, it would take hundreds of years before the world's current machines could crack the code. If China can master this technology, it could essentially take semiconductor chips out of the equation altogether, resulting in its technological world dominance. For China to accomplish this, however, it still needs to advance its semiconductor chip and AI technologies.

Takach's book makes a strong case for the need to manage the future of AI, semiconductor chips, and quantum computing. A reader with little to no background knowledge on these topics would be informed enough to be concerned of the challenges ahead. Yet the book does not provide equal emphasis on the fourth accelerator technology, the biotech industry. Although Takach presents the challenges to the industry and

makes a strong case for why biotechnology is extremely important, details are not as substantive as with the other three technologies.

Another area lacking development is Takach's discussion of the outcomes of Cold War 2.0, specifically with China. Takach seems to offer only three possible and drastic conclusions: China will start playing by the rules and be on par with Japan, Korea, and Taiwan; democracies decouple their technology from China, and it gets left behind the democratic free world; or China goes to war with its democratic adversaries. While this approach drives home the urgent need for democratic leaders to act now, it also does not consider China's response. China is an independent nation that has just as much right to its own sovereignty as every other country, and any drastic measures might push China over the edge, possibly starting a war. Yet if such measures are ignored or misinterpreted, China may not see any offramps, which could result in military conflict.

Nevertheless, *Cold War 2.0* is a great read, seeking to jumpstart the discussion on how leaders can begin to strategize innovative approaches for handling the challenges of addressing modern autocracies' influence over AI, semiconductor chips, quantum computing, and biotechnology. Even though Takach acknowledges that any decoupling actions would not be easy and would be met with resistance, all leaders of democracies who want to know how to stay ahead of a peer competitor like China should consider these recommendations. Change in itself is difficult to manage—even more so on a global scale. Yet as the leader of the free world, the United States would be wise to engage its Allies and partners to help in countering such threats from its peer competitors.

Lieutenant Colonel Eric S. Haegele, USMCR

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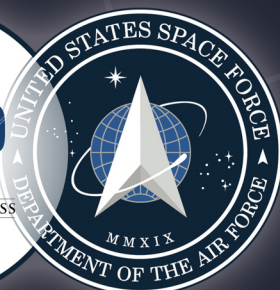
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