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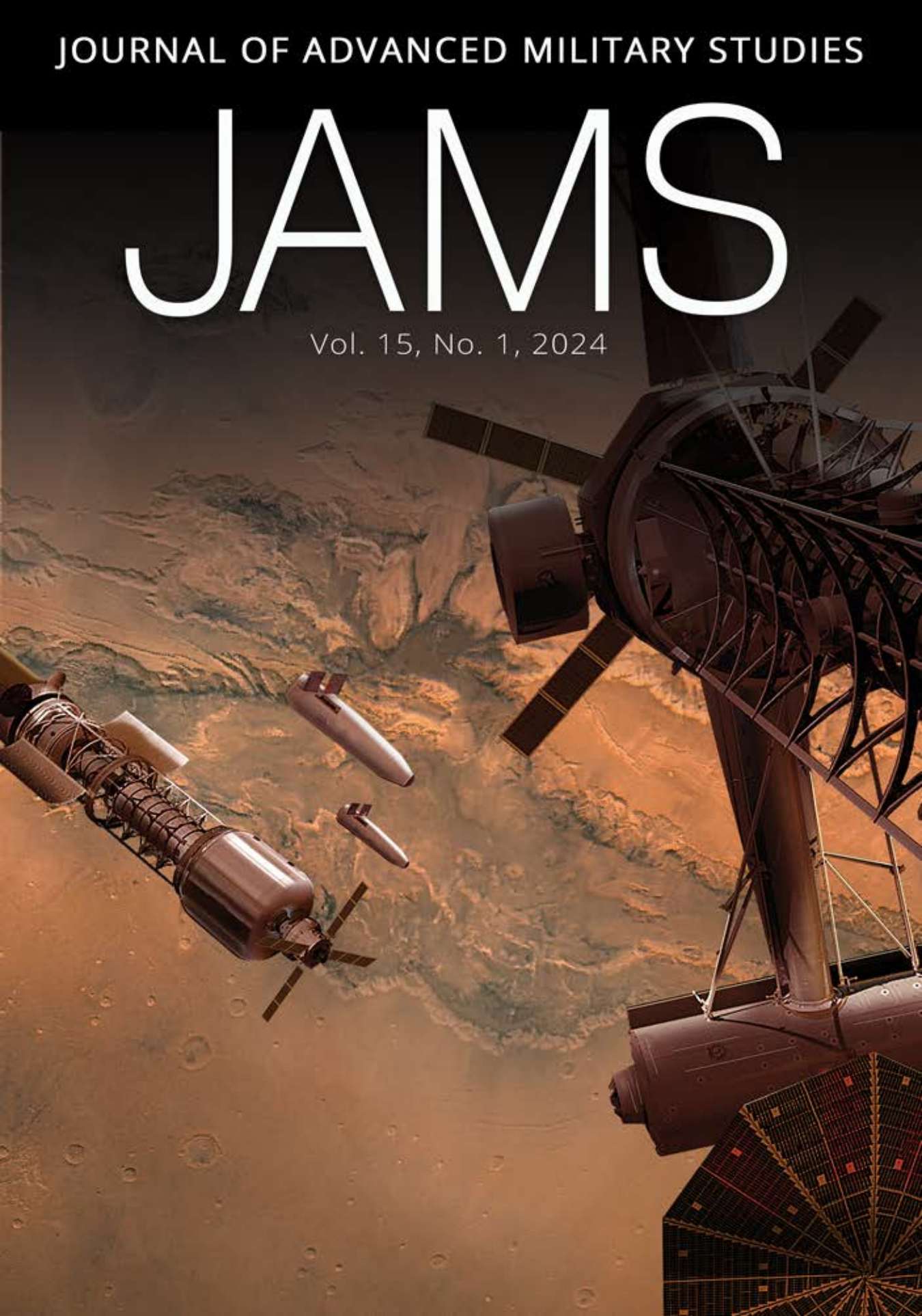

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From the Editor

The application of space technology to military purposes is nothing new. However, the intensified reliance by military forces on space capabilities coupled with a return to active contestation of space as a military domain increases the need for discussion of space applications and their implications for the joint fight. This issue of the *Journal of Advanced Military Studies* focuses on space-related topics, and that is a timely decision. However, thinking on these issues remains very much nascent, as is apparent in some of the articles in this issue.

The diverse and wide-ranging articles in the Spring 2024 issue are both directly and symbolically representative of the ongoing effort by military leaders and thinkers around the world to consider the ramifications of multiple fundamental changes currently underway in the space domain. These changes have major implications for how war is fought in all domains and geographic theaters. U.S. Marines, Space Force guardians, and other military and civilian scholars have an opportunity to add to the intellectual ferment around space topics and international security, but there is a long way to go to build theory on a strong foundation of technical insight.

One way to consider what humanity can accomplish in space is by envisioning a Venn diagram with overlapping circles depicting that which is technically feasible, that which is economically viable, and that which is acceptable under the policy set by the licensing or operating state. All three of the components of this Venn diagram are undergoing rapid change today.

The economics of space were transformed during the last decade as a few major investors, and many smaller ones, provided sufficient capital to overcome major technical and scale challenges and have now radically reduced the cost of launching satellites into space. The technology of space is advancing rapidly, enabled in part by the progress of the civilian electronics and information technology industries here on Earth, but also by the emergence of vertically integrated developers who are fielding satellites at a scale previously unimagined. On the policy side, national space laws are being revised in multiple ways to reduce barriers to entrepreneurship and new space applications, but they are also placing greater importance on the sustainability of the space environment. The Outer Space Treaty of 1967 places responsibility on the authorizing nation for all activity in space, whether governmental or nongovernmental.[1] The Jo-

seph R. Biden administration has released a framework for space priorities and a series of Department of Defense strategy documents that place heavy emphasis on harnessing commercial space capabilities for national security applications. But despite all these important changes, the fundamental laws of physics are unlikely to be repealed, and multiple order of magnitude leaps in key materials science properties are also unlikely in timelines measured in mere decades. We are in an era where big dreams can become a reality, but that does not mean that all big dreams are feasible.

The stakes are high. Humanity's reliance on space technology has never been greater. In an increasingly data-based world, satellites generate and move immense quantities of data to enable Earth-based businesses, infrastructure, and national security systems. Space technologies allow utility companies to balance energy flows across the electrical grid, provide the precise timing needed to record financial market transactions, increase the carrying capacity of a crowded air traffic system, and have supported critical increases in crop yields globally.

Dr. Eliahu Niewood and Dr. Matthew Jones's introduction to the changing nature of the space domain provides a solid foundation on the rise of the commercial space sector, the dramatic shifts in the economics of space launch, and the return of clear conventional military threats to space capabilities not seen since the Cold War era. They concisely explain the rise of proliferated low Earth orbit constellations of satellites, much of which required a willingness to step away from the natural tendency of military and intelligence space users to seek ever higher levels of technical performance. While Niewood and Jones correctly note that some applications inherently require large apertures in space, and hence larger and more expensive satellites, during the last decade we have seen that fielding many satellites that are "good enough" can offer advantages in terms of resiliency in the face of adversary attack, in access and revisit of locations of interest on the ground, and in reduced latency for communications. Niewood and Jones's description of what has changed in recent years is a good jumping off point for some of the more speculative articles that follow.

For example, Tom Wilkinson offers an overview of American public opinion on the militarization of space in the 1950s and 1960s, with particular reference to how early space launches gave public visibility to the emerging intercontinental missile threat and how Soviet technological advances called into question the competitive capability of U.S. society. The author's focus on sampling letters to the editor and similar sources provides useful insight into the so-called Sputnik crisis.[2] Adding to recent publications like Bleddyn Bowen's *Original Sin: Power, Technology, and War in Outer Space* and Robin Dickey's "The Rise and Fall of Space Sanctuary in U.S. Policy," Wilkinson provides another useful counterweight to our natural tendency to view as completely novel the last decade's increasing superpower tension in space.[3]

Two practitioners' articles in this issue grapple with specific organizational and institutional challenges that must be addressed to fully realize value

of expanded space capabilities in military operations. Marine Corps colonel Josh Bringhurst identifies the very real organizational obstacles facing Joint task forces bringing together space and terrestrial capabilities inside a theater that could be highly contested like the United States Indo-Pacific Command (USINDOPACOM) area of responsibility. The article explores the topic of how stand-in forces can help the Joint force complete kill webs. It also addresses the complex challenges of maintaining the effectiveness of these stand-in forces in the face of a People's Republic of China People's Liberation Army that has built a set of highly integrated systems and organizations to harness space capabilities that target long range missiles and other military forces.

On the organize, train, and equip side of the problem, Space Force lieutenant colonel Genelle Martinez identifies how building a strong U.S. Space Force intelligence capability could depend on creating training programs focused on the technical content needed for well-informed space operations and contribute to a strong Space Force intelligence career field culture. In Lieutenant Colonel Martinez's telling, the current approach that relies heavily on combined U.S. Air Force-U.S. Space Force initial skills training for intelligence professionals is efficient but not necessarily effective. The intelligence professional development case is just one of many where the very small scale of the U.S. Space Force is creating difficult trade-offs. The human and financial resources required to stand up service-unique training are scarce and cannot be applied to other missions.

Getting beyond military applications, Dr. Julian Waller's consideration of potential nondemocratic models of governance for small human settlements across the solar system raises interesting questions about how separated societies can evolve and how people organize themselves in an environment where both removing oneself from the community (exit) and speaking out to change the community (voice) are difficult, expensive propositions.[4] However, this process of evolution from command-oriented exploration missions likely will require significant time, since for the foreseeable future the early human inhabitants of these colonies are likely to be deeply dependent on and in essence directed by "mission control" elements back on Earth.

While there are enormous advances being made in the advantages that humanity is gaining from space technology for both civilian and military purposes, that advancement could be seriously slowed or reversed by an increasingly dangerous orbital debris environment. Most debris-creating events are either unintentional or the result of difficult mission trade-offs, but some of the largest events in history have been intentional acts involving antisatellite weapons (ASATs). In this context, Space Force lieutenant Max Schreiber offers a radical proposal that the United States undertake civilian space cooperation with the North Korean regime to create disincentives for North Korea to pursue a direct ascent antisatellite weapon. Currently, a North Korean ASAT appears to be a hypothetical threat. The Secure World Foundation's comprehensive *Global Counterspace Capabilities* report notes, "North Korea has no demonstrated ca-

pability to mount kinetic attacks on space assets: neither a DA-ASAT nor a co-orbital system. In its official statements, North Korea has not mentioned ASAT operations or intent, suggesting that there is no clear doctrine in Pyongyang's thinking at this point."[5] Moreover, this argument likely overstates the universality of the costs imposed by debris from an ASAT test or attack, thereby assuming that a North Korean DA-ASAT attack or test would equally affect Russia and China, two key supporters that North Korea often seeks to play against one another. The current U.S.-led effort to develop a norm against destructive ASAT testing also aims to raise the political costs for potential ASAT developers and has generated significant support in the United Nations and among like-minded nations. It has also served to further isolate Russia and China as nonsignatories and poses no substantial technical disadvantage to advanced spacefaring nations for whom the task of intercepting a satellite is not terribly challenging.[6]

While some of the articles contributed to this volume are built on highly speculative technical foundations, that reflects the immaturity of human thinking about the immense potential of space technology to change our lives. We must crawl before we run, and an overly narrow focus on what can be technically achieved with a modest extension of today's technology can miss the opportunity for leap ahead applications or the complete transformation of a mission or market area. The Marine Corps University Press is to be commended for its vision in dedicating this issue to such a critical topic.

Jamie Morin, PhD
Executive Director, Center for Space Policy and Strategy, the Aerospace Corporation

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Introduction

Eliahu H. Niewood, ScD; and Matthew Jones, PhD

From a national security perspective, the space domain today is fundamentally different than it was 10 years ago. It is also likely to be very different 10 years from now than it is today. The role of the commercial sector, the nature of development of space capabilities, the ways satellites are gaining access to space, the uses of space capabilities, the organization of the U.S. Department of Defense when it comes to space, and the likelihood of conflict in space all look very different today than they did in the past. This issue of the *Journal of Advanced Military Studies* considers a variety of these shifts in detail. To provide context and background for the individual articles, this introduction describes some of the connections between the changes and gives an overview of each one.

Advent of Proliferated Low Earth Orbit in the Commercial Sector

One of the two key factors driving the dramatic shifts in the space domain has been the advent of proliferated constellations of small satellites, primarily in low Earth orbit. The advent of proliferated low Earth orbit (pLEO) constellations began in the early 2010s and was the confluence of multiple factors. Ever smaller and cheaper electronics, the availability of venture capital funds looking for risky and high payoff investments, and the ability to handle large amounts of data and pull knowledge from that data were all required enablers of the proliferated low Earth orbit revolution. The revolution also required recognition though that flying large numbers of cheaper satellite and/or rapidly iterating design and capability of a satellite provided an alternate means of reducing risk and increasing resilience relative to traditional satellite development. Until

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the proliferated low Earth orbit revolution, satellite developers, particularly the U.S. national security establishment, were caught in a negative spiral where every time they designed a satellite they wanted to ensure its reliability was high, so they increased mission assurance, testing, and complexity, which increased cost, which increased the desire for reliability, which increased the amount of mission assurance, testing, and complexity, and on and on. The high cost of satellites and particularly the high cost of launching them also led to a predilection to add capabilities to satellites in an unfortunate attempt to get more value out of all that cost. This again increased the complexity of satellite design and the types of testing and mission assurance that needed to be done. Large satellites will still be required for a number of different missions, particularly those requiring large apertures or high power for sensing or communications, but even for those it may be possible to break the cost/requirements/mission assurance spiral.

Beginning in 1999, the emergence of a standard for small satellites known as CubeSats was one other factor in enabling the proliferated low Earth orbit revolution. The CubeSat standard was developed by Cal Poly (California Polytechnic State University) and Stanford to allow students to experience what it meant to design, build, and fly a satellite.[1] Part of the standard was the definition of a standard size unit for CubeSats, where a 1U CubeSat measured 10 cm in height, width, and depth. As the standard matured, and CubeSats grew from the first 1U cubes to 3U and even 12U designs, commercial companies began to develop components specifically for CubeSats, even whole CubeSat kits. Nanoracks and other private space-focused companies built launchers to eject CubeSats from larger satellites or space vehicles. The CubeSat ecosystem helped generate a new class of components and subsystems that could be used in smaller, lower cost satellites with relatively rapid iteration on capability. Researchers and engineers began to see that CubeSats could be useful for real missions, not just for student projects.

Planet, then known as Planet Labs, was one of the first companies to recognize that a different model was now possible. Rather than building a single or a small number of large, high reliability satellites with many different capabilities, they focused on building small, cheap satellites with one function in mind: the ability to provide moderate resolution imaging of the Earth. They recognized that a large constellation of such systems could image the whole Earth every day and that technology existed to ingest that data and make sense of it given the advances in big data analytics and emerging capabilities in machine learning. Planet kept the cost of each satellite down by using lower cost components, by not requiring them to be built in ultra-pure clean rooms, and by doing some fraction of their testing on-orbit. They rapidly iterated the design of the satellites from launch to launch, and they launched larger numbers of satellites more frequently so that a single satellite failure was a relatively minor occurrence. The lower cost of the satellites also allowed them to use an automated, largely hands-off approach to operating their constellation as they did not need to obsessively

monitor an individual satellite with tens of people per satellite. They built an infrastructure for data collection and analysis that allowed them to collect revenue off processed data. Currently, Planet is flying more than 180 Planetscope Dove 3U CubeSat imagers with 3-meter resolution along with more than 20 higher resolution SkySat imagers. BlackSky Global is developing similar concepts for somewhat smaller constellations of somewhat larger satellites. Hawkeye 360 uses a proliferated low Earth orbit constellation to monitor radio frequency signals like the maritime automatic identification system. ICEYE developed one of the first small synthetic aperture radar satellites and is now filling out that constellation.

These early companies were largely focused on Earth imaging. Somewhat more recently, there has been a move to provide internet access and resilient communications based on similar proliferated low Earth orbit constellations. Starlink, the constellation developed by SpaceX, is the largest player in this space and as of 2022 had nearly 5,000 satellites in orbit, more than the rest of the world combined. SpaceX's highly vertical approach to its supply chain has meant that it has not generated as much change in the wider commercial space industry to support its production, but the example it provides is leading other companies to work to provide similar capabilities. OneWeb had a constellation of more than 600 satellites as of 2022, also providing radio frequency connectivity. Kuiper is working to develop a similar capability as are others.

Change in Launch Capabilities

The large increase in the number of satellites to be launched has helped drive and/or been enabled by changes in the costs and availability of launch services. SpaceX is once again the biggest player here. Its development of the Falcon 1 in 2006, then the Falcon 9 in 2010, and then a highly reusable version of the Falcon 9 in 2015 has significantly lowered the price per unit mass of launch to low Earth orbit. Their assembly line approach to building Falcon 9 is unprecedented in the space community. SpaceX now performs multiple launches per week, with a goal of reaching one launch per day in the near future, and it is expanding the Falcon 9 and Falcon Heavy capabilities with even more payload capability via Starship.

There are also a growing number of companies working to offer small payload launches. One of the first of these was RocketLabs, with its Electron launch vehicle now having launched around 177 satellites to low Earth orbit with a 300 kg payload capacity with a reusable orbital-class small rocket.[2]

As early as 2018, the U.S. General Services Administration established a cost schedule for launches of small payloads with NanoRacks and has had a similar agreement with SpaceX for somewhat larger payloads since at least 2021.[3]

Change in the Nature of the Space Threat

Another, less positive change in the space environment is the growing capability and perceived intent by potential U.S. adversaries to attack satellites in the

event of conflict. These capabilities range from nonkinetic and reversible effects like jamming, to nonreversible kinetic effects generating significant amounts of debris. A watershed moment in this area was the Chinese test of a ground launched, direct ascent, hit to kill space weapon against one of their own dead satellites in 2007. That test has been followed by a significant expansion in antisatellite capability by both China and Russia.

According to the U.S. Space Force, China officially designated space as a new domain of warfare in 2015.[4] Their test in 2007 has been followed with what is now an operational capability for direct ascent capability against low Earth orbit systems with a test more than 10 years ago in 2013 to geosynchronous orbit indicating that they may have capability against that orbital regime as well. The Chinese are also developing repair satellites that may be placed in orbit and used at a later time to engage and damage an adversary's satellites.

According to the U.S. Space Force, the Russians have demonstrated cyberattacks against commercial space systems as part of their operations in Ukraine. They have developed ground-based, high-energy lasers to blind intelligence, surveillance, and reconnaissance satellite sensors and tested a direct ascent ASAT missile in 2021. Russia has also deployed orbital prototypes that eject smaller payloads, which may be used as weapons.[5]

The National Air and Space Intelligence Center (NASIC) has provided similar reporting, including describing how in 2022 China's Shijan-21 was used to tow a defunct satellite in geostationary orbit to the graveyard belt and how Russia's COSMOS 2504, 2519, and 2536 were all used to test low Earth orbit kinetic kill capabilities. NASIC mentions adversary antisatellite capabilities including ground site attack, cyberattack, directed energy weapons, electronic warfare, and kinetic attacks.[6] Similar reporting has been done by the Defense Intelligence Agency.[7] The United States recognizes the potential impact of these threats, declaring that United States "space forces must protect U.S. interests in a manner that preserves the safety, security, stability, and long-term sustainability of the domain."[8]

Implications for National Security

These changes around use of space have resulted in some significant impacts on national security. The U.S. military and others have reacted to these changes in a variety of ways; the examples below largely revolve around the U.S. national security enterprise.

National Security Adoption of the Proliferated Low Earth Orbit Approach

In 2019, then undersecretary of defense for research and engineering, Michael D. Griffin, directed the stand-up of the Space Development Agency (SDA).[9] The goal of SDA was to much more rapidly and affordably field national security space capabilities using the same proliferated low Earth orbit model em-

ployed by Planet, SpaceX, and others. Since its stand up, SDA has focused on delivering capabilities for tracking adversary ballistic and hypersonic missiles as well as providing resilient communications capabilities. They launched their first 10 Tranche 0 satellites to support data transport and missile tracking in April 2023, less than three years from initial contract award, a relatively short time for a U.S. government satellite program. The final Tranche 0 satellites were launched in February 2024, bringing the total in orbit to 27 systems. The transport satellites are also relatively inexpensive for a Department of Defense system, costing around $15 million (USD) per satellite.[10] SDA plans to launch its Tranche 1 satellites in 2024 and is working on Tranche 2 with more than 100 satellites as well as developing new capabilities as part of its Fire-control on Orbit support to the warfigher (FOO-fighter) satellites.[11] While not yet at the scale of Starlink or Planet, SDA demonstrates that the national security enterprise can implement the principles of the proliferated low Earth orbit in its own development efforts.

Leveraging Commercial Proliferated Low Earth Orbit

At the same time, the national security enterprise in the United States is working to leverage the capabilities developed by the commercial sector as part of the pLEO revolution. The U.S. intelligence community has been particularly involved in working with the pLEO commercial space sector with some more nascent efforts on the part of the U.S. Department of Defense. The National Geospatial-Intelligence Agency (NGA) signed an introductory contract with Planet for imagery in 2017, purchased a subscription for Planet imagery in 2017, and followed that with a larger contract in 2018.[12] In 2022, after taking over responsibility for commercial space for the intelligence community, the National Reconnaissance Office (NRO) awarded contracts for commercial imagery to BlackSky, Maxar, and Planet. Although Maxar is more of a traditional large satellite developer, both BlackSky and Planet fall into the proliferated low Earth orbit category.[13] The U.S. Space Force has a contract with SpaceX involving StarShield, which may provide a Department of Defense-unique variant of Starlink capabilities.[14]

Protecting U.S. Commercial Systems

Given the U.S. government's reliance on commercial space systems—sensing and communications—and demonstrated willingness of adversaries to target commercial systems, there is an increasing realization by the U.S. government of the need to provide mechanisms to better protect critical commercial space partners.

Reorganization of U.S. Department of Defense—Space

The United States has emphasized the critical nature of space to its national security through the creation within the last five years of both a dedicated combatant command for space, U.S. Space Command (USSPACECOM), and of

a dedicated Service, the U.S. Space Force (USSF), which is part of the Department of the Air Force. These two organizations have put increased attention at leadership levels to developing and protecting U.S. space capabilities.

The NRO, NGA, and USSPACECOM recently announced a tri-seal commercial space protection framework to improve the bilateral sharing of threat information with contracted commercial space companies to ensure the timely protection and availability during a time of escalation.[15] Other published strategies also highlight the need for improved integration and joint tactics, techniques, and procedures for dynamic space operations between U.S. government and commercial with the Space Force articulating the desire for a Commercial Augmentation Space Reserve to allow for the Service to gain access to additional commercial space capability in a time of crisis through voluntary, prenegotiated contracts and relationships that can be immediately exercised in a time of crisis.[16] In some cases, the protection of commercial assets for collision avoidance now falls on the Department of Commerce given the transition of the mission from the Department of Defense to the new space traffic coordination office under the Space Policy Directive-3.[17] The U.S. government recognizes the need for consolidated storefronts to access commercial space capabilities—for example, Space Systems Command's Commercial Space Office—although across the entirety of the U.S. government, there are still multiple offices acquiring different levels—pixels, value added services, launch services—to using the same vendors and suppliers to develop U.S. government operated capabilities. While promising, commercial space companies must follow and track multiple U.S. government strategies (USSPACECOM, Space Force, NRO, NGA) storefronts, and civilian agencies to accomplish their commercial objectives while supporting the Department of Defense.

Push for Dynamic Space

The Air Force has executed dynamic operations for more than 60 years using aerial refueling from the Boeing KC-135 Stratotanker to enable global reach and almost geographically and temporarily unconstrained operations for fighter and other aircraft. Refueling operations have been extended to the use of commercial tankers as demonstrated in the aerial refueling with a Boeing E-3 Sentry and Boeing RC-135.[18] The Space Force is now similarly looking to expand the notion to dynamic space operations and using commercial technology. Many legacy Department of Defense systems have not been designed to conduct dynamic space operations, often remaining in a single orbit with enough maneuvering capability for station keeping. Those space systems cannot maneuver to respond to a dynamic threat without a reduction in mission life given the inability to refuel in the same way we can with a fighter aircraft at risk who may need to deviate a flight plan. USSPACECOM and the Space Force have challenged the commercial space sector to offer solutions.[19] Recent contracts by Systems Space Command are investing in on-orbit refueling vehicles and standard ports for military satellite refueling.[20] Space in the national security context

looks very different today than it did as recently as ten years ago. The articles in this issue will describe in more detail a number of aspects of that evolution.

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Military Spacesteading
Space-based Logistics Mediums for Future Beachheads

Major Robert Billard Jr., USMC

Abstract: This article explores the concept of spacesteading as it pertains to military operations. Specifically, it expands on both potential and emerging technologies that could enable logistics nodes to be positioned in geosynchronous and geostationary orbit above the Earth to enable to rapid deployment of equipment. This article proposes that space domain domination would allow for a superior alternative to existing expeditionary logistics caches such as maritime prepositioning force ships and the Marine Corps Prepositioning Program–Norway. A pair of vignettes help to illustrate the value in the military enabling logistics capabilities within the space domain. While this article largely focuses on space-based logistics applications for the U.S. Marine Corps, these efforts would have far-reaching impacts to the whole of the U.S. military and beyond.
Keywords: logistics, space operations, space logistics, maritime prepositioning force, China, space elevator, carbon nanotubes

Space-based Logistics: Future Scenarios

The year is 2050. People's Liberation Army (PLA) forces are rapidly being deployed via reusable rocket to the notional country of Orange; an African nation far from the nine-dash line that once represented the extent of China's regional hegemonic goals of the early twenty-first century. Orange has

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experienced a quick and tumultuous political deterioration due to a coup from an influential military junta. In the wake of this catastrophe, global powers rush to establish influence in the region. Joining the PLA troops are brigades' worth of rolling stock, armor, field artillery, and every other operational piece of equipment that an expeditionary force would require to conduct combat operations. The equipment was dropped via space-based logistics nodes that were made possible through China's space elevator, which was completed in 2045. The consequences of the latter would prove devastating to global adversaries as it enabled the PLA to conduct extremely rapid global deployment of personnel and equipment at a moment's notice. While logistics planners in the West are still working through load plans to outfit deploying forces, the PLA has already secured their position as the dominant ground force in Orange. Chinese space developments through the 2030s and 2040s outpaced their Western counterparts, and China emerged as the dominant spacefaring nation. As a result, a country whose military and economic ambitions had previously been granted "near-peer" status was quickly able to leapfrog the competition. With the space domain now firmly under Chinese control, global hegemony finally appears firmly within their grasp.

Militarizing Space

This scenario is not science fiction, but rather a stated goal of the China Academy of Launch Vehicle Technology, an entity belonging to China's "main space program contractor China Aerospace Science and Technology Corp."[1] Accordingly, "By 2040, it hopes to put its new-generation launch vehicles into operation, making interstellar missions, asteroid mining and space-based solar power plants possible. Five years on, it hopes to make space elevators a reality."[2] Even if this stated timeline is unreasonable, it must be taken seriously.

The United States may dominate China in every instrument of national power (outlined in *Strategy*, Joint Doctrine Note 1-18), but if a burgeoning near-peer threat were to effectively conquer the space domain first, then that adversary would possess an incredible advantage—one that would easily supplant the United States as the de facto global superpower. *Space Operations*, Joint Publication 3-14, defines the *space domain* as "the area above the altitude where atmospheric effects on airborne objects become negligible."[3] "Dominating" the space domain would entail freedom of access for space-based vehicles and equipment or uncontested access. These definitions will be important to understand going forward as dominating this domain could enable basing future technologies and subsequent military utilization of these technologies.

While both China and the United States are currently parties to the 1967 Outer Space Treaty, which governs militarization activities in space, there is no assurance that any party would adhere to its principles if it meant ending a third world war on their terms.[4] In extremis, there is not a country in the world that would not leverage the full spectrum of every possible advantage that they may possess in such a scenario. The reality is that rapid space dominance is

rightfully within the purview of all spacefaring nations as such an ascendancy would effectively mitigate any shortcomings that country may otherwise have against the United States. Simply put, the United States could field the most effective military in the world, but it would be rendered useless if it can be neutralized from space. Reducing the problem set to only depict strategic weapons in space would massively undersell what space dominance can offer a country. Developments such as space elevators will drastically alter the mechanisms in which states wage future wars and will significantly reduce deployment times for personnel and equipment.

Future Marine Corps leaders will not be the ones to invest in, research, or develop the technology that will bring Marine Corps' equipment to orbit. Consequently, Marine Corps leaders will not be the ones to address the myriad scientific and engineering hurdles that must be overcome to achieve these evolutionary leaps in space technology. However, the military applications of a space elevator are impossible to ignore. The Marine Corps, and military leaders overall, must understand how they can adapt to future technologies that could shorten the timelines associated with deploying anywhere in the world.

Logistics Nodes

Current prepositioned logistics nodes utilized by the United States Marine Corps, such as maritime prepositioning force (MPF) ships operated by Military Sealift Command or geographically prepositioned caches in Norway, offer mechanisms to deploy equipment to far-flung places in the world. However, they come with major constraints. These constraints include:[5]

- Space limitations[6]
- Embarkation configuration[7]
- Spare parts availability[8]

Utilizing MPF equipment requires extensive lead times and coordination for planning, ship movement, offload, equipment assembly, and then movement of equipment to the desired location. Additionally, MPF offload at a contested port may not be desirable or possible depending on the adversary's defensive posture. These problems will not disappear in space, but the space domain will offer the potential for greater flexibility and response time once the space domain has been firmly established. This point is important as extensive research and development will be required in addition to the astronomical costs and time associated with large assets in space.

A critical pacing function of winning any war has always been logistics; the Marine Corps' *Installation and Logistics 2030* specifically states, "Among the seven warfighting functions, logistics most dictates the tempo of operations and the operational reach of a unit. No other warfighting function more profoundly affects our ability to persist in contested spaces."[9] Future wars will be no different. The side that can more efficiently transport and maintain the maximum amount of personnel and equipment will have a superior advantage. When an-

alyzing logistics through the contextual lens of a multidomain approach, space would truly be the final frontier. Domination in this realm will set a nation on the path toward global hegemony that will prove decisive. Enter "spacesteading" as a concept.

Military Spacesteading

Spacesteading is a natural extension of the concept of "seasteading." That is, the colonization of the sea (a portmanteau of the words "sea" and "homesteading") that was largely popularized by author Wayne Gramlich in a 1998 essay, though the word itself existed prior to this.[10] Applying this concept to space is not exactly novel, for example: Space historian Robert Zimmerman proposed a "Spacestead Act" in 2017 with the intent of enabling the United States to lead the world in furthering space exploration.[11] Such conversations tend to focus on individuals seeking liberty and independence from states in areas with limited or no government reach, such as international waters or outer space. In this approach, the term *spacesteading* will refer to any act of staking any orbital position around the Earth. Applying a colony approach to military logistics in space could enable an entity to cache military equipment in space stations in Earth's orbit. These stations could be unmanned, compartmentalized, and automated. Ground-based logisticians could quickly and easily identify the exact type and number of equipment needed for an operation and have it dropped from orbit to the exact location where it would be needed. Personnel could then be transported with a near nonexistent logistics train to exactly where they need to be; indeed, by the time this technology is practical it may be possible to transport personnel across the globe via rocket in a fraction of the time it currently takes. The sky is no longer the limit with the space domain, and whoever dominates this realm first will reap the benefits.

This is not to suggest that prestaging equipment in space would completely eradicate the current limitations and constraints that are experienced through other prepositioning means. Load planners, mobility personnel, operations cells, equipment owners, and all other key stakeholders would still require time to plan and train for the requirements associated with a space-based endeavor. But leveraging the fastest possible means of resupply provides an unmistakable advantage. Space-based options are also subject to a potential variety of setbacks. These could include enemy electromagnetic pulse (a.k.a. an EMP), which could stem from an enemy nuclear high-altitude burst, or even antisatellite weaponry. Considering this type of platform for logistics staging does not necessarily spell the end of existing mechanisms; however, given the extensive technological leaps that a spacesteading infrastructure presupposes, it offers a rapid response capability that would outpace existing structures.

As previously established, the Marine Corps will not be on the forward edge of the development of such emergent technologies. Nor will such technological leaps likely even consider the Marine Corps at the forefront of use-case possibilities. But once established, the Marine Corps (and other military orga-

nizations) must advocate for a relative primacy of use against other potential customers to space elevator (such as other military organizations or even private entities) to stand better poised to fight America's future potential wars and win.

Space Elevator

Current technology effectively precludes the deployment of larger stores of equipment in Earth's orbit. This is largely since construction in space is extremely difficult.[12] Further, building things on Earth and then launching them into space via rocket comes with major constraints, namely that the cost is far too prohibitive to launch equipment into space. As of December 2023, one could expect to pay approximately $0.28 million per kilogram by using a popular rideshare program through SpaceX.[13] Long-term and large-scale planning to stage military equipment into orbit would require revolutionary advancements in how humans can access outer space. One such proposal has been a space elevator. Space elevators are theoretical structures that use ground stations tethered to a counterbalance in space, with elevators (or "climbers" as they are generally referred to in this context) to ascend into a spot in geosynchronous and geostationary orbit.[14] Hypothetically these climbers could transport equipment constructed on Earth, far heavier than the payload capacity of a rocket, directly into orbit through the space-based harbor.[15] As a result, a military equipment colony could be constructed on Earth, raised via a climber, and then be stationed as a geosynchronous harbor for which equipment could be stored. From there, logisticians will be able to pick and choose what stores of equipment best suit operational needs. The equipment could be compartmentalized to preclude extensive load planning and time otherwise used rearranging equipment onboard something like an MPF ship. China is already apparently pursuing such a system. According to a Chinese state-run news source,

> a "Sky Ladder" system . . . is under study, as a starting point for such a space voyage, in a bid to reduce the scale of Mars probe and transport missions. . . . Technologies like the Sky Ladder delivery system have been mentioned before, as some scientists believe it would transport humans and goods to the moon for just four percent of the current cost.
>
> Xinhua Global Service has illustrated the process in a computer graphic footage. It shows a manned or cargo space capsule travelling along a carbon nanotube "ladder" to reach a space station before it is relaunched from the space station.[16]

Additionally, Japanese construction company Obayashi has outlined a specific timeline to build a functional space elevator by the year 2050.[17] Obayashi acknowledges that "current technology levels are not yet sufficient to realize the concept, but [their] plan is realistic, and is a steppingstone toward the construction of the space elevator."[18] The plan calls for a 20-year development and construction cycle that will require an Earth port and a geostationary orbit station

tethered by a cable, the latter being the main current technological constraint.[19] Accordingly, this plan will require 96,000 kilometers of carbon nanotube cabling weighing 20 tons initially, reinforced 510 times, and bearing a tensile strength of 160 gigapascals (a.k.a. GPa).[20] The current tensile strength measured GPa of carbon nanotube are considerably lower than this, though theoretical values would make this possible.[21]

Suffice it to say that this technological approach is hardly even in its infancy. There is much work to be done before this can become a reality, with a major current constraint being the development and functionality of appropriate cabling composed of carbon nanotubes. But importantly, the academic body of work surrounding space elevators indicates that it is a possibility. Further, market sources suggest that the United States may already have a head start in the practical development of carbon nanotubes. According to Future Market Insights:

- The North American carbon nanotubes market held a dominant share, accounting for 27.9 percent share in 2022.
- China's carbon nanotubes market secured an 8.1 percent global market share in 2022.[22]

Having the highest share of carbon nanotubes in the mid-twenty-first century may prove to be as decisive of an advantage as having the largest stores of uranium and plutonium did in the mid-twentieth century. Similarly, if the space race of the twentieth century, between the United States and the Soviet Union, culminated in the Moon landing, then a major milestone of the twenty-first century between the United States and China could become the question of who can develop the most—and best—carbon nanotubes the quickest.

The transformative nature of instant space accessibility with exponentially expanded space launch bandwidth, all at a fraction of the cost of current mechanisms, would represent the single most momentous revolution in transportation in millennia, greater than the opening of the Suez or Panama Canals. The first country that can embrace and harness this type of innovative approach to space logistics will hold the key to space access and dominance.

Challenges

When confronting the vast technological divide that exists between now and the time when space elevators may become a reality, it is important to study the technology through the contextual lens of military spacesteading. This contextual lens does not seek to answer the full gamut of how this technology can come into existence, but rather its utilization from a military perspective. As previously established, there are entities across the globe now that seek to develop a space elevator, and that alone warrants a thorough understanding of what possibilities that could bring to a near-peer fight. The challenges associated should not preclude planning and research. As far back as 1984, NASA explored options for space tethering in a published technical memorandum and

concluded that the associated challenges "do not detract from the value of these prophetic concepts because some of those may be considered as distant goal setters that provide direction for future developments."[23]

However, there are clear technological challenges that exist, which also impede the implantation of such innovations. For example, while current orbiting objects are at risk of conjunction with each other, the existence of a stationary elevator will guarantee that there will be collisions. This challenge alone will be difficult to overcome for anyone hoping to develop a space elevator. This problem has been established for decades. For example, author Arthur C. Clarke proposed an alternative in 1966 that would try to mitigate the potential for collisions through the "Sky-Hook."[24] The Sky-Hook, accordingly, is a "satellite in low circular equatorial orbit [that] has two long tethers deployed in opposite directions. The system rotates in the orbital plan in the same sense as the Earth rotates. The tethers touch the Earth's surface during each rotation such that the velocity of the lower tether end cancels the orbital motion of the cable carrying satellite."[25] Ultimately, it was concluded that "the theoretical strength of the cable material" required was "more than two orders of magnitude greater than that of available engineer materials" of the time.[26]

To maintain the concept of a space elevator without resorting to a Sky-Hook, or some other temporary tethered device, there have been suggestions on anticollision mitigation techniques as well. Dr. Casey Handmer posited that "transverse vibrations are probably an excellent way to transmit power along the [climber] cable and to enable it to avoid collisions with satellites at lower orbits."[27] He further adds that many issues associated with corrosion, micrometeorites, etc., "can be dealt with by covering the structure in a shield like the shield on the ISS. It consists of a ceramic layer which absorbs the impact by shattering, and a metallic shield layer which can absorb lots of small impacts."[28] These two methods in combination may help mitigate a large quantity of potential issues associated with the prospect of collisions; but they would not cover every possibility. This is merely an exercise in showing that even current understanding of the problem set can provide some potential solutions that would be more readily available by the time this technology comes into existence.

Material strength of the structure is a primary concern. As previously established, carbon nanotubes are the only currently existing material that could potentially serve as construction material for such an elevator system to exist. According to NASA, however, these nanotubes are rated at a technology readiness level (TRL) of four, implying that research has been conducted to prove their feasibility but not validated in a laboratory environment.[29] Consequently there is a long way to go until they are rated at a TRL of nine where they will be proven for operation.

The point in highlighting some of these challenges as major obvious obstacles is not to dismiss the concept as an impossible fantasy, but rather to prove that this undertaking is massive. But this does not mean that the associated challenges are insurmountable. To further emphasize, the Marine Corps should

not necessarily seek to identify and address the scientific and engineering constraints associated with the creation of this technology. Rather, the Marine Corps and future military logistics planners should know that logistical doctrine must evolve rapidly to take advantage of emerging technology.

Establishing New Beachheads in Space

In the 1940s, logistics nodes were established at great cost by landing support Marines on beaches across the pacific. These beachheads were staunchly defended to the death by many thousands of Marines fighting to claim islands from the Japanese. From them, additional equipment was able to flow from the sea that gained tactical superiority for the Marines in these conflicts. By the end of the war, the United States' naval dominance effectively precluded the Imperial Japanese Navy from supporting their defensive campaigns on islands like Iwo Jima. A major lesson learned from those examples was that freedom of movement and logistics throughput were significant factors in deciding the culmination of the war. So, too, would those same factors help to determine who can freely dominate space and consequently assure themselves of global hegemony.

To maximize the utility of military spacesteading operations, orbiting logistics nodes should reflect the size, scale, and scope of ground-based requirements. These stations should provide tailorable option sets that can easily detach from the node to rapidly form needed gear sets, or they should be capable of deploying to the ground as a whole. There should be multiple such stations in orbit at any given time to enable the most rapid possible deployment of gear as well as to ensure redundancy. The *International Space Station* orbits Earth every 90 minutes, according to NASA, therefore at minimum the capability to spacestead equipment will allow for equipment to be orbitally dropped in at least such a time, but the more nodes that exist in orbit the faster that equipment could be deployed to the desired location.[30] Utilizing both a geostationary approach from the harbor atop the space elevator, as well as geosynchronous stations that were built on Earth and launched thanks to the space elevator, will allow the greatest possible flexibility toward achieving logistics requirements. Aboard these stations, equipment can be stored in modular and detachable containers that can survive the delivery mechanisms from space to the ground. Mobility personnel within Marine Expeditionary Forces (MEF), in conjunction with their space operations personnel, will be equipped with load planning software that will quickly identify exactly what equipment will detach and where it will land. Timing the landing with the operations section of the MEF will ensure that gear and personnel arrive at the same time. Space logistics will become a new practical field for existing military logisticians. New subordinate specialties will come into existence. For example, space delivery personnel will complement existing air delivery Marines. These Marines will specialize in the specifics of planning for and receiving spaceborne items that will have unique considerations.

While much focus has been on replicating the capabilities of the MPF pro-

gram, pivoting toward space-based approaches could completely revolutionize even the most standard resupply missions that the Marine Corps conducts while deployed. More basic, albeit critical, resupply functions such as Class I (food and water), Class III (oil), Class V (ammunition), and even Class IX (repair parts) could easily be dropped to forward deployed units in a fraction of the time and a fraction of the cost to current methods. Further, when operating in an extremely hostile environment where an ever-present threat of improvised explosive devices, conventional mines, or even antiair threats prevent safe resupply to outstations, space-based resupply could prove to be the difference between life and death.

Orange Redux: Possible Outcomes of Space-based Logistics Use

The year is 2050. Deposed government leaders of Orange desperately reach out to Western leaders for assistance in curtailing the violent takeover from the military junta. To stem the tide for regional influence in Africa, the White House approves a unilateral intervention plan to send in the Marines and restore the duly elected government to power. After receipt of the warning order, I MEF assesses the scale required to drop an entire MEF's worth of personnel and equipment into the influential African nation in the following 48 hours. I MEF, now no longer as constrained as much by the tyranny of distance, quickly identifies the equipment density list needed for such an operation. Thankfully, previous exercises and wargames have already identified most of what will be needed. The date is set, and Marines with their primary weapons load into Air Mobility Command's transport rockets, which can take them anywhere in the world in less than 30 minutes (this capability had already been predicted much earlier in the century).[31] The appropriate rolling stock, communications equipment, and everything else that the task force will require is already identified and ready to drop from orbit where space delivery Marines from the G-4 will meet with it to coordinate dissemination.

Thankfully, in this updated version of the events, the United States invested heavily into carbon nanotube development in the 2020s and 2030s, which enabled the country to be the first in the world to establish a space elevator with U.S. military primacy of use. While the People's Republic of China is still busy posturing diplomatically, the United States is already at work with boots on the ground favorably reestablishing the regional order of things.

At the conclusion of hostilities, the spacesteaded equipment will travel to a home station via rocket where it will receive proper maintenance and redeployment to the space station through the space elevator that originally delivered it to space.

Other Space Logistics Possibilities

The topic of space logistics is coming more into the forefront of military con-

sciousness. Tyler Bates, writing for Air University's journal *Æther*, recommends significant space logistics paradigm shifts:

> By the early 2030s, SpOC [Space Operations Command] should have a space sustainment space delta that would oversee its own space operations squadrons responsible for on-orbit refueling and on-orbit vehicle maintenance. This will provide US and Allied forces the ability to sustain space forces across multiple orbital regimes, from low-Earth orbit to cislunar space.[32]

The prospect put forward here of refueling and maintaining equipment in space will be complementary and critical to successful space-based logistics. He expands with two other points that will also aid in this endeavor: space-to-terrestrial energy distribution and rocket logistics.[33] The former focuses on harnessing the orbital capacity to gather more sunlight for wireless transmission to Earth as an energy source while the latter describes utilizing rockets to transport gear rapidly across the Earth.[34] Harnessing solar power from the unencumbered vantage points that space offers would not only allow for microwave transmission of power, but could theoretically tap into geostationary, space-elevator based harbors to directly transmit power to the surface. Assuming the yield from such a venture would be exponentially greater than the return on investment of surface-based solar panels, the impact of this could have significant ramifications that far exceed military applications. To be sure, every function of logistics can and should be developed for space-based utilization. Refueling capacity, energy production, maintenance, and transportation will all serve as complementary capabilities in the space domain that will give the United States an edge over any near-peer competitors who seek a technological or strategic advantage.

Recommendations

Space is designated by North Atlantic Treaty Organization (NATO) as an operational domain akin to ground, maritime, air, and cyberspace.[35] Success in any domain requires extensive logistics support. Space-based logistics will be the pacing factor in determining ownership in that domain. As a result, senior military leaders and advisors would be keen to recognize the value of investing in, and utilizing, emerging technologies to advance existing prepositioning concepts. Military spacesteading is such a mechanism that will directly enable ground-based success from space-based assets. While historically space has been a domain largely dominated by intelligence and communications subject matter experts, the future will require experts from a variety of fields to develop space-based logistics platforms.

The military is an entire industry in the United States that is uniquely poised, budgeted, and equipped to invest in the type of research and development that could yield revolutionary advances in military technology such as would be required for these concepts. The benefit to society writ large would

additionally be immeasurable. If the United States does not do it, then the door is open to a competitor to seize a mighty advantage that will be difficult to surmount after the fact.

Conclusions

The militarization of space is a relatively new phenomenon that has opened extraordinary avenues for those entities willing to explore them. The rapid technological developments throughout the end of the twentieth century to the present day has opened new potential avenues into transportation, energy production, resupply, and maintenance. While the term *militarization of space* may generally conjure up visions of imagery satellites, or even placing actual kinetic or strategic weapons in orbit, it cannot be overstated how important it will be to establish a logistics footprint in space.

While several logistics mechanisms have been discussed, the United States would instantly develop a national logistics center of gravity though the development of a space elevator. While the technological leap to get to its implementation would be staggering, the capabilities that this would provide will far outweigh the associated costs. The twentieth century provided such leaps in space exploration that perhaps few living in the year 1900 could have ever dreamed to be possible. This century should be no different—the Marine Corps specifically must continue to find ways to embrace and adapt not only emerging technologies, but the concept of those that do not even appear within grasp. Future logistics innovators who heed this will be well poised to transform the Marine Corps to be prepared for the future space race and its associated paradigm shifts in strategy.

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The Void Above
The Future of Space Warfare and a Call to Update the Rule of International Space Law

Alan Cunningham

Abstract: In an age where space warfare is becoming more likely and a militarized space is already a reality, it is imperative to develop a strong legal framework to try and prevent nation-states from engaging in warfare. By implementing legal standards, improving on the existing legal framework, and taking input from outside legal sources, outer space can be made safer and the potential for armed conflict more protected against.
Keywords: outer space, international security, international law, space law, international relations, military affairs

Introduction

Cyberattacks, network intrusion, and other forms of electronic based warfare are becoming the way in which the military forces and intelligence services of the world conduct their operations to gain the upper hand on adversaries. The 2014–15 hack by Chinese intelligence of the Office of Personnel Management (OPM) remains one of the most serious data breaches in U.S. government history while the Chinese intrusion of the National Oceanographic and Atmospheric Administration's (NOAA) network and the ongoing Russia-Ukraine conflict shows how war will be waged in a new, highly technologically advanced digital age.[1]

Cyberattacks are becoming the name of the game, for both intelligence operatives and legitimate military states. And nowhere will this kind of warfare be waged more stringently and actively than in outer space. As such, with a new front growing in a geopolitical sense, it is important to examine the current

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legal governance of space and how it can be updated or otherwise more readily relevant to current issues.

Warfare on the Final Frontier

What was once the final frontier for humanity is now the last true battleground in the cyberwar. For many hackers, with the development of privatized space travel and the creation of an entirely new Service branch for the U.S. armed forces, outer space has become a battleground with a growing sense of worry and fear regarding cyberattacks by nonstate actors disrupting internet access, interfering with the Global Positioning System (GPS), and turning "satellites into weapons."[2] Not only is the threat from nonstate actors growing, the greater level of concern is from state actors, like Russia and China, for strategic dominance in outer space.

Russia

Russia clearly is a significant geopolitical threat to the United States, easily one of the greatest foreign threats to American national security in the twenty-first century.

While their military may not be as strong as previously thought thanks to their lackluster performance in the Ukraine-Russia conflict, their cyber capabilities still rank highly among foreign adversaries and, if anything, have become more competent in their cyberattack abilities since the invasion.[3] Historically, Russia has been excelling in codebreaking, computer network intrusion, and waging warfare online since the downfall of the Soviet Union in 1991, doing so through the proliferation of "private cyber companies," some of which were started by former KGB (Committee for State Security) officers and further expanded by Vladimir Putin's oligarchs.[4] The state's cyberattack activities in Ukraine certainly, but also across Europe, Asia, and the Western Hemisphere show a highly capable and effective apparatus.[5]

The U.S. intelligence community (IC) has repeatedly identified Russia as a key cyber actor. Their 2022 annual threat assessment stated that the Russian Federation would "remain a top cyber threat [with a focus] on improving its ability to target critical infrastructure . . . in the United States as well as in allied and partner countries" while also using these cyber operations "to attack entities it sees as working to undermine its interests or threaten the stability of the Russian Government."[6]

The 2023 annual threat assessment reiterated this, in addition to highlighting Russia's commitment to warfare in space. The IC concluded that, in spite of the country's massive foreign and internal struggles during the past year, that Russia "is capable of employing its civil and commercial remote sensing satellites to supplement military-dedicated capabilities that reduce the U.S. ability to perform sensitive military activities undetected" while also "prioritizing and integrating" different highly technical capabilities (e.g., geolocation, advanced

GPS, intelligence, surveillance, and reconnaissance) to bolster their total space capabilities.[7]

The assessment goes into further detail, stating:

> Russia continues to train its military space elements, and field new antisatellite weapons to disrupt and degrade U.S. and allied space capabilities. It is developing, testing, and fielding an array of nondestructive and destructive counterspace weapons—including jamming and cyberspace capabilities, directed energy weapons, on-orbit capabilities, and ground-based [antisatellite weapon] capabilities—to try to target U.S. and allied satellites . . . Russia is investing in electronic warfare and directed energy weapons to counter Western on-orbit assets. These systems work by disrupting or disabling adversary C4ISR [command, control, communications, computers, surveillance, and reconnaissance] capabilities and by disrupting GPS, tactical and satellite communications, and radars.[8]

Already, the United States has seen Russia's spatial capabilities in action. On the eve of Russia's invasion of Ukraine on 24 February 2022, exactly an hour before Russian troops moved into Ukraine, Russian hackers "launched destructive 'wiper' malware called AcidRain against Viasat modems and routers, quickly erasing all the data on the system" and, after being rebooted, these systems and "thousands of terminals . . . were permanently disabled."[9] Victor Zhora, the deputy chairman and chief digital transformation officer of the State Special Communications Service of Ukraine, stated that this cyberattack in the early hours of the conflict was "a really huge loss in communications in the very beginning of war" while others throughout Europe were affected by the cyberattack.[10]

By May 2023, it was the consensus of the U.S. intelligence community, the United Kingdom, and the European Council that Russian hackers were behind the downing of these key communications services, resulting in "tens of thousands of internet connections in at least 13 countries were going dead . . . making it much tougher for the [Ukrainian] military and intelligence services to coordinate troop and drone movements in the hours after the invasion."[11]

In December 2022, it was reported that the Cybersecurity and Infrastructure Security Agency (CISA) of the U.S. Department of Homeland Security (DHS) found that "the Russian military group known as Fancy Bear, or APT28 . . . [were] lurking inside a U.S. satellite . . . communications provider with customers in U.S. critical infrastructure sectors," this having gone on for months.[12]

In addition, Russia is also engaging in antisatellite weapons (ASAT) technology in support of their strategic and tactical goals. Having developed antisatellite weapons since 2007, Russia increased their abilities in November 2021 by launching a "PL19 *Nudol* interceptor [at] the now-defunct Soviet-era COSMOS 1408 satellite" resulting in a debris field "of at least 1,500 trackable pieces of debris in low orbit" causing immense geopolitical concern and threat-

ening any kind of military and spaceflight operations.[13] This can be seen as the culmination of decades-long desires for Russian aerospace superiority, which were steeped in the 1991 Persian Gulf War and the 1999 North Atlantic Treaty Organization (NATO) bombing of Yugoslavia.[14]

Russia's motivation behind this test was likely twofold, according to Deganit Paikowsky with Hebrew University of Jerusalem's Department of International Relations, as it signified to the international community that Russia is using antisatellite weapon technology to reassert its status as a superpower in space and "enhance . . . its defense and deterrence capabilities."[15]

Russia's capabilities for warfare in space are steadily increasing, having a robust cyberwarfare apparatus while also continually developing their ASAT competences for total aerospatial domination.

China

China, in many ways, surpasses Russia in terms of spatial domination. The IC's 2023 annual threat assessment made numerous assessments of China's abilities and capabilities, finding

> China's space activities are designed to advance its global standing and strengthen its attempts to erode U.S. influence across military, technological, economic, and diplomatic spheres [by way of continuing] to integrate space services—such as satellite reconnaissance and positioning, navigation, and timing—and satellite communications into its weapons and command-and-control systems in an effort to erode the U.S. military's information advantage. . . . Counterspace operations will be integral to potential [People's Liberation Army] PLA military campaigns, and China has counterspace-weapons capabilities intended to target U.S. and allied satellites [already fielding] ground-based counterspace capabilities including electronic warfare systems, directed energy weapons, and ASAT missiles intended to disrupt, damage, and destroy target satellites.[16]

From an ASAT and counterspace weapons standpoint, China surpasses Russia in these threats. China first tested an ASAT-level weapon in 2007, destroying "an aging Chinese weather satellite" and has advanced their technology and capabilities steadily. [17] Due to this establishment of outer space as a military domain and solidifying their national space program under military control, China now "has an operational ground-based anti-satellite missile capability" and are testing scavenger satellites "which use grappling arms to capture other satellites" alongside having their satellites orbit "the geosynchronous belt . . . to sidle up to other satellites in space."[18]

China's development of hypersonic missile technology also has been assisting its rise in space dominance. In August 2021, China "launched a rocket that carried a hypersonic glide vehicle [through] low-orbit space before . . . [missing] its target by about two-dozen miles" in a test that caught the IC by surprise.[19]

Such developments of ASAT technologies and continued hypersonic missile development have resulted in the Pentagon announcing that China's military and defense posturing poses "the most consequential and systemic challenge to U.S. national security," essentially confirming what some have suspected.[20]

The IC found that China intends "to match or surpass the United States by 2045" and likely aims by 2030 to "achieve world-class status in all but a few space technology areas."[21] Based on the publicly available information and recent developments, it stands to reason that China, as in all other areas of military and national defense, will be a peer competitor to the United States for the next few decades.[22]

A Response from the U.S. Armed Forces

In response, the U.S. Department of Defense (DOD) aims to make space a priority alongside their adversaries. While most understand the "space race" of the Cold War to be an effort to beat the Soviet Union in scientific achievement, it also included developing intercontinental ballistic missile (ICBM) technology, unmanned aerial systems (UAS), and gaining an upper hand on U.S. adversaries by way of intelligence gathering and removing any first strike capabilities.[23] And to a large degree, the United States has never stopped innovating in space, continuing to be on the cutting edge of space warfare and innovating all manner of technologies originally meant for space operations.[24] With the growing militarization of space by Russia and China, the United States has engaged in many actions to combat this militarization, the most important of these being the creation of the U.S. Space Force.

With the creation of the Space Force in December of 2019, the culmination of decades of policy planning and theory, their entire goal is to protect and defend "U.S. interests in space from potential adversaries" strictly focusing on training troops in peacetime for spatial combat operations.[25] Since their creation, the Space Force has endeavored to make space a priority. This is evident in their policy and budget statements while they are also creating an entirely new unit "dedicated to targeting other nations' satellites and the ground stations that support them."[26] Coupling this with the U.S. Army's recent development of an office "to manage the portfolio of capabilities . . . [including] intelligence, electronic warfare and sensor," the DOD has substantially stepped up and recognized the growing trend of space militarization currently underway.[27]

From a policy standpoint, the Joseph R. Biden administration, in March 2023, released their *National Cybersecurity Strategy*, which called for "[rebalancing] the responsibility to defend cyberspace" toward larger federal institutions and private businesses as opposed to local governments and individuals alongside "[realigning] incentives to favor long-term investments" by recommitting the United States to international and industrial partnerships. This policy has been praised by many for seemingly calling for more tech and software regulation and reform, but also for helping to better define and outline what kinds of "offensive cyber operations" the Pentagon could undertake, which became

clearer when the Pentagon's own cyber strategy was released in May 2023. This policy called for financial and physical investment in cyber capabilities, aligning with international and private partners on direct operations, and better training/equipping forces for cyber missions.[28]

While this very real threat has been recognized by the United States as a serious and pressing issue, the matter of ensuring any kind of retaliatory or preventive action abides by and is enshrined in law, however, is another matter that must be readily addressed before any further action is taken.

Abiding by the Rule of Law

One of the main challenges to any U.S. outer spatial defense strategy comes from the lack of a clear and detailed international legal framework governing national security missions in space. Currently, "neither international law nor diplomacy has grappled effectively with space cybersecurity."[29]

Instead, there are manuals that offer guidance on space legal affairs to the international community and individual nation-states, though they are not legally binding nor official. The *Tallinn Manual 2.0* addresses the applicability of international law in cyberwarfare while both the Woomera International Law of Space Operations (a.k.a. *The Woomera Manual*) and the *Manual on International Law Applicable to Military Uses of Outer Space* (*MILAMOS*) "provide guidance on the international law applicable to space warfare."[30] It must be noted that these documents are largely theoretical in nature, not being produced by governments or any international legal or policy body, rather scholars and academics in the field. As such, while these are quite beneficial, there are challenges to their implementation given no governmental body or legally authoritative entity has embraced these works.

The current legal framework for global space governance is embodied within five United Nations treaties: the Outer Space Treaty (OST, or formally, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies) of 1967, the Rescue Agreement (formally, Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space) of 1968, the Convention on International Liability for Damage Caused by Space Objects of 1972, and the Convention on Registration of Objects Launched into Outer Space of 1976, all of which more represent the time period they were created in rather than addressing the current state and developing a framework for any future issues.[31] For example, the OST, while it does address a variety of issues in relation to proliferation, is only rather specific in principle as it addresses the use, placement, and control of weapons of mass destruction (WMDs) and nuclear weapons in space resulting in the difficult question of "what constitutes a weapon and [whether] its placement in space breach the requirement that outer space be used exclusively for peaceful purpose" in addition to failing to "provide any concrete rules that states must abide by in testing conventional weapons."[32]

Clearly, the international legal framework concerning military capabilities in space needs an update. Cyberattacks, antisatellite weaponry, and devices by which a foreign state could be able to neutralize another state's ability to engage in spatial warfare are no longer constrained to academic journals and conferences but are a current reality for governments, private corporations, and everyday civilians. The OST is still important and serves as an effective framework; however, its wide mandate has resulted in difficulty with it being the sole measure to "adequately govern space" and failing to consider more newer technologies.[33] Having a more robust, complete, and articulated rule of law for what military activities are and are not allowed in space would be the first step to secure space from such threats like China and Russia.

The unofficial or legally binding manuals (e.g., *Tallinn Manual 2.0*, *Woomera Manual*, *MILAMOS*) are all useful places for the international community to consult with and advise in developing laws necessary to safeguarding space; however, some experts caution they should not be implemented without extensive revisions or alterations. Some practitioners of space warfare have criticized the manuals for being "too-focused on legal theory, rather than real-world cases" while some authors of the manuals have openly stated that their work does not define what law "is should and ought to be" when it comes to space.[34] A thorough and complete analysis of these manuals, seeing what aspects of them are practical to real-world affairs and ensuring complete compliance with existing treaties, should be the first step for the international community in updating the world of space law for the modern, cyber age.

These new and more current updates to the current manuals and policies in place would not only help allied governments, nonstate actors, and civilian organizations in space travel and operations, but would also work to limit Chinese and Russian militarism in space as well as American militarization of this new strategic region. Some may argue for a ban of all weapons and the complete demilitarization of space; however, this is quite unrealistic as the issue of weaponry in space is already at hand, making any banning of conventional weapons or offensive operations problematic.[35] Surely this would assist in halting future militarization of space. Going forward, a more conciliatory effort should be applied instead to nation-states that work to militarize space.

This conciliatory view has been recommended by a multitude of individuals with experience in both space law, national security/defense, and in the space domain. Daryl G. Kimball, an executive director of the Arms Control Association, suggested as far back as 2007 the establishment of "stronger norms against dangerous activities in space, including flight tests that simulate hostile attacks against satellites and the deployment of anti-satellite and space weapon."[36] Others, including a former deputy director at the National Reconnaissance Office (NRO), a former undersecretary of energy for nuclear security, and a former senior diplomat working disarmament, all of whom are fellows with the Rand Corporation, argue for "deterrence . . . the capability to respond with overwhelming force to aggression . . . [pursuing] arms control agreements

as a complementary approach to enhancing stability, bolstering deterrence and avoiding costly arms races."[37]

David C. DeFrieze, then chief counsel for the U.S. Army Research Development and Engineering Command, wrote in 2014 that

> a standing committee is needed to provide a credible, knowledgeable, and equitable forum for regulating, monitoring, and adjudicating claims and disputes relating to the damage caused by objects launched into space, whether they are designed for destruction or not . . . [as well as] using the current economic deterrence and enforcement capability of the World Trade Organization to address and collect on unresolved adjudicated state liabilities. . . . A logical place for this committee would be the United Nations.[38]

It is important to note that some of this has already been undertaken by Western nations, including the United States, when developing ways to counter such space threats but also through the United Nations Open-Ended Working Group (OEWG) on Reducing Space Threats Through Norms, Rules, and Principles of Responsible Behavior.[39]

Nonetheless, some are hesitant to further codify space law. Laura Grego, a research director in the global security program at the Union of Concerned Scientists, detailed in a 2020 interview with the *Scientific American* that these "unofficial norms of behavior . . . registering new satellites sent into orbit, deorbiting their dying ones to avoid creating debris, not testing [direct ascent] DA-ASATs on their own satellites and not destroying another country's satellites" advocate, in the event a binding set of rules is unable to be articulated, for "a nonbinding international agreement based on current norms."[40] This interview was conducted prior to Russia's 2021 ASAT missile test and the Russian invasion of Ukraine, so it shows that such unofficial norms can be blatantly violated by nation-states with little to no repercussion.

Having these unofficial norms codified in law and using these, alongside the various manuals developed by legal practitioners, as a starting point for a more modern, internationally respected, and legally valid treaty is one of the best practices in ensuring the halting or pathway toward the demilitarization of space.

A diplomatic solution toward halting a further militarized outer space, in many cases, will be far more effective than an outright military solution. While a military solution would be on hand in the event there is a pressing matter that cannot be resolved diplomatically, the Department of Defense and U.S. armed forces can counteract some offensive operations in a way that would not be overly aggressive by using maneuverable satellites or engaging in jamming of enemy space equipment.[41] But diplomacy is and should remain the primary solution to any developments that occur in space to avoid a full on space race or any further debilitating and harmful activity using such weapons.

The research presented here suggests that addressing, redeveloping, and re-

organizing the legal framework currently in place by the international community into a codified, official legal treaty dictating what kind of military action is appropriate and what is not allowed in space would result in better outcomes for space. As mentioned above, the unofficial norms and the prior treaties all in place should be collectively considered in total and improved on or updated to reflect the current time. The more scholarly suggestions contained within the manuals should also be consulted and implemented on a case-by-case basis to adapt to the changing methods of warfare and plan for any potential, more theoretical issues that could arise.

Strengthening the international community's response to such spatial threats is imperative and essential in order to keep space as free of harmful conventional and unconventional weaponry as possible, ensuring militarism is kept to a limited manner in space.

Conclusion

Limiting the number of conventional weapons in space should be of utmost importance to the United States and the rest of the international community alongside lessening the impact of offensive cyber operations on Russia and China's part. Research and expert opinion have shown that diplomacy is by far one of the most assured measures by which the international community can be kept safe from man-made threats by way of space.[42] The United States should invest in their offensive capabilities, but also should make a strong push for diplomatic avenues and negotiations as a method of resolving the issues at hand.

The rule of law governing space must be updated, expanded, and developed to fully adapt to this modern, cyber age in which highly advanced technological weapons are becoming the primary way in which nation-states commit espionage and warfare against their adversaries.

Outer space offers many opportunities for humanity, namely deepening the understanding of our galaxy, the universe around us, and the origin of life as well as offering people the ability to explore and potentially find new planets in which to colonize. Placing conventional and unconventional weapons and allowing unfettered offensive cyber operations in space are not one of those uses.

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The Soviet *Sputniks* and American Fears about the Militarization of Outer Space

Tom Wilkinson

Abstract: The publication of the U.S. Department of Defense's *2020 Defense Space Strategy* and its recognition of outer space as a "distinct warfighting domain," along with recent media discussion regarding the militarization of outer space by powers such as Russia and China, seems to portend a new era of outer space relations. The so-called "final frontier" that has for years been treated as a realm of scientific and civilian exploration with a spirit of cooperation appears poised to transform into a domain of military competition. The early fears centered around three key themes: the possible terrestrial impact of rocket technology capable of launching a satellite, the unknown applications of satellite technology, and the assumption that the launch of the Sputniks had opened up a new frontier, one that the United States had failed to reach at the time of the Soviet achievements. An examination of these themes and how Americans discussed the Sputniks reveals that while the domain of space looks incredibly different in the twenty-first century, discussion surrounding the militarization of outer space has a longer history that could offer insights for contemporary discussion.
Keywords: Sputnik, Cold War history, space history, Dwight D. Eisenhower, disarmament

Since the end of the Cold War, outer space has typically been understood as a place of international science and cooperation. The *International Space Station*, continuously occupied since 2000, stands as one of the most obvious symbols of this cooperative spirit. Yet the 2020s is shaping up to

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be a watershed moment for human activity in outer space. Increasing tensions and antagonism between the great powers appears set to extend into humanity's "final frontier." Antisatellite weapons tests, the United States' establishment of a national space power strategy, and even alleged Russian plans to deploy nuclear weapons in planetary orbit all seem to portend a new era of military competition, one in which outer space becomes heavily militarized. While it may be tempting to view this contemporary moment as a new development, the military implications of this frontier have been discussed since the first satellite launches of 1957.

This article provides a historical overview of some of the fears and anxieties that emerged at the dawn of the Space Age, when the United States was understood to be behind in matters of outer space technology and policy. Broadly speaking, the fears that emerged in the post-*Sputnik* period centered on three key themes: the possible terrestrial impact of advanced rocket technology, the unknown applications of satellite technology, and the assumption that the launch of the *Sputniks* had opened a new frontier in the wider Cold War that the United States seemed ill-equipped to deal with. While the administration of Dwight D. Eisenhower sought to allay some of these fears and resolve some of the tensions that emerged, the perspectives offered throughout late 1957 demonstrate alternative paths left unfollowed.

Debate over the impact of new Soviet technologies played out across the media landscape of 1950s America. Throughout this article, the author focuses predominantly on analysis and commentary appearing in print culture; magazines such as the defense weekly *Aviation Week,* popular culture and current affairs magazine *Life,* and discussion from various newspapers—the *Atlanta Constitution,* the *New York Times,* the *Los Angeles Times,* the *Chicago Daily Tribune*, and the *Washington Post and Times Herald*—including articles, editorials, and letters to the editor throughout the United States. These sources provide insight into media and popular perceptions of the early years of the Space Race, and the construction of "outer space" as a new domain of military competition in the minds of American media and the public.

Focusing on these sources, rather than those produced through American governmental or defense institutions, reveals a multiplicity of perspectives and narratives. While this article predominantly examines sources that contributed to the well-documented "master narrative" of a crisis in the post-*Sputnik* period, it is important to note that there was not one unified narrative as is commonly remembered.[1] Americans who wrote to their local newspapers or national magazines drew attention to other aspects of the *Sputnik* launches or contemporary events to explain or justify American "loss" on this front, or to push back against the wider narrative of a crisis through their support of the Eisenhower administration or admonishment of other commentators for what they perceived to be unfair critiques.[2] This complexity in the past reminds us to seek out multiple perspectives on the threat posed by the militarization in the present.

Furthermore, it is worth noting that scholars often characterize these sourc-

es as limited in terms of the media and especially the public's understandings of the early Space Race, American progress in military missile programs, and general knowledge regarding outer space science. Historian Walter McDougall notes that regarding matters of outer space, "The public learned as if from a rookie professor, who kept one chapter ahead in the textbook. The uses to which satellites might be put went unreported, the real connections between satellite and missile forces were lost on the reporters, the fact that Sputnik was far more an engineering triumph than a scientific one was an especially fateful misapprehension."[3] Responses from the Americans who wrote to media outlets can reflect and highlight these misapprehensions, which contributed to the wider concern of a "Sputnik crisis." While these concerns may not be factually accurate, they offer a snapshot of the mindset expressed by these individual Americans at critical junctures.

Throughout the early years of the Cold War, the Soviet Union had often been perceived as a technological backwater compared to the United States. However, with the launch of *Sputnik 1* in October of 1957, the Communist superpower seemed to prove this assumption wrong. The Soviet launches of *Sputnik 1* and *Sputnik 2* led to a sense of crisis in the United States, with various media outlets lambasting the Eisenhower administration, the military establishment, and even the American people and their apparent complacency as they sought to explain the Soviet achievement or what many perceived as an American loss. These events came to be called the "Sputnik crisis" and has seen much written on it already.[4] While the crisis itself was in many ways created and propagated by American media outlets, it should not be understated just how seriously some individuals within the American upper echelon viewed the Soviet achievement. One dialogue cited in *Aviation Week* reported that Budget Director Percival Brundage dismissed *Sputnik*'s importance. Brundage stated the satellite would be forgotten within six months, to which former minister to Luxembourg, Perle Mesta, responded "and in six months we may all be dead."[5] The danger that many assigned to the Soviet success was clear—on some level, it posed an existential threat to the United States. By no means was this fear universal, nor was it necessarily an accurate reflection of the military reality, but it was a widely held perspective among members of the public, media commentators, and even congressional officials. Those Americans who were concerned by the *Sputniks* offered varied perspectives on the exact nature of the threat: was it the power of Soviet rocketry, the implications of satellite technology, or the emergence of outer space as an entirely new domain of conflict?

Fear of the Recognizable: Rocket Technologies

For many Americans, *Sputnik 1* (and a month later, *Sputnik 2*) quickly came to symbolize Soviet military capabilities. Media outlets made it abundantly clear that *Sputnik 1* was not just a scientific success for the Soviets; it was a military success as well. The successful launching of a satellite more than 500 miles above the planet's surface required a powerful rocket—one that could also func-

tion as an intercontinental ballistic missile (ICBM).[6] The *Chicago Daily Tribune* used the satellite's launch as evidence of the existence of a Russian ICBM, as did the *Los Angeles Times*.[7] Ralph McGill, the editor of the *Atlanta Constitution,* went even further in his front page column on 7 October 1957, when he directly compared the status of the American and Russian missile programs—and found the American three-stage rocket program, crucial in his view to an ICBM, to be lacking.[8] *Sputnik 1*'s launch proved, seemingly, that there existed a serious technological gap between the two superpowers.

To the public's knowledge, the United States did not possess a functional ICBM, while the Russians did. Ralph McGill quoted an unnamed "missile man" about the implications of *Sputnik* and its rocket: "It scares the —— out of me."[9] An unnamed official from Project Vanguard—the American satellite program underway at this time—was cited by another article in the *Atlanta Constitution*, claiming that "if they can do that [launch a satellite] they can drop ICBMs on us."[10] With many articles of this sort situated on the front page of newspapers throughout the nation, American audiences were bombarded in the days following *Sputnik 1* by claims that the Russians could drop the bomb at any time. Within 48 hours of *Sputnik 1*'s launch, American media had positioned the satellite as evidence of Soviet missile superiority.

While mainstream media commentators spent the days after *Sputnik 1*'s launch vacillating between articles that were near hysterical with fear, and articles that actually praised the Soviet Union for its achievement, defense commentators promptly demanded a response from the government. Perhaps the most vocal was Robert Hotz, editor of defense magazine *Aviation Week.* To Hotz, the launch of *Sputnik* made it clear that the two superpowers were engaged in a technical competition, and in October 1957 the Soviet Union had matched, if not overtaken, the United States in this "technological race."[11] Hotz echoed the calls already emerging from political figures for a congressional investigation into the state of America's military missile programs, writing, "They [the American people] have a right to find out why a nation with our vastly superior scientific, economic and military potential is being at the very least equaled and perhaps being surpassed by a country that less than two decades ago couldn't even play in the same scientific ball park."[12] Such an investigation, he believed, was critical for the "future safety and security of this nation and the rest of the free world."[13] Furthermore, Hotz demanded a major reappraisal of American research, development, and production programs by the nation's top political leaders, particularly because *Sputnik 1* came after "a long chain of Russian surprises in the development of atomic-airpower weapons ranging all the way from jet bombers, supersonic fighters, both intermediate and intercontinental ballistic missiles, and hydrogen warheads."[14] The launch of *Sputnik 1,* dismissed by some in Eisenhower's administration as a scientific bauble or a matter of little consequence, seemed instead to Hotz a serious military and scientific challenge.

Politicians in the following weeks also emphasized the apparent disparity marked by *Sputnik 1*'s launch. Senator Styles Bridges (R-NH) outlined the

significance of the satellite launch: "The mere fact that the Soviets have been successful in launching their satellite indicates clearly that they possess the same type of technical knowledge that is required to project an intercontinental ballistic missile. Military implications of such technical knowledge in the hands of a potential enemy to the U.S. are tremendous in scope."[15] Senator Richard Russell (D-GA) held a similar stance, telling Congress two weeks earlier, "We now know beyond a doubt that the Russians have the ultimate weapons—a long-range missile capable of delivering atomic and hydrogen explosives across continents and oceans. "[16] The launch of *Sputnik 1* proved, it seemed, that the Soviet Union could strike the United States at any time. America's relative geographical isolation, which had served to insulate the mainland from the severity of conflict wrought upon Europe in the twentieth century's major wars, could no longer be relied upon for defense.

Adding to these anxieties over rocket technology were boastful comments made by Soviet premier Nikita Khrushchev to reporters. In an interview given to *New York Times* reporter James Reston, Khrushchev stated that if a "rocket war" broke out, the United States—and, by association, capitalism—would be destroyed.[17] While many Americans would ordinarily dismiss Khrushchev's claims as bluster, comments from military officials during this time served to reinforce his assertion. Captain H. L. Miller of the U.S. Navy, for example, confirmed to media that all American and allied bases in Western Europe were under threat from Soviet missile attack.[18] While Miller made it clear that the United States possessed countermeasures at this point—tactical bomber strikes launched from American aircraft carriers, for example—not every media outlet noted this fact.[19] Meanwhile, General Thomas S. Power, the head of Strategic Air Command, warned an Air Force Association audience that the Soviet Union would launch a devastating attack as soon as the nation possessed a sizable missile stockpile, something observers believed would occur in late 1960.[20] Power's speech drew heavily on Cold Warrior mentality, noting that the United States was the "major obstacle" to the Soviet Union and its leaderships' goals. Therefore, logic dictated the Soviet Union would act to remove said obstacle as soon as "they believe they have attained—the capability of doing so with impunity."[21]

The emergence of the alleged "missile gap," reinforced through media interpretation of contemporary defense studies, contributed further to these fears of Soviet military domination. The "Gaither Report," for example, confirmed Miller's and Power's claims. Calling the evaluation "grim," Claude Witze of *Aviation Week* told readers that this report stated American Strategic Air Command (SAC) bases throughout the world—the cornerstone of American nuclear policy—stood at risk of being wiped out by Soviet missiles until 1960.[22] A defense study undertaken by the Rand Corporation, reported on by *Aviation Week* and cited in the *Chicago Daily Tribune,* confirmed even the worst possible fears.[23] A defense system against Soviet missiles would not be feasible for some time, unless the priority was assigned solely to American strategic bomber bases. To defend American cities would simply cost too much.[24] The opening of the Space

Age, or rather, the successful use of a large Soviet missile to orbit *Sputnik 1*, had apparently altered the military balance of the Cold War.

Finally, inflaming these fears was the culture of secrecy surrounding developments on both Soviet and American rocket technologies. In particular, the realization that *Sputnik 1*'s launch did not mark the first successful test of a Soviet ICBM shook public faith in the Eisenhower administration. One editorial in the *Atlanta Constitution* noted that the Soviets had successfully tested a missile a few weeks prior, but that fact had been minimized in the United States.[25] Writers at *Aviation Week,* meanwhile, took it upon themselves to reveal that not only had the Eisenhower administration been fully aware of Soviet missile development, but they had taken little action to counter it. On 21 October 1957, the magazine published a long-form story detailing the existence of American radar stations in Turkey which, for two years, had been tracking Russian missile launches.[26] Editor Robert Hotz was furious, claiming the existence of these stations was not a secret to anybody except "the vast bulk of American people who are most vitally affected by it."[27] In a period when many had assumed the Soviet Union was far behind the United States, the revelation that they had not been—and the government had known this—was shocking. In fact, *Aviation Week* claimed that the Soviet Union had possessed ICBM technologies since at least 1956.[28] Thus, it appeared that the Soviet Union possessed the ultimate weapon, while the United States lacked it: *Sputnik* directly challenged American national security. Other American media outlets that ran with this story in the following days were similarly angered: "But the essential fact, which the forthcoming congressional investigation is certain to establish, is simply this: the Administration reacted to hard intelligence of Soviet technological progress, especially in the missile field, by sharply cutting back on our own efforts in that field."[29] In light of this revelation, *Aviation Week* and others propagated a firm belief that not only had there been a race underway in this sphere, but that the United States had willingly allowed itself to be overtaken. Worse, the Eisenhower administration had done so unbeknownst to the American people.

Meanwhile, Americans had little-to-no accurate knowledge of what was occurring in their own military missile programs. Prior to *Sputnik 1*'s launch, missile launches were (supposed to be) classified affairs. Despite this, missile launch days from the Patrick Air Force Base Cape Canaveral complex were treated as an open secret. As Evert Clark noted for *Aviation Week*, "There is no hot war, and talk is looser than it might be in other circumstances."[30] Americans regularly turned out to watch test launches of the Atlas I ICBM and other missiles, while businesses in the region capitalized on the excitement of test launches using names like "Missile Bar B-Q" or "Sea Missile Motel."[31] However, members of the public and the mainstream media were limited in the information they could access, thus having little way of knowing whether a test was successful or not—evident in media articles that called tests "failures" in direct contradiction of official statements.[32] This culture of secrecy excluded American audiences

from having a full understanding of the state of their nation's missile programs, driving some of this fear over Soviet developments.

Among the various congressional investigations following *Sputnik*'s launch was an investigation by the House Government Information Subcommittee, chaired by John Moss (D-CA), which found that the White House had maintained a policy of complete secrecy on information regarding the nation's missile programs. In his testimony to the subcommittee, Dr. Clifford Furnas, former assistant secretary of defense for research and development, revealed his belief that the extreme secrecy was unnecessary. In his eyes, more information would have meant that "the American people would have had more confidence" in their own missile programs.[33] Congressman Moss agreed with this view, noting that the policy of secrecy meant "the American people are to be denied the facts affecting national survival."[34] Although the issue of national security was cited in response to the *Sputniks*, for these current and former government officials, national security was not strengthened through secrecy but instead weakened. They believed if the American people had a greater understanding of their own missile programs their fears of Soviet superiority could be assuaged.

One solution promoted in the immediate post-*Sputnik* period was, then, rather simple: provide the American people with more information on the state of the nation's missile programs. Going forward, it was decreed that more information regarding America's missile programs would be disseminated so that the nation was aware of its supposed deficiencies vis-à-vis the Soviet Union. The Department of Defense initially altered its security policies to allow more openness within weeks of *Sputnik 1* and started to provide the American people with (some) results of missile tests.[35] Likewise, Murray Snyder, assistant secretary of defense for public affairs, promised that there would be a greater loosening of information, including an invite to the American press to witness the launch of "the 20-inch earth satellite planned for March."[36] The openness of the American space program relative to the Soviet Union's would later be touted as one of the program's major strengths, but at this stage it was a prompt and simple counter to the military crisis gripping the minds of the nation.

This gap in knowledge between the general public and members of the Eisenhower administration was undoubtedly one of the greatest drivers of some post-*Sputnik* anxieties and can help explain some of the fear over the terrestrial impact of the *Sputniks*. Media understandings of the Soviet program, which combined military missile testing and the satellite program, treated the American *Vanguard* program in the same way. Eisenhower had been quick to emphasize that this was not the case but met limited success. In his first press conference following the Soviet success, the long history of the American satellite program and its inception as a project for the International Geophysical Year was outlined. Included was the simple fact that America's missile program and its satellite program had been intentionally separated from one another early in the process, for fear that merging the two would actually be detrimental

to scientific goals as well as military progress.[37] Following the launch of *Sputnik 2*, Eisenhower continued to emphasize that Earth satellites themselves were in no way a reflection of military strength; "Earth satellites, in themselves, have no direct present effect upon the nation's security."[38] However, this is not to say he completely dismissed concerns over military strength; the president acknowledged, as he had in his first press conference, that the thrust capacity required to launch a satellite to orbit did help indicate the state of Soviet military technology.[39] America's lack of a satellite, however, did not represent the state of its military missile program.

On historical reflection, Eisenhower's perspectives can be seen to be well-justified. In a report to Eisenhower dated 28 December 1957, James Killian Jr., special assistant to the president for science and technology, updated the president on the American satellite and missile programs, and his conclusions found little to worry about. Killian believed that American missile development was proceeding at a satisfactory pace, even going so far as to call U.S. progress in the missile field "impressive."[40] While the United States was likely behind the Soviet Union at the time, Killian noted that this was largely "because we started much later and not because of inferior technology."[41] The "missile gap" also ceased to be an issue in a relatively short period, similar in some ways to the earlier "bomber gap" of the mid-1950s. By 1963, American officials were asking "Where did the missile gap go?," reaching the conclusion that while a serious missile gap had been a possible future phenomenon, it had never become established in the ways feared.[42] A 1981 retrospective study, furthermore, concluded that the "missile gap" debate was in part "the product of uncertainty and disagreement concerning Soviet deployment activities and intentions that spilled over from the intelligence community into the public arena."[43]

Fear of the New: Unknown Applications of Satellite Technology

The threat that seemed to be posed by Soviet space achievements was not, however, limited to terrestrial uses of the launch vehicle. Satellites themselves were a new and relatively unfamiliar technology, and the applications to which they could be put generated fears of their own. Media attention to the *Sputniks* often heightened these fears, in part due to the limitations in knowledge of both reporters and readers. One particular misinterpretation of the science made its way to *Aviation Week.* A letter to the magazine, from an Alfred Machado Jr. of New Bedford, Massachusetts, outlined its author's worries. Machado believed that Russian satellites could be used to broadcast "transmutation beams," which would cause U.S. nuclear materials to decay, leaving America's atomic arsenal "no more explosive than lumps of iron."[44] Although later letters to *Aviation Week* made clear that other readers considered his fears overblown and that he misunderstood the science he cited, Machado's letter reflected the fear of the unknown that had gripped some Americans.

These anxieties over the unknown often reflected the lived experiences of

Americans, many of whom held memories of the attack on Pearl Harbor in 1941. The prospect of a new and more devastating surprise attack, launched from outer space, was a common fear throughout letters to the media and in editorials themselves. One editorial in the *Los Angeles Times* inferred that a "new Pearl Harbor" had already occurred.[45] The satellite, as well as the Soviet ICBM, may not have been a "tables-turning" event but its psychological impact was the same.[46] James A. Broadhead, a reader of the *Los Angeles Times*, believed that *Sputnik* proved Soviet missile claims accurate, and thus the prospect of a missile attack with hydrogen-bomb warheads existed. Broadhead noted that if the Soviets had one missile, they could have many, meaning "a mass attack on many targets might well make possible another Pearl Harbor, only a million times worse."[47] Sylvan Gotshal, a reader of the *New York Times,* penned a letter to that outlet in which he argued that *Sputnik* was "more dangerous in its implications for the future of our country than ever was Pearl Harbor."[48] For Gotshal, *Sputnik* was one of the greatest threats to the United States to ever exist. Gotshal justified his argument by noting that *Sputnik* was not just a hit to American prestige; a satellite of its kind could be easily fitted with an atomic warhead.[49]

Atomic attacks from outer space were not the only feared use of satellite technology. Allen Klein, a reader of the *Washington Post and Times Herald,* perhaps presciently in the context of the twenty-first century, questioned what could happen if the Soviet Union outfitted its satellites for espionage.[50] Even worse, reflecting once more the unknown nature of space science, what if the Soviet Union equipped future satellites for chemical warfare?[51] Fear even gripped some political figures. Congressman James T. Patterson (R-CT) predicted that Russian satellites would be used against the United States as soon as it was possible. Patterson not only believed that future satellites could be used as weapons platforms, but that a whole raft of measures could be deployed from space.[52] Patterson told an American Legion Post audience that "Sputnik V" would weigh more than a ton, include television receivers and transmitters, and be able to jam radars, radios, and televisions.[53] Furthermore, such a satellite would be able to broadcast Soviet propaganda anywhere in the world—a direct threat to one leg of America's "containment" policy.

These public discussions over the possibilities of satellite technology also reveal that even in the wake of the Soviet launches, there were believed to be multiple paths forward. Gotshal, for example, pushed for a militarized response to outer space technologies, arguing that the United States ought to "throw off the bonds of lethargy and complacency" and urgently develop satellite and missile technologies to rebalance the situation.[54] Klein, however, urged that efforts to achieve global disarmament should be increased.[55] A similar attitude was held by one Michael Caroe, who wrote to the *New York Times.* Caroe was fearful of how satellites, and the science they acquired, could be used to further the development of military technologies such as the ICBM. Much like Klein, he appealed to the idea of international cooperation, calling for "strict control of this newly acquired use of the heavens."[56] This divide in public opinion re-

flects discussions already ongoing in media commentary and the political world at this time. The necessity of reevaluating and reorganizing American defense efforts, advocated for by individuals like Robert Hotz, occurred simultaneously with American efforts to push through stronger disarmament legislation at the United Nations. In particular, a new American proposal had already called for international control of "outer space missiles" and urged the peaceful use of space.[57]

Military officials also voiced their concerns over the potential applications of satellite technology. Brigadier General Robert M. Woodward, the civil defense director for Illinois, believed satellites such as *Sputnik* would provide military advantages to the Soviet Union and enhance future targeting.[58] In his eyes, "The soviet man made satellite has thrust back the curtain of a previous obscure future to reveal a new panorama of dangers and the accompanying need for heightened vigilance on the home front."[59] Retired Major General John L. Homer shared such a view. Homer believed that *Sputnik* signified the beginning of a new era in which it would be impossible to maintain defense secrets.[60] The Soviet satellite would nullify all American defense weapons (except missiles), while also being able to survey the entire planet multiple times a day.[61] To these men, the launch of *Sputnik 1* made the United States more vulnerable to attack than ever before.

Outer Space: A New Frontier

Finally, the launch of the *Sputniks* in late 1957 led to the prompt acknowledgment of outer space as a new frontier. The military balance of the Cold War seemed to be tipping against the United States with the opening of a new domain, and fear abounded over what Communist domination of this region could mean. In early 1958, North American Aviation ran an advertisement in *Aviation Week* that reflected the rhetoric politicians and military officials were deploying:

> Today, our soldiers and sailors and airmen stand guard on the ramparts of the free world, but at the same time our civilian and military scientists and engineers are hard at work building our defenses on a new fronter. That frontier is Outer Space. There, someday soon, will lie the power to keep the world free—or enslave it.[62]

The Space Age had, it seemed, created a situation in which outer space itself was a new frontier, a region where American military strength would be required in order "to keep the world free."[63] This reinforcement of Cold War rhetoric—that is, only a world in which the United States controlled the new frontier was a world in which freedom reigned—was a common theme in discussion of "control" over outer space. In Congress, for example, Senator Lyndon Johnson (D-TX) opened 1958 stating that the human race had "multiplied its capabilities to infinity," but "the exploitation of these capabilities by men of selfish purpose holds the awful threat of a world in subjugation. . . . The mastery

of such capabilities by men wholly dedicated to freedom presents instead, the prospect of a world at last liberated from tyranny, liberated in fact from fear of war."[64] Military officials were already putting forward plans on how to best exploit this new frontier.

Outer space and its use as a new domain of conflict offered various possibilities for tactical advantages or disadvantages. One possibility advanced was the use of the Moon as a new "high ground" in case of terrestrial conflict. Such a view was promoted by Brigadier General Homer Bousher, deputy for research and development in the U.S. Air Force Directorate of Development. The Moon had a number of benefits, he pointed out: low gravity could allow warheads to be "catapulted" toward the planet without large rockets, but crucially it provided a retaliation base "of unequaled advantage."[65] If the United States had a lunar base, for example, the Soviet Union would either have to target the Moon first—giving 48 hours of detection and preparation—or strike the continental United States, only to receive massive destruction 48 hours later.[66] Another perspective, advanced by the retired Lieutenant General James M. Gavin, was that within eight years, the era of missiles and satellites

> will have shrunk the world to such an extent that militarily the earth itself will be a tactical theatre. Manned space flight will be here. We will truly live in a "balance of terror." The very nature of strategy will change, leaving the realm of physical combat to go into full-scale psychological warfare and leaving the earth's environment to go into space.[67]

Gavin believed that from 1965 onwards, space-based weapons would threaten operations on land, while defending against reconnaissance would become increasingly challenging. As such, terrestrial military policy would have to change—for example, the use of railroads, tunnels, and canyons for missile launches to prevent targeting from space-based weapons.[68]

While both men planned for conflict in this new realm, this did not mean they necessarily believed outer space needed to be militarized. Much like the debate occurring in the pages of American newspapers, both military officials saw the militarization of space as a last resort. Bousher, on the one hand, made clear that an armed space force would only be necessary if international agreement to keep space peaceful could not be reached, and even then it would be necessary solely as part of a deterrent force.[69] Gavin, on the other, took a much more apocalyptic view:

> If this planet is to remain inhabitable by man, a space program must be developed under the United Nations. We should establish as a matter of priority a United States space command directly under the Department of Defense and put it at the service of the United Nations. We should ask that our allies and the Soviets also contribute to such a U.N. program. If the exploration and control of space can be carried out under the auspices of the United Nations, we will not have to concern

> ourselves with space war. Instead, the exploration of space can be conducted for the peaceful purposes of mankind.[70]

The emergence of a new frontier in space led to prompt debates on the roles of each Armed Service and their suitability to control the new technologies associated with outer space. Each of the branches of the Armed Services were already engaged in their own missile research, and the close relationship between missiles and rockets meant each branch could possess the means to achieve outer space milestones. Pre-*Sputnik,* questions already existed over which branch should actually oversee these technologies. Post-*Sputnik,* this competition was cited on multiple occasions as damaging to the overarching field of American research and development. According to Senator Lyndon Johnson, "It may be true that this country was in no race to produce the satellite. But certainly the Armed Services were engaged in a race with each other to control the guided missile. And we cannot afford many more races like that."[71] At this stage, Johnson had seemingly accepted the administration's insistence regarding the lack of a space race, but still recognized the uncertainties that had characterized American missile research. In the House of Representatives, another Texan Democrat, George McMahon, stated regarding inter-Service competition:

> The sad fact is that today the armed services appear to be more interested in out-doing each other than in getting ahead of the Soviet Union. . . . First, the Army came to us and said they could do the (satellite) job best. Then the Navy came. We left the administrative decision to the Defense Department. But it appears there was little spirit of cooperation. . . . There appear to be far more compelling reasons now for a merger of the Air Force and the Army than there ever were for separating them.[72]

The most concise explanation of the problems with American missile development was provided by *Time* magazine three weeks after *Sputnik 1*'s launch. According to *Time,* missiles had upset the balance among American Armed Services, with each branch seeing specific applications for them. The Army saw missiles as artillery; the Air Force, as unmanned planes; the Navy, as modifications of carrier planes and battleship guns.[73] As such, each branch involved itself in missile development, with the result being duplicate programs. American military branches were now competing for the same brainpower, researching and utilizing the same technology, and keeping secrets from one another. By 1950, there were more than 40 separate missiles being developed among the three branches, many for the same purpose.[74] While several of these projects were canceled in the early years of the decade by Secretary of Defense George C. Marshall, the problem had reemerged by 1957. *Time* pointed to the Navy's Sidewinder missile and the Air Force's Falcon as an example: both missiles were designed for air-to-air combat, with similar operational distance.[75] *Time* noted that allowing these rivalries to continue was the easy way out; instead, hard

choices needed to be made.[76] Yet despite all the critiques, both the Air Force and the Army continued to jostle for prime position.

Both branches believed that they ought to possess the powers of missile and space technology and were willing to use the fears stoked by assertions of a "space race" to justify their claims to new weapons and greater funding. For example, Lieutenant General Clarence S. Irvine of the U.S. Air Force argued that the Air Force needed both manned aircraft and missiles in its inventory, citing the "mixed forces" concept as the right path forward. Irvine noted "the mixed forces concept is correct because we cannot sacrifice clearly proved systems for relatively unproved ones."[77] In a further attempt to assert its responsibility for the new field of aerospace matters, Air Force officials even directed the establishment of a "Directorate of Astronautics," to which they would assign their own space research, including the proposed Pied Piper surveillance satellite.[78] This initiative quickly ran afoul of the Department of Defense, and within a week an order was issued to withdraw the establishment of this group.[79] Despite this, Assistant Secretary of Air Force for Research and Development Richard Horner tried to plead his branch's case to the Senate Preparedness Subcommittee, telling them that a small investment could quickly turn Air Force facilities to "the problems of conquering space."[80]

However, the Army refused to back down, pressing forward with their own claim to be the primary space agency. Following *Sputnik 1*'s launch, Army experts openly criticized the Eisenhower administration. They claimed that their missile teams were unfairly overlooked when they already had rockets that could have been used to "launch a crude satellite in order to win the 'race' with Russia."[81] Two days after the Air Force had announced its Directorate of Astronautics, deputy commander of the Army Ballistic Missile Agency (ABMA) Brigadier General J. A. Barclay told a Washington audience that "we are now at the threshold of what Dr. Wernher von Braun has termed man's greatest adventure—the exploration of outer space. The scientific importance of satellite projects is uppermost in our minds at the moment. But larger carriers, propelled into orbit by larger rockets, have tremendous military significance also."[82] In Barclay's mind, his team was the one best positioned for space exploration, although unlike Air Force officials he argued that scientific knowledge was the critical mission of ABMA. Further enhancing the Army's argument was the claim of officials that "he who controls the land will control the space above it," highlighting the perceived importance of the ground-based military branch.[83] Predictably, the Air Force took umbrage to this statement, with Lieutenant General Irvine calling it a "twist of words" and that control of air, or space, was necessary to protect the land below.[84] While these two branches continued to argue over which was better equipped for this new frontier, they functioned under the key assumption that military outer space technology would fall under their purview. Newly appointed Secretary of Defense Neil McElroy had other plans.

McElroy's solution, supported by government policy groups, was a relatively

straightforward one. He would take the responsibility for research and development away from each branch of the military, instead placing it with a new agency within the Department of Defense: the Advanced Research Projects Agency (ARPA).[85] ARPA's role at the time, as outlined in *Aviation Week*, was thus: "ARPA's function will be to proceed with research and development of weapon systems and military requirements for an indefinite period, and space projects authorized by the President for one year."[86] By the time this first year was up, it was expected that Congress would have formulated a wider space policy and either established an independent space agency, or vested those powers in an already-existing agency.[87] McElroy and the groups that supported this proposal believed this was the appropriate longer-term response to both the Space Race, and the inter-Service competition, that they understood to be underway. Taking military research and development away from the disparate branches was hoped to put an end to the squabbles between branches over funding and jurisdiction for space-related technologies; instead, these new technologies would be developed by ARPA and assigned to the appropriate branches as the agency saw fit. Likewise, this gave the Eisenhower administration time to organize its own, clearer policy regarding outer space, and whether power should be vested in a military or civilian agency. In this process, the administration possibly delayed the "arms race" for weaponized satellites and space stations that many feared could emerge, but also paved the way for the transformation of the National Advisory Committee for Aeronautics into the National Aeronautical and Space Administration later that same year.

This did not mean the Eisenhower administration ignored the value that militarized applications of outer space technology could bring. Rather, Eisenhower's approach was to ensure that the American space program would be primarily civilian in nature. It was his belief that doing so "will emphasize the concern of our Nation that outer space be devoted to peaceful and scientific purposes."[88] During his tenure, the United States still pursued military reconnaissance satellites such as the Corona program, in part due to concerns over Lockheed U-2 overflights of the Soviet Union and the potential for an international incident (a fear that did come true with the downing of pilot Gary Powers in 1960).[89] However, with the establishment of NASA and this attempt to ensure that the bulk of the American space program would appear civilian and scientific in nature, Eisenhower managed to avoid engaging in a full-scale competition for the weaponized satellites and space stations that members of the public had feared.

Conclusion

The launch of the first Soviet *Sputniks* in 1957 caused a great deal of anxiety among members of the American public. The satellites stood as a symbol of a technical brilliance that many had assumed the Soviet Union incapable of at that particular moment, and America's apparent inability to launch a satellite before, or even shortly after, the first *Sputnik* led to a great deal of speculation

on just what this new technology could mean. Americans imbued the *Sputniks* with fear and caused them to ask questions. What did their launch mean for Soviet missile technology and America's relative position in the military competition of the Cold War? Could satellites be utilized as weapons of war, in what ways, and how could this be prevented? How was the United States supposed to engage in this entirely new frontier: an arms race, or disarmament? While the Eisenhower administration implemented some policies that sought to allay the ongoing crisis and prevent the nation from undertaking an immediate outer space "arms race," many of the underlying worries were not resolved through solutions offered by military commentators or members of the public.

Apprehension over the militarization of outer space was not solely an American concern, nor did it dissipate in the 1950s. The launch of the first TIROS satellite in 1960, intended by NASA as a weather observation satellite, drew prompt criticism from the Soviet Union for the clarity of images that could suggest a secondary use as a military observation satellite.[90] While the two superpowers were able to work together on the Outer Space Treaty of 1967 to ban weapons of mass destruction, this does not necessarily prevent other space-based military activities. Evidence suggests, for example, that the 1974 Soviet space station *Salyut 3* had a "defensive cannon" installed in order to intercept any American spacecraft if necessary.[91] Furthermore, a recent report from the *New York Times* suggested that Russia plans to deploy nuclear weapons in space in flagrant violation of this agreement.[92] The modern reemergence of this discussion can thus be understood as a continuation of an older question: To what extent will we allow outer space to become a military domain?

Modern public-facing discussion regarding the militarization of outer space has not yet reached the same level of "crisis" commentary that we see following the launch of the *Sputniks* in 1957. A Pew Research Center poll from 2023 found that only 44 percent of Americans believed that the United States would have engaged in military conflict in outer space by the year 2073.[93] Readers' comments left on recent articles from the *New York Times* regarding Russian deployment of a nuclear antisatellite weapons system demonstrate more concern over domestic politics and the leaking of classified information from members of Congress than the predictions of space-based weaponry—a departure from the praise outlets such as *Aviation Week* received following their own revelations of classified material in 1957.[94] While popular opinion may not reflect the same concerns as the post-*Sputnik* period, institutions with greater knowledge of the situation are beginning to raise the alarm.

In some ways, the concerns being voiced today are reminiscent of those expressed in the 1950s. The U.S. Department of Defense's 2020 *Defense Space Strategy* addressed the challenges posed by orbital-based weapons and the deployment of nuclear weapons technologies in space. Likewise, concern over the technical advancements of potential adversaries is a reminder of the feared "missile gap" and technical prowess of a post-*Sputnik* Soviet Union, while apprehension over the public's level of knowledge remains a factor that policy makers

have to contend with.[95] The Center for Strategic and International Studies, in their 2023 *Space Assessment Threat*, concluded that counterspace weapons have become part of a broader tool kit for national militaries and are already on the way to being integrated into wider military planning.[96] The responses advocated in the past may not necessarily be fitting for the modern context, but examining them and the diverse perspectives offered in 1957 can help inform the conversation about militarization today.

Certainly, the domain of outer space today is significantly more complex than that of 1957. Twenty-first century societies, economies, and militaries rely heavily on satellite technologies developed over the course of the Space Race. The outright militarization of space as feared in 1957, such as nuclear launch sites on the Moon or orbital weapons platforms targeting the Earth, never quite came to pass. At the same time, proposals for ensuring lasting peace in space, such as Bousher's hopes for an international agreement on disarmament or Gavin's vestment of power in the United Nations, have also failed to appear. While outer space has to some degree already been militarized through the use and deployment of surveillance satellites, as one example, it has primarily functioned as a realm of scientific, commercial, communicative, and predominantly peaceful activities. The proliferation of national space programs, as well as of private space companies, has created an environment fraught with non-military targets, whose accidental or intentional destruction comes with great risk to all of us reliant upon them. In this age, then, it is perhaps more critical than ever to explore alternative ways to contain or limit the militarization of outer space, and to do so requires examining all perspectives possible. We successfully avoided the worst of the post-*Sputnik* fears decades ago; it would be a mistake to make them a reality today.

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Marine Corps and Space Force Integration for a More Lethal Joint Task Force to Counter China

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Abstract: The objective of this article is to highlight the unique capabilities of the Marine Corps and Space Force and how they can function as part of a Joint Task Force (JTF) operating within U.S. Indo-Pacific Command (USINDOPACOM). More importantly, it aims to discuss the need to establish a Joint force structure and package that minimizes the risk should the United States need to quickly shift from competition to a crisis or, worse, conflict with China. Determining command relationships, allocated resources, and authorities as part of a JTF structure and package will be critical to quickly transition such a force in response to a crisis or engage the People's Liberation Army (PLA) in conflict.
Keywords: U.S. Marine Corps, Space Force, Indo-Pacific area, Joint task forces, force structure, great power competition, China, People's Liberation Army, PLA

Introduction

> The most comprehensive and serious challenge to US national security is the People's Republic of China's (PRC's) coercive and increasingly aggressive endeavor to refashion the Indo-Pacific region and the international system to suit its interests and authoritarian preferences.[1]

Unlike any previous adversary the United States has faced, China has the potential to match or exceed the United States economically, diplomatically, militarily, and technologically. The United States does not want a war with

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China. Instead, the United States seeks global competition with China as a means of deterrence to avoid a crisis or, worse, a conflict. China is actively modernizing the People's Liberation Army (PLA) to become a regional, and eventually global, power. The PLA bears the responsibility to "shape [China's] security posture, deter and manage crises and conflicts, and win local wars."[2] Should a conflict arise between the United States and China, U.S. planners expect China to use the PLA to attempt a fait accompli to rapidly eliminate U.S. regional capabilities. China's goal is to achieve a decisive victory against the United States that will cause the United States to negotiate for peace rather than suffer additional casualties.

To deter China from escalating beyond its current level of competition against the United States and countering China's attempt at a fait accompli, the Joint Staff is developing an inside-out defense in which a Joint Task Force (JTF) will have an established and dispersed inside force, which the Marine Corps refers to as the stand-in forces (SIF), on the first island chain that will coordinate operations with the outside force on the second island chain to conduct strikes against the PLA. This JTF coordination will occur within kill webs. As explained in *A Concept for Stand-in Forces*, "kill webs allow for the rapid identification and selection of assets for tasking and re-tasking within and across military boundaries from disaggregated or distributed forces. Stand-in Forces help the fleet and joint force complete kill webs."[3] Kill webs seek to integrate each Service's different and often overlapping kill chains to improve sensor-to-shooter, cross-domain fires, multidomain warfare, and cross-domain warfare. By integrating the kill chains, kill webs represent the redundant and resilient network of communication relays and sensors that allow for the effective employment of kinetic and nonkinetic weapons. In the event of a conflict, the JTF's goal is to use kill webs to blunt PLA offensive operations by applying attrition warfare to wear down China's will to continue the conflict.

China has developed antiaccess/area-denial (A2/AD) capabilities consisting of a sophisticated network of short-, medium-, and long-range sensors and ballistic missiles that are supported with an integrated air defense, medium- and long-range bombers, and antiship cruise missiles.[4] These capabilities exist primarily to defend mainland China from attack but can be employed in an offensive capacity. Some long-range A2/AD capabilities can strike targets near the second island chain. Success for the United States in such a conflict will depend on how well this JTF can maneuver, execute multidomain fires, and survive inside the PLA's A2/AD environment.

A conflict with China would likely be over Taiwan's reunification or China's maritime claims to the South China Sea, presenting unique geographic and strategic challenges that a JTF must overcome to defeat the PLA. The USINDOPACOM area of responsibility covers more than 52 percent of the Earth's surface. The area of responsibility in this article will be the area defined by the South China Sea, East China Sea, and the first and second island chains.

Depending on the scope of the crisis or conflict, this area of responsibility could be divided into several area of operations, each assigned to a JTF commander. While a smaller portion of USINDOPACOM, the area of responsibility discussed in this article is still a large region that will present geographic, environmental, and limited infrastructure challenges for the United States and China.

Strategically, the United States regards China as a near-peer competitor and pacing threat; however, in this area of responsibility, China seeks to apply *informatized warfare* (a term used interchangeably with informationized warfare) to gain and maintain battlefield dominance over the United States. For China, informatized warfare has been a key concept in its modernization efforts to counter what it perceives as the technologically superior U.S. military by exploiting vulnerabilities in U.S. information networks while developing PLA capabilities for cyber warfare, electronic warfare, and precision-guided munitions.[5] China's goal is to use informatized warfare to enhance its A2/AD capabilities and effectively create a bubble in which the PLA will have military advantages over the JTF. The PLA's integration of all its services into its A2/AD environment will give it advantages in all the warfighting domains within the area of responsibility. By intently studying the U.S. military since the Gulf War, China has developed asymmetric capabilities to challenge the JTF's reliance on space superiority for assured access to satellite communication and Global Positioning System (GPS). Despite these advantages, China's primary focus on information dominance and enabling a hierarchical top-down decision-making process within the PLA creates a vulnerability that a well-integrated and equipped JTF could exploit.[6]

Should the United States be forced to engage China in a conflict, no single U.S. military Service will be able to defeat the PLA alone in this area of responsibility. Even the U.S. military working by itself cannot defeat the PLA in China's own backyard. Integration among all the U.S. Services as well as U.S. regional and global allies and partners will be critical to success. USINDOPACOM will develop a JTF to best counter the PLA threat that integrates all of the U.S. Services and regional allies and partners. Each Service will have to use space capabilities to support the JTF's ability to conduct all-domain operations against the PLA: the U.S. Air Force to conduct long-range strikes, the U.S. Navy to support ship movements and naval strikes, and the U.S. Army and U.S. Marine Corps to support inside forces' ability to conduct fire, maneuver, and remain in the kill webs. The way the Space Force supports the Marine Corps should be identical to how it supports the other Services and U.S. allies and partners within the JTF. The JTF will likely be run by the Navy, Air Force, or Army.

For a much larger conflict with China, the United States in coordination with USINDOPACOM would likely develop a multinational force with a framework that establishes JTFs designed to address specific mission requirements and operational needs. In the event of a crisis or conflict with China, a JTF can be established faster than a multinational force. As such, this article will focus on integrating the Space Force's and Marine Corps' unique capabili-

ties into a JTF to better cover their limitations and support the joint force. The Marine Corps has a large presence on the first island chain, organic mobility, force protection capabilities, and all-domain capabilities, making it ideally suited to be the JTF's inside force. Although equipped with all-domain capabilities, the Marine Corps' space capabilities are limited to localized ground-based jammers. Guardians have ground- and space-based capabilities that can restrict the PLA's ability to deny or degrade the JTF's space superiority. The Space Force's small size and lack of personnel and equipment in the area of responsibility make it dependent on other Services for terrestrial mobility and force protection. The Marine Corps and Space Force are perfectly suited to leverage each other's unique capabilities to cover existing limitations and become a critical component of the JTF.

For the Marine Corps and Space Force to be well-integrated into a JTF and use kill webs to exploit PLA vulnerabilities, USINDOPACOM must develop a JTF structure and package to help the United States quickly transition from competition with China to crisis or conflict. China aims to exploit U.S. vulnerabilities by using informatized warfare and regional A2/AD capabilities to achieve a quick, decisive victory. Any unnecessary delay in the United States transiting out of competition with China is a vulnerability that the PLA would exploit to conduct a fait accompli or gain an initial advantage that the JTF would be hard-pressed to overcome.

A JTF structure needs to be in place before a crisis or conflict starts so that a JTF package can be rapidly employed to utilize prepositioned equipment and capabilities to execute an assigned mission with established objectives and functional kill webs. To best support Marine Corps and Space Force integration now, USINDOPACOM must establish a JTF structure with command relationships and authorities, identify Space Force capabilities that will be assigned to a JTF, and the Joint Staff must update existing space doctrine to make it a joint document that expands on maritime and littoral operations. With a JTF structure in place, the next step is developing a JTF package. To further enhance Marine Corps and Space Force integration in the near future of two to three years, the USINDOPACOM must establish a JTF package that can employ Space Force personnel and ground-based capabilities that will be permanently based in the area of responsibility, utilize space-based capabilities assigned to USINDOPACOM, and use technological improvements to ensure JTF units can stay in the kill webs, survive inside the PLA's A2/AD environment, and deny the PLA's ability to maintain information dominance. Developing, exercising, and equipping a JTF structure and package will ensure the United States can quickly transition from competition with China to crisis or conflict.

The goal of this article is to discuss the threats the U.S. military faces in the area of responsibility, identify the Marine Corps' and Space Force's unique capabilities and limitations, and offer recommendations on improving the JTF structure now and the JTF package in the near future so that the Marine Corps and Space Force can be better integrated to support the JTF's ability to maneu-

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The article is divided into three main sections. The first section will focus on the threats and challenges the United States will face in the area of responsibility due to geography, environment, limited infrastructure, and PLA capabilities. It will also discuss how the U.S. military can exploit vulnerabilities within the PLA's structure. The second section will examine the unique capabilities and limitations of the Marine Corps and Space Force and how, when well integrated into a JTF, each Service's unique capabilities can cover their respective limitations and enhance the JTF's lethality. The third section will further discuss the above recommendations for both the JTF structure now and the JTF package in the near future to ensure a well-integrated Marine Corps and Space Force can improve the JTF's ability to support the inside-out defense.

Challenges and Opportunities of Operating in the First and Second Island Chains

The first section of this article will look at the challenges of operating in the area of responsibility based on geography, environment, limited infrastructure, and PLA A2/AD capabilities. It will conclude by discussing how a JTF can use some of these challenges to its advantage and exploit PLA vulnerabilities. Operating in the East China Sea, South China Sea, and first and second island chains will present significant challenges that a JTF must overcome. The tyranny of distance, lack of infrastructure, challenging environment, and PLA A2/AD capabilities will make it difficult for the United States to respond to a China-initiated crisis or deny China's attempt at a fait accompli to rapidly eliminate U.S. and allied capability in a decisive battle.

Facing the PLA in this region will force the JTF to operate inside highly sophisticated A2/AD environment: "In addition to expanding its conventional forces, the PLA is rapidly advancing and integrating its space, counterspace, cyber, electronic, and informational warfare capabilities to support its holistic approach to joint warfare."[7] The PLA has developed informatized warfare to apply and integrate its advancements in these warfighting domains. The goal of informatized warfare is to use information dominance and space superiority to deny and disrupt the technological advantages that the U.S. military has been relying on for decades. China seeks to evolve informatized warfare into intelligentized warfare through the further development of advanced technology such as artificial intelligence (AI), improved autonomy of unmanned systems, and more sophisticated space-based capabilities.[8] Intelligentized warfare will rely heavily on AI for faster data collection and manipulation to enable PLA leaders to make faster decisions than their adversaries and give the PLA a significant first mover advantage.

While China will have some advantages, it will be just as strained operating in this vast area, tracking and attempting to target the dispersed JTF units, and controlling its forces with a highly centralized command structure that will use

its technological advancements to exercise greater control over PLA forces. A well-developed, integrated, and equipped JTF could exploit these PLA vulnerabilities to either deter a conflict with China or blunt PLA offensive operations.

Geographic, Environmental, and Infrastructure Challenges

Geographically, the South China Sea is the largest sea in the world, covering an area that is a little bigger than India (1.4 million square miles). Including the East China Sea increases the size to nearly 2 million square miles. Although there are several definitions of the first and second island chains, a graphical depiction of the Department of Defense (DOD) definition is provided below.[9] The first island chain varies in distance from China to as close as 160 kilometers to as far as 1,700 kilometers. The first island chain is approximately 4,989 kilometers long, starting at the southern tip of mainland Japan and running along the South China Sea's eastern and southern borders. The second island chain is roughly 1,996 kilometers east of the first and extends approximately 4,989 kilometers from Japan to Indonesia. For reference, the distance from Los Angeles, California, to the island of Maui in Hawaii is 4,989 kilometers. The distance between the first and second island chains is roughly the distance from Los Angeles to the middle of Texas. In a conflict with China, the PLA would attempt to control an area bigger than India, while the JTF's inside force would be spread across a 4,989-kilometer island chain supported by an outside force more than 1,600 kilometers away. Although the inside force would be concentrated around the sea lines of communication, this is still a vast distance that will create challenges for the JTF and PLA.

The vast distances, tropical weather, limited freshwater, extreme temperatures, and dense vegetation in the first and second island chains will present environmental challenges the JTF must overcome. Addressing these challenges demands careful logistics planning and technological advancement to ensure the personnel in place can be sustained and their equipment is durable enough to withstand these harsh conditions. Complicating the logistics issue further will be the requirement to sustain the force while operating inside the PLA's A2/AD environment. The environmental challenges in this area will stress a JTF's ability to keep the inside force a viable part of the kill webs through low signature logistical sustainment, communications, and execution of fire and maneuver.

Geographically, the JTF faces an asymmetric disadvantage, as the area of responsibility is far closer to mainland China than the continental United States. In a conflict with China, the PLA will benefit from internal lines of communication for sustainment. The United States currently has centralized logistics hubs in Japan and Guam. Instead of relying on these vulnerable hubs for sustainment, the United States is working to disperse its logistics footprint through prepositioned stockpiles of water, food, fuel, and medical supplies. This will allow the JTF to disperse faster in a crisis or conflict and maintain a lower signature, as it will be less dependent on resupply.

Diplomatic agreements and regional infrastructure improvements must be

Map 1. The first and second island chains

Source: *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China, 2010* (Washington, DC: Office of the Secretary of Defense, 2010), 23.

made before prepositioning these stockpiles. Most islands in the area of responsibility are remote, austere locations with limited ports, airfields, roads, and communication networks whose governments prefer to stay neutral in the ongoing U.S./China competition. Diplomatically, the United States is actively working to establish bilateral partnerships with these countries to gain access to their existing infrastructure so that improvements can be made and the United States can begin prepositioning logistics stockpiles in the next 2–3 years. Fortunately for the United States, China's wolf warrior diplomacy and aggressive actions in the area of responsibility have helped the United States gain regional partners. In February 2023, the United States expanded its military involvement with the Philippines by resuming its Enhanced Defense Cooperation Agreement to gain access to four more bases, bringing the total to nine.[10] The Philippines are a critical part of the first island chain. Greater access and partnership with this island state will significantly improve the United States'

ability to establish prepositioned logistics stockpiles and the inside force's ability to deter and blunt the PLA.

China's Regional Capabilities

The South China Sea and East China Sea are China's backyard in which it has developed infrastructure and A2/AD capabilities to give the PLA an advantage. China's strategic actions support its plans to become a regional power and employ informatized warfare. In this area of responsibility, the United States will be fighting on foreign shores, while the PLA will benefit from its regional advantage. Scobell et al. explains that "with a focus on playing the 'home game,' the major tenet of China's 'informatized' strategy is to build capabilities to deny the ability of a powerful state to gain and maintain access to operating areas that hold Chinese interests at risk."[11] In a conflict with the United States, China sees itself as the weaker opponent that must develop and use any capability that denies the U.S. military access to the area of responsibility. Information dominance and space superiority are critical to China's informatized strategy and warfare. As such, the PLA continues developing A2/AD capabilities to "blind and deafen the enemy."[12] For the JTF, this means cutting off individual units' ability to stay in the kill webs. Without the ability to communicate and coordinate, a dispersed force would be rendered ineffective and vulnerable to attack. In the event of a crisis or conflict, the PLA has developed a counterintervention doctrine and supporting A2/AD capabilities to stifle the U.S. military's ability to project power rapidly into, or operate effectively within, the area of responsibility during a conflict.

The PLA has been intently studying the U.S. military since the Gulf War and has developed advanced military capabilities that will challenge the JTF's ability to maintain air, sea, and space superiority in the area of responsibility.[13] Specifically, the PLA has focused on the U.S. military's dependence on space capabilities.[14] As the United States has become more reliant on space to give it a military advantage, the PLA views space capabilities as "not only the glue of the modern integrated battlefield, but also the glue of the modern military power system. . . . Once the space information guarantee is lost, the battlefield will collapse and the war system will also be paralyzed."[15] In the PLA's assessment, U.S. military dependence on space has become a critical vulnerability that the PLA plans to exploit by developing space and counter-space capabilities that will give it an asymmetric advantage on the battlefield.

China is evolving from informatized warfare to intelligentized warfare with the development of more sophisticated technology such as AI.[16] This new type of warfare will help the PLA achieve a fait accompli over the United States by using rapid information processing to provide senior commanders with the best situational awareness for a faster decision-making process. Advanced technology will improve the information and intelligence flow to strategic leaders and increase the speed at which their decisions reach the tactical level. The PLA will be able to react faster to changing conditions on the battlefield and maintain a

faster operational tempo against the United States.[17] Intelligentized warfare will further empower the centralized control senior decision-makers can exert over PLA units.

Taking Advantage of Geography and PLA Weaknesses

Although China has a regional advantage in the South China Sea and East China Sea, it will still have to overcome the same geographic and environmental challenges that the United States and its allies and partners will face. The South China Sea and East China Sea make up a vast area where dispersed units maintaining a low signature can hide inside China's A2/AD environment. The PLA will prioritize identifying, tracking, and targeting the JTF's inside force. Actively searching for low-signature JTF units may come at the cost of revealing the location of PLA capabilities that can be targeted. The JTF can blunt PLA offensive operations by forcing the PLA to expend resources to search for elements of the JTF's inside force. If those elements can coordinate attacks with the outside force or be able to fire, maneuver, and hide again, then the JTF can both blunt PLA offensive operations and deny the PLA's freedom of maneuver in the East China Sea and South China Sea. Given the vast expanse of water in the area of responsibility, the U.S. Navy will play a critical role in blunting PLA operations and denying their freedom of maneuver. The geography and environment will be a challenge that the JTF could turn into an advantage to help maintain the inside force's low signature and help blunt any PLA offensive operation.

Infrastructure within the region will take time to build, yet the United States is making progress. China's wolf warrior diplomacy and aggressive actions with their East China Sea and South China Sea neighbors have done much to help the United States gain and build stronger ties with allies and partners in the region. China wants to be seen as a friendly state that seeks to help other countries through its Belt and Road Initiative (BRI), yet its actions are causing more countries to see China as a threat. The United States should continue highlighting China's aggressive behavior toward its neighbors to increase the number of countries willing to let the United States preposition capabilities within their borders.

In China's efforts to counter the U.S. dependence on space and embrace the concept of informatized warfare, China has created its own dependency on space and information. Using space superiority to gain "information dominance as a means to win on a modern net-centric battlefield is a key pillar of Chinese military strategy. Denying that pillar makes Chinese success unlikely, and the US deterrence strategy should exploit that vulnerability."[18] To deter China from escalating its competition with the United States into conflict, the United States needs to create doubt in the minds of senior PLA and Chinese Communist Party (CCP) leaders: doubt that now is not the right time to initiate a conflict, doubt in the location of U.S. forces, and doubt in the validity of the information being provided to them to make a decision. Degrading the systems that enable informatized warfare, such as space capabilities, and hiding

forces within the area of responsibility will create this doubt that a JTF can use to deter conflict or defeat the PLA.

In the event of a conflict, China is developing a highly centralized command and control system for senior CCP and PLA leaders to exercise control at the tactical level. Given the CCP's control over the PLA, senior CCP leaders will likely be heavily involved in the decision-making process. Intelligentized warfare will prioritize leveraging AI to gain and process intelligence faster than an adversary, so senior CCP and PLA leaders can make decisions faster than their U.S. counterparts. Pursuing advanced technology for the PLA reflects "a system that prefers and gravitates towards centralized military decision-making. However, such a system is prone to becoming overwhelmed and for seniors to reach down and interfere."[19] The PLA command and control system favors control over command. The PLA goal of rapid decision-making could be hampered if the decision-makers are only a select few strategic CCP and PLA leaders who place their faith in AI yet could find themselves overwhelmed and doubting the information their system is presenting them. Strategic leaders making bad tactical decisions within a centralized command and control system creates a strategic and tactical vulnerability that a well-integrated and equipped JTF can exploit.

Marine Corps and Space Force Unique Capabilities and Limitations

The second section of this article will examine Marine Corps and Space Force unique capabilities and limitations specific to USINDOPACOM and the area of responsibility. This analysis is critical to determining how each Service can be integrated into the JTF to defeat PLA capabilities and exploit PLA vulnerabilities. With this understanding, it becomes possible to provide recommendations for what must be done now and in the near future to improve each Service's contributions to the JTF.

With III Marine Expeditionary Force (III MEF), the Marine Corps has 20,000 forward-deployed or permanently stationed personnel primarily in Japan and Guam that could be rapidly deployed throughout the area of responsibility to operate as USINDOPACOM's stand-in forces to deter or counter PLA offensive operations. The stand-in forces would be useful because they "[are] uniquely positioned to enable joint force access and targeting; sense and make sense of the battlefield; and close kill chains, applying lethal fires, when required, to deter or defeat our adversary."[20] III MEF developed the Marine Littoral Regiment to serve as this inside force supporting the inside-out defense. With organic mobility and multidomain capabilities, the Marine Littoral Regiment is the stand-in forces' maneuver element uniquely positioned on the first island chain to enable all-domain JTF operations.

The Marine Corps relies heavily on space capabilities. While its organic ability to conduct fires and effects in the space domain is limited to localized, ground-based jammers, the Marine Corps can still kinetically engage PLA coun-

terspace capabilities. The PLA has developed ground-to-space, space-to-space, and space-to-ground capabilities that threaten U.S. space superiority. This PLA threat necessitates that the Marine Corps integrate with the Space Force, which operates a wide range of capabilities critical to the JTF's ability to conduct all-domain operations without prohibitive interference in the space domain. Space Force elements assigned to the JTF and working in coordination with U.S. Space Command (USSPACECOM) ensure that the JTF maintains space superiority by protecting friendly space assets and denying or degrading any adversary's use of space. As the newest U.S. military Service, the Space Force is the smallest, lacks organic mobility and force protection, and has a small force posture in USINDOPACOM with a recently established Service component headquarters and no ground-based capabilities in what would be the JTF's area of responsibility. The Space Force must be able to integrate its capabilities into the JTF and leverage Marine Corps strengths to improve its support to the JTF.

Marine Corps Unique Capabilities

The Marine Corps is an expeditionary crisis response force prepared to be the stand-in forces in a conflict with the PLA. III MEF is permanently stationed on the first and second island chains inside the reach of the PLA's A2/AD capabilities and supported by forward-deployed units.[21] It is both a deterrent and combat force capable of blunting PLA offensive operations in the event of a conflict. Under Marine Corps direction, III MEF developed the Marine Littoral Regiment to support the JTF as the stand-in forces' maneuver element within the first island chain. The Marine Littoral Regiment will be "mobile, low-signature, persistent in the contact to blunt layers, and relatively easy to maintain and sustain as part of a naval expeditionary force."[22] As one of the JTF's maneuver elements, the Marine Littoral Regiment uses organic mobility and low-signature capabilities to disperse and rely on prestaged logistics to hide within the first island chain's key terrain locations, specifically areas that challenge the PLA's sea lines of communication. From this vantage point, the Marine Littoral Regiment serves as a deterrent force to "contest what Chinese doctrine has identified as necessary prerequisites for conducting a successful military campaign: air superiority, sea control, and information dominance."[23] The Marine Littoral Regiment can coordinate with other elements of the JTF to blunt PLA offensive operations by attacking PLA aircraft and ships. Remaining hidden in key terrain locations allows the Marine Littoral Regiment to prevent the PLA from gaining information dominance and helps create doubt in the minds of Chinese leaders. This doubt could deter a conflict or, at least, give the United States time to prepare for conflict. Even if the Marine Littoral Regiment cannot deter the PLA from escalating a crisis into a conflict, the Marine Littoral Regiment can still delay the PLA long enough for additional elements of the JTF to flow into the area of responsibility and be in a better position of advantage. Should the U.S. strategy of deterring conflict with China fail, the Marine

Littoral Regiment, as III MEF's contribution to the JTF, will at least prevent the PLA from accomplishing a fait accompli of United States, allied, and partner forces in the region.

The Marine Littoral Regiment supports the inside-out defense by being in an established position to rapidly disperse within the first and second island chains and, if needed, deploy to Taiwan before a conflict starts to help the JTF blunt PLA offensive operations. When effectively employed by the JTF, the Marine Littoral Regiment will be the inside force that will continue to attack the PLA and provide the JTF with the ability to conduct operations inside the first island chain. The Marine Littoral Regiment has organic "multi-domain capabilities such as sensors, missiles, and electronic warfare systems" that can "disrupt an adversary's plans at every point on the competition continuum."[24] From key positions in the first island chain, the Marine Littoral Regiment supports JTF kill webs by creating small weapons engagement zones to identify, track, target, and, when needed, engage PLA forces. Another Marine Littoral Regiment mission supporting the inside-out defense will be to "degrade key Chinese systems to create gaps in China's A2/AD networks that outside forces could then exploit."[25] Coordinating operations with outside forces in either a support or supporting role will be critical to blunt PLA efforts to move freely within the area of responsibility and expand operations outside the first island chain. This coordination will also be critical to creating windows of opportunity where the outside force can logistically sustain the inside force with ammunition, food, water, medical supplies, and casualty evacuation. As the JTF's inside force, the Marine Littoral Regiment fills a critical role in deterring China from starting a conflict and denying PLA efforts to decisively defeat the United States should deterrence fail.

Marine Corps Limitations

The Marine Corps is not directly responsible for developing, acquiring, or operating military space capabilities, and it does not have the same level of responsibility for developing and maintaining these capabilities. The Marine Corps has organic capabilities in every warfighting domain, yet its space capabilities are limited to ground-based, localized jammers. To utilize the full range of space capabilities, the Marine Corps uses Marine Space Support Teams and is developing the Marine Corps Information Command to provide space operations expertise to ensure Marine Corps commanders can maximize the data, products, and services space capabilities provide to improve planning, integrating, and coordinating across all warfighting functions. Marines trained in space operations will help the Marine Corps "take full advantage of space-based capabilities in order to increase lethality and survivability"; however, these planners and coordinators are still just requesting the full range of services provided by space-based capabilities from the command or service who owns these assets.[26] For organic access to the full range of space-derived data, products, and services,

the Marine Corps must integrate with the Space Force because "in a conflict with a peer adversary, first moves may be in space and cyber, so we must enable our Stand-in Forces, MEUs, and MEFs to integrate with, and have access to, those capabilities now."[27]

To be an effective inside force that can participate in the JTF's kill web to blunt PLA offensive operations and coordinate operations with the outside force, the Marine Corps must be able to counter the PLA's space capabilities. Maintaining space superiority against China is a critical mission the JTF will have to rely heavily on USSPACECOM to accomplish. While USSPACECOM fights to maintain space superiority, the Marine Corps must be prepared to fight through the degradation of space capabilities and use integrated space capabilities to ensure the JTF gains and maintains space superiority over the PLA.

The degradation or possible loss of space capabilities cannot be the critical component that shuts down the Marine Littoral Regiment's offensive capability. A key component of the inside-out defense will require the Marine Littoral Regiment to establish and maintain operational "bubbles" inside the PLA's A2/AD capabilities that can use a combination of terrestrial- and space-related systems to keep PLA units out of their kill web by denying/degrading the PLA position, navigation, timing, communications, and ability to send and receive intelligence, surveillance, and reconnaissance. Accomplishing this objective will require the Marine Littoral Regiment to be integrated with dedicated Space Force units that can assure the regiment maintains access to the JTF's kill webs via redundant position, navigation, timing, and communication as well as the ability to send and receive intelligence, surveillance, and reconnaissance. This will also be critical to ensuring the Marine Littoral Regiment can maintain its low signature to maneuver and survive on the first island chain and potentially Taiwan. Seamless integration with the Space Force as part of the JTF is the best means of mitigating the Marine Littoral Regiment's risk of fighting the PLA with degraded space capabilities.

Space Force Unique Capabilities

The Space Force develops and maintains a growing range of space capabilities critical to the security and effectiveness of the U.S. military, including space security, combat power projection, space mobility and logistics, information mobility, and space domain awareness. Maintaining space capabilities is important because "space operations preserve freedom of action, enable joint lethality and effectiveness, and provide independent options."[28] Guardians conduct space operations to ensure U.S. military space capabilities can achieve global and local effects. Global effects support strategic objectives. Local effects support operational and tactical objectives. At the operational and tactical level, the goal of the Space Force is to ensure that in a crisis or conflict the JTF can maintain local space superiority and deny or degrade any adversary's use of space capabilities against the JTF. This is critical in a conflict with China. Only by the United States maintaining space superiority within the area of responsibility can it hope

to win in a conflict against the PLA. The Space Force's advanced space capabilities are critical in helping the JTF maintain local space superiority and keeping the Marine Littoral Regiment in the JTF's kill webs. For assured communications, position, navigation, timing, intelligence, surveillance, reconnaissance, and JTF kill web access, the Marine Littoral Regiment will rely heavily on combat power projection, space mobility and logistics, and information mobility.

Considering the U.S. military's dependence on space capabilities, the Space Force is a critical enabler in providing JTF integration across the Services: "As DoD builds superior space forces, it must further develop and enhance the integration of space warfighting doctrine, capabilities, and personnel into national, joint, and combined operations."[29] Guardians are tasked with being "expert integrators and communicators to ensure Joint counterparts in all Services and at all levels understand fast evolving space capabilities and threats, and their operational implications."[30] Although limited in number, guardians leverage their specialized training and control of space capabilities to ensure the joint force maintains space superiority.

In November 2022, the Space Force activated USSPACEFOR-INDOPAC as its first Service component to an overseas combatant command due to the threat that China poses to U.S. space capabilities and the need to quickly integrate guardians into USINDOPACOMs operational and tactical levels. The Space Force's goal is to leverage space capabilities to keep China at the competition level and deter it from escalating to a crisis or conflict. It will accomplish this by avoiding operational surprise and denying the first mover advantage in space.[31] Should deterrence fail, guardians must be well integrated into the JTF to keep a crisis from further escalating and ensure the United States can defeat the PLA. USSPACEFOR-INDOPAC is the first step toward further guardian integration with the other Indo-Pacific units focusing on deterring or defeating China.

Space Force Limitations

Compared to the other U.S. military Services, the Space Force is the smallest, lacks organic mobility and force protection, and has a small presence in USINDOPACOM with no assigned capabilities. The Space Force's projected size is 16,000, with about one-half being uniformed personnel.[32] By comparison, III MEF has 20,000 uniformed personnel assigned. The Space Force supports global and local requirements with a smaller force than the current Marine Corps forces on the first and second island chains. Each Service has space subject matter experts that support space planning, coordination, and training efforts, yet the Space Force will still be challenged to have a presence within each combatant command below the strategic and operational level. The Space Force must continue to be deliberate in where it decides to place its personnel and assets so that they can be directly tied into a combatant command's operational and tactical level.

Without organic mobility and force protection, guardians must be assigned

to units with these organic capabilities. For mobility, the Space Force must compete with the other Services for U.S. Transportation Command assets. Based on the build-up of forces that the United States anticipates needing to deter a crisis with China from escalating to a conflict, the Space Force will face strong competition from the other Services to get to the area of responsibility. Should a conflict arise, it will be extremely difficult to continue flowing forces into the first island chain due to the PLA's A2/AD capabilities and the vulnerability of large transport aircraft and ships. Regarding force protection, the Air Force provides the Space Force with this capability as a base support function. If deployed, guardians must rely on another Service to provide force protection. Since the Space Force will likely not have organic mobility and force protection based on its mission set, guardians must be assigned, in either a support or supporting role, to a unit with these capabilities. The Marine Corps, with its Marine Littoral Regiment, can provide mobility and protection.

Creating USSPACEFOR-INDOPAC is a good step toward integrating guardians into every level of USINDOPACOM; however, it currently consists of a headquarters unit in Hawaii, providing operational level support, and a component field command, U.S. Space Forces Korea (USSPACEFORKOR), assigned to U.S. Forces Korea. Unlike the other Services, USSPACEFOR-INDOPAC has no presence on the first or second island chain and no service-specific capabilities assigned. There is currently no direct coordination between the Space Force and those U.S., allied, and partner forces on the first and second island chain. If needed for deterrence or conflict, the Space Force must identify and source units from the United States to move into the area of responsibility. The first time a guardian steps foot in the area of responsibility should not be as a JTF attempts to deter crisis escalation or blunt PLA offensive operations.

If a JTF needs an assigned space-based capability, it must request and be allocated that capability from the Space Force. JTF requests for desired space effects would go to USSPACECOM for approval. A JTF unfamiliar with controlling and employing those ground-based space capabilities that could be deployed into the area of responsibility will face challenges in seamlessly integrating those capabilities and effects with the rest of the force and using them to support the inside-out defense. If the guardians' goal is to ensure the U.S. military maintains space superiority against China and deters China from escalating beyond competition, then the Space Force must integrate its personnel and capabilities into the JTF and leverage existing Marine Corps strengths.

Recommendations for Marine Corps/Space Force JTF Integration Now and in the Near Future

The third and final section of this article will provide recommendations for how the Marine Corps and Space Force can be integrated into the JTF structure now and what must be done in the next two to three years to improve their roles within a lethal JTF package. The goal is to ensure that the Marines and guardians can leverage each other's unique capabilities to maneuver, execute

multidomain fires, and survive inside the PLA's A2/AD capabilities. These recommendations will help the JTF overcome the challenges of operating in the area of responsibility against the PLA. Building a JTF structure and package is a complex task in which the responsibility falls on the combatant command. Having to hastily assemble a JTF in response to a crisis or conflict presents a significant risk due to lost time building such an organization and the inability to exercise it prior to execution. The PLA would exploit this risk to its advantage. Having a JTF structure and package in place will help USINDOPACOM mitigate the risk it will face should it have to quickly transition from competition with China to crisis or conflict.

A JTF structure is a permanent military organization that ties strategic objectives to operational planning. It establishes integration and support/supporting relationships among the various service components by defining hierarchies and authorities. The JTF structure also determines which capabilities need to be in place. The Space Force has no presence and no ground-based space control capabilities in the first or second island chain. As such, USINDOPACOM must determine which guardian capabilities it will need and how to get those capabilities and effects into, and assigned to, the area of operations. For a JTF structure integrating the Marines and guardians, USINDOPACOM must clearly define command relationships and authorities and identify needed Space Force personnel and space-based capabilities. The U.S. military must begin developing a joint space doctrine that expands on the current *Space Operations*, Joint Publication 3-14, and adds a section on maritime and littoral operations.

Once USINDOPACOM establishes a JTF structure, it can begin developing a JTF package. Based on the JTF structure, a JTF package is a temporary group of units tailored to a specific mission. Within the JTF package, the supporting and supported relationships are more clearly defined. A JTF package could be used to blunt PLA offensive operations or respond to a crisis with the mission of deterring it from escalating into conflict. To accomplish its assigned mission, the JTF package must be capable of maneuvering, executing multidomain fires, and surviving against the PLA. In the next few years, the U.S. military must place Space Force personnel and ground-based capabilities where they can be most effective in the area of responsibility, assign ground-based capabilities to USINDOPACOM, and make technological improvements that support JTF units' ability to stay in the kill webs, maintain a low signature, and survive through maneuver and logistical sustainment.

Recommendations for a JTF Structure

USINDOPACOM is responsible for organizing the JTF structure according to a clearly defined mission and set objectives, required capabilities, and threat assessment. The JTF structure includes a range of capabilities and personnel. It is designed to respond to a wide range of missions and challenges with clearly understood hierarchies and the required authorities to execute kinetic and nonkinetic fires. When developing a JTF structure, the focus should be on

establishing a more comprehensive organization that is flexible enough to respond to a wide range of missions and challenges, from deterring conflict escalation to blunting PLA offensive operations. The JTF structure should establish the framework for building a JTF package assigned to a specific mission.

Establishing Command Relationships and Authorities

Since the JTF will rely heavily on space capabilities and may be required to conduct space control operations to maintain space superiority, "[c]learly defined command relationships are crucial for ensuring timely and effective execution of space operations in support of combatant commander (CCDR) objectives."[33] Command relationships establish the main effort and supporting efforts as determined by the mission and objectives. They allow the JTF commander to execute mission command. Integration among the different services and allies and partners starts with command relationships, or hierarchies, by defining the supporting and supported relationships. The JTF structure would establish these supported or supporting relationships within the various elements of the JTF, preferably based on functional lines. Once codified, the JTF structure is a place to begin planning and tailoring the JTF for a specific mission; however, command relationships can be adjusted accordingly based on the mission and set objectives. Initial command relationships must first be defined within the JTF structure to help reduce the time required to plan, build, and establish a JTF. If a predicted crisis or conflict with China is imminent, then USINDOPACOM needs an effective JTF that can be quickly stood up today. This will help deter the PLA from escalating a crisis into conflict and, should conflict arise, prevent China from successfully executing a fait accompli in a potential conflict.

The JTF structure must also establish authorities for executing kinetic and nonkinetic fires. Every element and commander within the JTF must understand their allocated authorities. In a conflict over Taiwan, those appropriately delegated authorities should account for the challenges the JTF will face, including maintaining space superiority. Authorities should be established so a unit can continue executing its mission, even if the PLA temporarily cuts it off from the JTF's kill webs. Quickly executing missions at the tactical level while possibly cut off from higher headquarters can only be accomplished if the JTF structure establishes standing rules of engagement and predesignated, developed, and approved target lists with specific preapproved fires authorities. In a conflict, authority to execute these fires based on standing rules of engagement must get pushed down to lower levels to allow tactical units to quickly respond to changing situations on the battlefield. Authorities must be deliberately planned and preestablished within the JTF structure prior to mission execution.

Unlike previous conflicts involving the U.S. military, the JTF's space superiority may not be guaranteed, and elements of the JTF may only have windows of space superiority with which to execute a mission. The Marine Littoral Regiment, as part of the JTF's inside force, should be able to use or receive timely approval to coordinate the use of space-based capabilities deliv-

ering terrestrial effects that support the Marine Littoral Regiment's ability to conduct fire and maneuver. Presently, the approval authority for employing space-based capabilities is at the National Command Authority or the commander of USSPACECOM. USINDOPACOM can delegate space coordinating authority and has planning teams and coordination cells to help prioritize space support requests. USSPACECOM will likely maintain operational and tactical control of space-based capabilities for the duration of any conflict. The Marine Littoral Regiment can still quickly execute a complex mission involving ground-based space capabilities if integrated with a guardian unit that has access to space-derived data, products, and services that can support the regiment.

Identify Space Force Personnel and Capabilities to be Assigned to JTF

Employing Space Force units within a JTF structure will be challenging, as none are forward deployed or permanently stationed within the area of responsibility. USINDOPACOM must identify the capabilities it will need in a JTF structure, coordinate with the Space Force for those capabilities, and determine how to move those personnel and associated equipment into the AOR. Marines will integrate with guardians in accordance with the JTF structure's established command relationships and authorities, but the Space Force will first need to get to the area of responsibility. Based on the current disposition of the Space Force, those guardians would have to be sourced from the United States. To get an effective JTF in place now, Space Force will need to permanently base those personnel and equipment in the area of responsibility as soon as possible. Once identified, those units must begin integrating with other Services at the operational and tactical levels. For the Marine Corps, the operational level will be III MEF and the tactical level will be the Marine Littoral Regiment and 31st Marine Expeditionary Unit (31st MEU). Space Force planners should work directly with III MEF to begin coordinating space-based effects into the operational and tactical level to support the inside force. Guardian units must also begin working with the other U.S. Services and regional allies and partners to conduct joint exercises and gain familiarity with the local area. The first time a guardian assigned to the JTF steps foot on the first island chain and begins integrating with their fellow joint partners should not be as the JTF is being stood up to respond to a crisis or conflict. The JTF commander will be accepting a high amount of risk if the many JTF units cannot integrate, train with, and exercise their capabilities prior to execution.

USINDOPACOM must also determine which planning and operational cells must be augmented with additional personnel. Due to the Space Force's small size, space planners and subject matter experts must be brought in from other Services. To be adequately represented, the Marine Corps must send some of its space subject matter experts to the JTF headquarters and USINDOPACOM. The Space Force must have representation at the JTF headquarters and maintain its existing headquarters footprint within

USSPACEFOR-INDOPAC. Given the importance of maintaining space superiority, each Service must have space subject matter experts well-represented and appropriately placed within the strategic and operational levels.

Dedicating ground-based space capabilities and assigning guardian units to be permanently stationed in the area of responsibility and others that can rapidly deploy as needed to support a China-focused JTF are temporary solutions that should be considered now.

Update Existing Joint Space Doctrine

To help connect the JTF's operational plan for using space capabilities to support tactical execution, the U.S. military must develop a Joint space doctrine that updates the current *Space Operations*, Joint Publication 3-14, and expands on it by adding a new section on maritime and littoral operations. Considering the key role that naval forces will play in an area of responsibility largely defined by islands, JTF planners must be able to draw on a doctrine that coordinates space operations with maritime and littoral activities. By October 2024, the U.S. military should have working groups assigned to updating the Joint space doctrine. Additionally, the Marine Corps must sponsor a collaborative work with the Navy and Space Force to develop a new section of the Joint space doctrine focused on maritime and littoral operations.

Doctrine guides the development plans that can be used to establish tactics, techniques, and procedures. This doctrine should be applied to not only the Marine Corps and Space Force integration but also the guardian's integration with the other Services. All U.S. Service components and U.S. allies and partners have become heavily reliant on space assets. As such, "[t]he joint force must be capable of integrating military space operations as part of joint operations, be capable of defending the space assets that are critical enablers of joint operations and deny adversary benefits from their space capabilities."[34] An updated Joint space doctrine will provide a starting point for planners to better integrate military space operations into the JTF structure and develop missions that attack the PLA's space capabilities. The functional components of the JTF will use space capabilities to conduct all-domain operations against the PLA.

Updating the Joint space doctrine would also lay the groundwork for how other Services would support the Space Force. For the Marine Corps, this would provide initial guidance toward supporting guardians with organic mobility, logistical sustainment, and force protection. Supporting the Space Force should not be unique to each Service. To improve integration into the JTF structure, the Space Force should receive comparable, multilateral support from each Service. Supporting space operations and having space superiority contested are new problems for the U.S. military that must be accounted for when developing a JTF structure. A more inclusive Joint space doctrine will provide a starting position for the JTF structure to successfully connect operational plans to tactical execution so that the JTF can maintain space superiority and deny or degrade PLA space capabilities.

Summary

A JTF structure in USINDOPACOM must account for the challenges of operating in the area of responsibility and against the PLA. China will seek to counter the JTF's traditional reliance on space to prevent U.S. forces from maintaining space superiority. Should China escalate its current competition with the United States to a crisis or conflict in relation to Taiwan, the United States will face risk as it attempts to transition out of competition. Having a JTF structure in place now with supporting doctrines, clear command relationships and authorities, and identified ground-based space capabilities with plans to assign forces and move them to (or preposition in) the area of responsibility will help mitigate this risk. With a JTF structure in place, the Marine Corps and Space Force can further integrate their unique capabilities to improve the JTF's lethality and combat effectiveness.

Once USINDOPACOM establishes a JTF structure, it must ensure that JTF personnel are properly trained and equipped to perform their roles. The JTF structure must be tested and utilized in wargames and exercises to include the application of an updated Joint space doctrine. An untested JTF with improvised doctrine reacting to a PLA crisis or conflict will struggle to regain and maintain the initiative. As the operational environment changes, it will be necessary for USINDOPACOM to review and refine the JTF structure to ensure that it remains combat effective. By constantly reassessing the mission and objectives, adjusting the capabilities, and making changes to the organization and training of the joint force, the United States may be able to deter China from escalating beyond competition and, if deterrence fails, be able to rapidly respond to any PLA-initiated event.

Recommendations for a JTF Package in the Near Future

An established JTF structure enables the creation of a JTF package tailored to a specific mission. The near future recommendations for a JTF package will expand on the previous section's discussion of what the JTF structure needs now. These near future recommendations are what the U.S. military must do in the next few years to ensure it can rapidly transition out of competition with China to carry out any mission against the PLA while maintaining space superiority. Once Space Force personnel and ground-based space capabilities, and space-derived data, products, and services have been identified for inclusion in the JTF structure, the next step is forward deploying or permanently stationing those assets to where they can be most effective on the first or second island chain.

The mission of maintaining U.S. space superiority will largely fall on USSPACECOM. In the near future, USSPACECOM must determine what it needs to maintain this strategic capability and the priority of support it can provide to the JTF in the form of space-derived data, products, and services.

For the JTF package to be able to maneuver, execute multidomain fires, and survive, units within the JTF require capabilities that keep them in the kill webs, provide organic long-range sensing and shooting, and maintain a

low signature while conducting maneuver and logistical sustainment. Implementing these near future recommendations will improve the ability of the Marine Corps and Space Force within the JTF to deny or degrade China's ability to successfully conduct informatized warfare. The U.S. military must increase Space Force ground-based space presence in USINDOPACOM and provide technological improvements to ensure JTF units can stay in the kill webs, survive inside the PLA's A2/AD threat ring, and deny the PLA's ability to maintain information dominance.

Placing Space Force Personnel and Ground-Based Capabilities on the First or Second Island Chains

Deploying Space Force personnel and their organic ground-based capabilities to the JTF's area of responsibility will consume valuable transportation resources and limit other Services' ability to flow forces into the area of responsibility to augment their existing capabilities within the first and second island chains. Depending on these guardian units' level of mobilization, it could take a week to more than a month to move them into the area of responsibility. USINDOPACOM needs to identify which Space Force personnel and capabilities will be needed to support the JTF so that they can begin training with other units in the area of responsibility is a good first step. The next step is to place these Space Force personnel and capabilities in the area of responsibility, where they will be in the best position to be quickly assigned and begin operating as a critical component to the JTF. If they are already in the area of responsibility, the Space Force will greatly assist the JTF's ability to rapidly transition from competition to crisis or conflict. Instead of waiting for transportation from the United States, guardians can use III MEF's organic mobility to rapidly deploy in support of the JTF package.

USSPACEFOR-INDOPACOM engages USINDOPACOM headquarters at the operational level. With an established permanent presence in the area of responsibility the Space Force will be better integrated with those first and second island chain units at the operational and tactical levels. This will allow guardians to gain greater familiarity with the area of responsibility's geographic challenges and better integrate with the other USINDOPACOM forces and U.S. regional allies and partners. Guardians can also partner with Marines to begin prepositioning logistics throughout the area of responsibility to improve the Space Force's ability to conduct rapid deployment and sustainment. If the U.S. military wants to maintain space superiority against the PLA, then it must add the Space Force to its long list of military personnel and capabilities already present in the area of responsibility.

Ensuring USSPACECOM Can Maintain Space Superiority

USSPACECOM must identify the space-based capabilities it needs to maintain space superiority and counter PLA attempts to deny, degrade, and disrupt those capabilities. Satellites often contain several space-based capabilities that

support multiple areas of responsibility, combatant commands, and U.S. government agencies. A conflict with China could impact U.S. space assets supporting other strategic missions. USSPACECOM must continue to advocate for a U.S. space architecture that is redundant enough to absorb the loss of satellites and resilient to withstand certain kinetic and nonkinetic attacks. In addition, USSPACECOM should work with USINDOPACOM to determine which space-derived data, products, and services may be prioritized to best support the JTF.

Depending on the nature of the crisis or conflict, the JTF could play a role in supporting USSPACECOM's mission to maintain space superiority through kinetically striking PLA space capabilities or using assigned ground-based space capabilities. This will require coordination through the JTF's assigned Space Force elements. If that coordination is not rehearsed prior to a conflict, then the higher risk of failure could be disastrous for both the JTF and the United States.

Technological Advancements to Support the JTF

The U.S. military must continue to advance technology that denies China's ability to conduct informatized warfare and enables the JTF package to remain in the kill webs while maneuvering, executing multidomain fires, and surviving within the reach of the PLA's A2/AD capabilities. With informatized warfare, China will strive to use its multidomain intelligence, surveillance, and reconnaissance capabilities to gain higher fidelity information faster than the United States so that the PLA can maintain a faster operational tempo and outpace the JTF's decision-making. Senior CCP and PLA leaders want to use informatized warfare to gain information dominance, so they can know where JTF units are located and quickly employ PLA forces against them. A JTF package can counter China's critical demand for information dominance by using space control to jam, deceive, deny, and disrupt PLA intelligence, surveillance, and reconnaissance. A well-integrated Marine and guardian force could apply these capabilities to create gaps within the PLA's A2/AD environment and inject doubt among senior CCP and PLA leaders concerning the fidelity of the information their system is providing them. This would slow down the PLA's decision-making ability and force the PLA to expend time and resources on attempting to regain information dominance. Denying China's ability to effectively conduct informatized warfare will allow the JTF to either deter China from escalating a crisis into a conflict or blunt China's offensive operations.

The U.S. military's continuing development of Joint all-domain command and control (JADC2) will improve the JTF's ability to communicate and attack PLA forces. Once operational, JADC2 will eliminate gaps in existing communication networks by linking multiple platforms across the area of responsibility. The goal is to flatten kill webs so that the JTF's network of sensors, communication nodes, and weapons can seamlessly connect. JADC2 will not only improve the integration between the Marine Corps and Space Force but also between the other Services, U.S. allies, and partners.

To defeat the United States, China will use the PLA's multidomain capabilities to identify and remove JTF units from the kill webs. Whether through kinetic or nonkinetic means, isolating a JTF unit will weaken the JTF package. To prevent the PLA from isolating a JTF unit, the U.S. military must advance capabilities such as JADC2 that assure communication and position, navigation, and timing to improve the JTF's ability to sense and shoot and allow units to maintain a low signature during maneuver and sustainment. For communication and position, navigation, and timing, the JTF needs redundant ground- and space-based capabilities to support a unit's primary, alternate, contingency, and emergency plan for staying in the kill webs. Critical space-based capabilities, such as satellite communications and GPS, must have alternative terrestrial-based land, sea, and air capabilities that could be fulfilled by unmanned systems. The U.S. military's space architecture augmented with access to commercial and allies' space-based capabilities should be resilient enough to withstand an attack and have enough redundant capabilities to ensure that the loss of a satellite does not permanently degrade or deny the JTF access to space-derived data, products, and services. If space-based communication and position, navigation, and timing are temporarily lost, then the JTF should be able to rely on terrestrial-based capabilities. The Space Force's role in supporting the JTF should be to guarantee space-based communication and position, navigation, and timing. If lost, then the JTF should have access to alternative terrestrial-based communications and position, navigation, and timing. Based on China's understanding of the U.S. military, the PLA's primary mission will be to deny or degrade the JTF's access to space-based capabilities. A JTF package can continue to communicate and use position, navigation, and timing if the United States develops redundant and resilient space-based capabilities that can withstand attacks and have terrestrial-based backup capabilities.

An improved, organic ability to sense and shoot will give the JTF a longer range to find, fix, track, target, engage, and assess the PLA. The JTF's inside force will consist of units varying in size from fire teams to companies spread across the first island chain. A longer-range, organic ability to fix, track, target, engage, and assess using kinetic or nonkinetic capabilities will allow the JTF units to support each other as required with overlapping fields of fire. Improvements to ground-based directed energy lasers would allow Marines to support guardians by delivering nonkinetic effects against PLA space-based capabilities in low Earth orbit. Being able to temporarily blind a low Earth orbit satellite would allow the JTF to help USSPACECOM maintain space superiority, create needed gaps in China's A2/AD capabilities, and remove a critical pillar in the PLA's efforts for informatized warfare.

To maintain a low signature, the inside force should primarily act as the sensor for coordinating attacks with the outside force executing strikes against the PLA. The Space Force and Marine Corps can already assist each other by providing greater access to multidomain sensors. This can be further improved by developing a sensor network as part of the JTF kill webs. A multidomain

sensor network is resilient enough to tolerate the temporary or permanent loss of several sensors and still support the ability of guardians and Marines to gain and maintain custody of targets and assure the JTF's ability to deliver effective kinetic and nonkinetic fires. Having a resilient and redundant sensor network integrated into the JTF's kill webs would improve the JTF's ability to deny PLA efforts at information dominance and blunt PLA operations through well-coordinated kinetic and nonkinetic effects.

Maintaining a low signature will also be critical for survivability, specifically for the inside force. Even if units can maintain a low signature while communicating, sensing, and shooting, they will still need to survive with logistical sustainment and the ability to quickly maneuver to avoid detection. This ability will be necessary for any inside force that employs kinetic or nonkinetic fires. Currently, the Marine Corps identifies logistics as the pacing function for its stand-in forces' operations. Logistics sustainment will require the same level of coordination between the inside and outside forces as is required for conducting strikes. Prepositioned logistics will help, but these supplies cannot last indefinitely. Additionally, it is doubtful that host countries will accept, and the U.S. military will allow, the prepositioning of lethal munitions and possibly nonlethal capabilities.

The Navy is developing small, low-signature craft for local littoral mobility. The Marine Corps is working to develop "resilient logistics webs in a contested environment with multiple options for support, to include distribution networks, and multi-domain delivery methods."[35] Safely maneuvering in the area of responsibility will be critical to the JTF's success. The maneuver force must improve on camouflage, concealment, and deception to help mask logistics movements and ensure that maneuvering forces remain hidden. If an element of the JTF's inside force must fire, maneuver, or be resupplied, it will face a higher risk of being discovered and fired upon by the PLA's A2/AD capabilities. In a protracted war of attrition, the JTF cannot afford to lose every unit that fires on the PLA as the PLA has a large force that can endure greater losses. The JTF package must survive and defeat China by continuously striking the PLA, constantly maneuvering to avoid detection, and logistically sustaining a large force spread out over a vast area.

Summary

Assembling a JTF package is the next step following the establishment of a JTF structure. Once these organizations are in place, the U.S. military can better rapidly transition from competition with China to crisis or conflict. The JTF package and associated recommendations build on what the JTF structure needs now. In the near future, the Space Force must permanently station personnel and organic capabilities on the first or second island chains where they can best integrate with the other Services that are already present. This will put guardians in a better physical location to be rapidly assigned to a JTF package and rely on the JTF's organic mobility to maneuver with Marines against

the PLA. Assigning ground-based space capabilities to USINDOPACOM will shorten the kill chain and support the Space Force in employing its full range of capabilities to ensure the JTF can help USSPACECOM maintain space superiority.

The U.S. military is funding the research and development of capabilities to counter China's efforts at informatized warfare. As the U.S. military progresses with developing near-term capabilities for the JTF package, it should do so with a single-minded focus on providing the warfighters on the first and second island chains guaranteed access to the JTF's all-domain capabilities to defeat the PLA. JADC2 and other emerging technologies must improve the JTF's ability to remain in the kill webs while maneuvering, executing multidomain fires, and surviving within the PLA's A2/AD environment. Since the PLA can contest the United States in every warfighting domain, a JTF package needs redundant and resilient all-domain capabilities. In particular, JTF units must be able to operate without assured space superiority, but at the same time have the means to ensure the JTF can help the United States and U.S. allies and partners regain space superiority. Preventing China from achieving space superiority in a conflict will hinder China's ability to effectively execute informatized warfare. As critical elements of the JTF package, the Marine Corps and Space Force must be trained and equipped to help the JTF maintain and, if needed, regain space superiority.

Conclusion

Deterring China and preparing the U.S. military to defeat the PLA in a conflict is a wicked problem that the United States is focused on solving. The area of responsibility discussed in this article is a vast geographic area with environmental challenges and limited infrastructure that will make it difficult for both the U.S. military and the PLA. China's aggressive action in the region has helped the United States improve bilateral agreements with regional partners. The U.S. military recently gained access to key locations in the Philippines, which will significantly help preposition logistical supplies for the JTF's inside force. Despite the United States improving relations with regional partners, China still has advantages in the area of responsibility due to its formidable A2/AD capabilities. China is advancing technology that will further support informatized warfare, deny or degrade U.S. space superiority within the area of responsibility, and give senior CCP and PLA leaders the ability to make decisions to rival their U.S. counterparts. China's reliance on information dominance and a command structure that enables senior leaders to make decisions creates a vulnerability that a well-integrated and equipped JTF could exploit.

As critical force providers of the JTF, the Marine Corps and Space Force have unique capabilities that, when integrated, cover the gaps created by their limitations. The Marine Corps is strategically positioned on the first island chain to be the JTF's inside force. The Service has all-domain capabilities, but its space capabilities are limited to localized ground-based jammers. The Space

Force has organic ground- and space-based capabilities to ensure the JTF's access to the space domain. Guardians lack organic mobility and force protection, which the Marines can provide if tasked. The Space Force currently has a limited permanent presence in the USINDOPACOM area of responsibility. For a JTF to have all-domain capabilities supported by all the Services, the assigned Space Force units would have to be rapidly flown into the area of responsibility if they were not permanently stationed or deployed there.

To help the United States rapidly transition from competition with China to crisis or conflict, USINDOPACOM must have a JTF structure in place that can be used to develop a JTF package assigned to a specific mission. For a JTF structure to be in place now, USINDOPACOM must establish clear hierarchies and authorities. The Space Force must identify which personnel and capabilities will be provided to the JTF, and the U.S. military must update its existing Joint space doctrine to include adding a section on maritime and littoral operations. This will improve the integration between the Marine Corps and Space Force at the strategic, operational, and tactical levels so that they can apply their unique capabilities to deter or defeat the PLA. In the near future, the JTF package must draw on Space Force personnel and capabilities already assigned to USINDOPACOM and permanently stationed in the area of responsibility. The U.S. military must advance technology that supports individual JTF units' ability blunt PLA offensive operations by remaining in the kill webs, executing long-range sensing and shooting, and using low signature mobility for maneuver and logistical sustainment. These near future recommendations will allow the JTF package to rapidly deploy a well-integrated Marine Corps and Space Force team that can exploit China's vulnerability and deny its plans for informatized warfare by maneuvering, executing multidomain fires, and surviving inside the PLA's A2/AD capabilities.

Deterring China and defeating the PLA in an area of responsibility in which it has advantages over the U.S. military is not impossible, but it will require a great deal of effort. Maintaining, regaining, and possibly operating without space superiority is something that the modern U.S. military has never had to face with an adversary. Space superiority will be critical to ensuring the JTF can operate in this vast area of responsibility, remain in kill webs, and keep the PRC from successfully executing informatized warfare. The U.S. military must provide the JTF with everything it needs to succeed and survive inside the reach of the PLA's highly sophisticated A2/AD capabilities. As critical components of the JTF, the Marines and guardians must be seamlessly integrated before employment and have organic capabilities that can keep them alive while still constantly attacking the PLA in every domain. Additionally, these capabilities, command relationships, and authorities must be routinely exercised and practiced. The cost of not preparing and equipping the JTF and its Service components for conflict will be the rapid and unacceptable loss of U.S. personnel and capabilities within the region.

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A Call for Space-Domain Intelligence Training

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Abstract: U.S. Space Force intelligence initial skills training (IST) currently occurs via U.S. Air Force pipelines. However, as the Space Force matures, it must take ownership of its training programs. Consolidating guardian intelligence initial skills training under the purview of the newest Service fosters a critical space-domain focused mindset and guardian culture at the outset of a member's career.

Keywords: U.S. Space Force, space domain, intelligence, training, culture, identity

Introduction

The U.S. Space Force's intelligence initial skills training takes place at Goodfellow Air Force Base (AFB) using U.S. Air Force curriculum. This training instills fundamental analytic skills, but operationally focuses on the air domain versus space domain. As a result, intelligence guardians graduate intelligence skills training without a critical baseline knowledge of the contested, degraded, and operationally limited space environment.[1] To remedy this disconnect, guardian intelligence training must be divorced from Air Force intelligence training. A stand-alone Space Force intelligence pipeline will drive cultural and operational advantages crucial to the long-term success of the nation's youngest Service.

Scope

This research focuses on intelligence skills training, which is a guardian's first

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introduction to career-field-specific training and takes place immediately after basic military training (BMT). While BMT is central to military cultural indoctrination, it is outside the scope of this article. The Space Force will likely continue to leverage Air Force basic military training for the foreseeable future; this work instead seeks to influence dedicated Space Force training pipelines following BMT.

The Space Force currently sends new accessions (primarily second lieutenants and specialists) to separate cyber, space, and intelligence skills training "technical schools." Any changes to intelligence training due to a space-domain focused approach should inform curriculum development across all Space Force career fields. Future analysis is necessary to refine intermediate and advanced intelligence training as well.

Roadmap and Methodology

This research examines the current state of intelligence skills training for guardians and why it must evolve. Culture ultimately lies at the heart of the argument for a separate, space-focused intelligence training pipeline. Historical Army Air Corps and Marine Corps case studies offer additional evidence for this radical shift in training.

Background

Space Force initial skills training occurs separately among the Service's three primary operational career fields: space operations, intelligence, and cyber. Space operations training occurs at Vandenberg Space Force Base (SFB) in California, intelligence training at Goodfellow Air Force Base (AFB) in Texas, and cyber training at Keesler AFB in Mississippi.[2] Both intelligence and cyber personnel attend Air Force technical schools, providing trainees with a complete immersion in an air-centric training environment. The disparate foundational culture instilled in Space Force intelligence members due to their attendance at an Air Force technical school poses a challenge for Space Force leadership. A unique space culture should be instilled in new servicemembers, with intelligence skills training offering a critical opportunity early in a guardian's career.

After basic military training, initial skills training (IST) further develops a military mindset, lexicon, and belief system for both officer and enlisted trainees.[3] Intelligence guardians attend initial skills training for approximately six months.[4] Some students later attend additional specialized cryptologic training at Corry Station, Florida.[5] Overall, students obtain approximately two hours' worth of space-related training material during the entirety of their IST experience.[6] Most of this training is executed at the unclassified level, offering only basic, definition-based instruction.[7] The current curriculum teaches traditional analysis skills using the air domain but fails to prepare intelligence professionals for the contested, degraded, and operationally limited space environment.[8]

As part of initial skills training, intelligence guardians attend several separate courses in support of various intelligence occupational specialties.[9] Student

numbers range from 1 to 4 guardians per class, integrated with approximately 12–16 airmen (varying greatly depending on course).[10] This classroom dynamic falls short of providing meaningful attention to space-related topics or building a space-centric mindset. Interaction with other guardian students during IST, or even permanent party Space Force members, is sporadic at best while intelligence guardians are at Goodfellow AFB. After basic military training, initial skills training is arguably the most impactful experience of a new guardian's career, and it is here that the Space Force must solidify the foundation for guardian culture and identity.

Argument

Transitioning intelligence IST from the Air Force to the Space Force facilitates a shared experience among Space Force trainees, again solidifying a cultural foundation first initiated in basic military training. Edgar H. Schein, author and leading expert in organizational culture, offers a worthwhile framework for how the Space Force can continue to foster a "space culture" in initial skills training. This cultural framework drives the argument for separating guardian IST from the Air Force. Currently, intelligence guardians study and focus on air-centric processes and threats. While this training is invaluable in teaching a student to think like an intelligence professional, students graduate technical school with a severe lack of baseline space knowledge.

Cultural Context

The classic definition of organizational culture, set forth by founding expert Edgar Schein, provides a valuable lens through which IST culture can be examined.[11] Schein defines organizational culture as the "accumulated shared learning" of a group of individuals, established as they collectively work through challenges of "external adaptation" and "internal integration."[12] Their shared learning involves a "system of beliefs, values and behavioral norms" validated over time.[13] Through this validation, the system of beliefs evolves into "basic assumptions," which the organization then teaches to new group members.[14] Schein's definition offers a valuable framework for analysis, emphasizing shared learning, internal integration, and cultural DNA.

Schein identifies shared learning as the first key factor in organizational culture. It takes time for shared learning to accumulate and, thus, for a shared culture to develop.[15] The Space Force is in the earliest stages of this development process. Guardians must establish space-mindedness across their occupational specialties, including the intelligence career field, before a cohesive culture can take root. The current construct for initial skills training robs the Space Force of a vital opportunity to foster the distinct Service-wide culture it seeks to establish.

Shared learning can instill a common space-mindedness in IST trainees. The Space Force captures the need for a shared space-mindedness in its *Space Capstone Publication*, which charges guardians to focus on space's unique ap-

plication and value.[16] In this seminal publication, the Space Force calls on servicemembers to "protect, defend, and project US spacepower."[17] To this end, guardians must pursue the science of warfighting and the art of mastering space.[18] This unique, space-centric blend of science and art provides the foundation for the Space Force's purpose, identity, and culture. The Space Force is the sole authority for cultivating a unique combat-ready service for the space domain, and guardians alone must answer this call.[19] The earlier in their career that intelligence guardians embrace this charge, the better they can support and integrate into the broader space domain. A lack of shared learning steeped in the knowledge of space prevents intelligence personnel from fully answering the charge set forth in the *Space Capstone Publication* to all servicemembers.

Current IST architecture denies intelligence guardians a critical opportunity for shared foundational, space-focused learning with other guardian trainees. This situation impedes the development of Space Force organizational culture because shared learning is considered the essential component of organizational culture's definition.[20] Shared learning results from collective education, time dedicated to a group's common experience, and leadership involvement.[21] By definition, shared learning must take place together. As intelligence and space operator trainees execute initial skills training separately, intelligence students immersed in an air-centric versus space-centric environment embody an Air Force culture after completing their training instead of a Space Force one. Intelligence guardians lack an opportunity for shared learning with their space counterparts until they reach their first operational units. Thus, the Space Force misses a vital opportunity early in intelligence training to establish true space-mindedness. This mindset is critical for the successful execution of space operations and is different from the air-mindedness instilled in them via their Air Force training.

Based on Schein's definition, internal integration is the second key factor that drives organizational culture. After the shared experience of learning drives initial cohesion and a common identity, the group stabilizes and builds on this foundation.[22] Identity further influences "internal integration," shaping how the organization views itself.[23] Once a culture forms through the inculcation of identity, the group passes its culture on to new members. However, much of what an organization learns is passed down only through direct membership and firsthand experience.[24]

Intelligence trainees presently are denied "direct membership" to the space community due to their disparate training location, and lack firsthand space experience in intelligence skills training, two crucial factors to their integration with space operators. Schein argues that learning predominantly takes place as a member becomes a part of a group's "inner circle."[25] The Space Force risks alienating nonspace operator career fields by failing to include them in the inner circle of space-centric training, which presently exists at Vandenberg SFB. Intelligence guardians are surrounded largely by airmen in their classrooms, have limited exposure to guardian instructors or other professional space mentors,

and only minimally study the space domain. The Space Force must integrate intelligence members into the "inner circle" of space-centric training at the outset of its Service-wide cultural development and individual's careers. Intelligence professionals waste valuable time when they arrive at their operational units due to a lack of early integration. Consequently, new members must navigate their intelligence roles and responsibilities in an operational setting, with no prior knowledge of the space domain or interaction with space operators. Background knowledge and experience in IST would greatly facilitate this operational integration and improve unity of effort among all Space Force mission stakeholders.

Cultural DNA, the last component from Schein's definition of organizational culture, can strongly influence the advancement of guardian culture. Cultural DNA is formed through an organization's earliest shared learning experiences and includes the "beliefs, values, and desired behaviors" that initially contributed to the group's success.[26] This learning is taught early and becomes so deeply ingrained that it cannot be altered without fundamentally changing the group as a whole.[27] *The Guardian Ideal* is a primary source of the Space Force's cultural DNA.

The Guardian Ideal is a foundational document for all Space Force servicemembers. It summarizes five key areas intended to build an organizational culture that enables warfighting in the space domain.[28] These areas include connecting in a collaborative environment, leading digital enablement, generating and engaging talent, developing and employing that talent, and integrating resiliency across the force.[29] This document also outlines a *Guardian Commitment,* which sets forth team leader and team member roles and responsibilities as military professionals.[30] The values of character, connection, commitment, and courage are fundamental to both leaders and team members.[31] The focus areas and values outlined in *The Guardian Ideal* provide the building blocks of the Space Force's cultural DNA. These concepts apply equally to space operator and intelligence guardian trainees but are instilled unequally based on their disparate training environments. Space operators, surrounded by space professionals at the outset of their initial skills training, have key themes from *The Guardian Ideal* enforced throughout their day-to-day experiences. Intelligence trainees, however, attend guardian all-calls and mentorship sessions only as their Air Force training curriculum allows. Space-focused opportunities are secondary in this air-centric training environment. Until the Space Force breaks away from Air Force culture, space will continue to be taught and utilized as an extension of air power.[32] This secondary training prioritization drives negative messaging for new intelligence members and fails to communicate the inherent value of their chosen domain, space. *The Guardian Ideal* sets a cultural foundation for the Space Force—but its concepts are best achieved through operational application and lived experience over the course of time.

Culture is a time-intensive phenomenon, and the Space Force must proceed strategically. Creating a Service-level culture could take years and even

decades.[33] The strength of a culture is contingent on time, and the Space Force must use every opportunity it can to unite guardians along the milestones of their careers.[34] The Space Force cannot reasonably build a Service-wide culture within four years of its creation as a separate Service. Space Force culture will take many years of cultivation based on the shared experiences of its space operator, intelligence, cyber, acquisitions, and engineering professionals. However, an optimal starting point for this shared experience is the initial training members attend after entering the military. Intelligence skills training integration for space operators and intelligence members offers a positive example for integration across space career fields. The Space Force has yet to evolve its organizational culture fully and is building one through its members' ongoing interactions.[35] How the Service builds its culture today will be critical to its long-term success.

Schein's definition of organizational culture sheds light on the current state of shared identity, or lack thereof, among intelligence and space operator trainees and how Space Force leadership can best move forward to establish a healthy, shared culture among all members. As these leaders work toward this objective, it is critical to consider how the Service can best instill culture at the earliest point of a guardian's career—across all occupational specialties. All guardians must understand, at a fundamental level, the space warfighting domain and internalize their place in the Service. Space Force culture must reflect a space-mindedness unique to the Service, ultimately shaping how the United States responds to future space threats.[36] As evidenced by the analysis of shared learning, internal integration, and cultural DNA, initial skills training is where the Space Force should focus its efforts.

Current Developments

Space Force leadership recognizes that an evolving space domain demands intelligence professionals who possess a fundamental understanding of space. Adversaries increasingly seek to attack what they perceive to be an American overreliance on space, with this overreliance viewed as a strategic vulnerability.[37] In a December 2022 guidance memorandum, the Space Force chief of intelligence (S2) highlighted the emerging threat posed by Chinese and Russian counterspace capabilities. He wrote that "our service's journey is just beginning" and emphasized that those in the Service today are given a unique opportunity as its "initial architects."[38] These "architects" will also shape future Space Force intelligence capabilities as part of the Department of Defense and broader IC.[39] The S2 intends to optimize the organize, train, and equip (OT&E) function of the Space Force's intelligence enterprise to emphasize "critical thinking and data-driven problem-solving."[40] The Space Force must evolve from "traditionally passive, reactive space operations which provide a service" to "intel-driven, predictive, and proactive all-domain operations."[41] The memo concludes with an outline of the S2's strategic priorities, which includes the development of "digitally proficient intelligence professionals who are recognized as experts in

adversary space," along with the growth of baseline intelligence competencies, to include "analysis, collections, targeting, and integration with operations."[42] The S2 has thus emphasized not only traditional analytic skills, but integration with space operators—which requires a shared baseline in both knowledge and experience.

While the Service must move toward fully separating its intelligence skills training from the Air Force, it is taking initial steps toward providing a stronger space domain baseline—with Space Training and Readiness Command's (STARCOM) standup of the Space Intelligence Fundamentals (SIF) course at Goodfellow AFB designed to mitigate current intelligence skills training shortfalls.[43] The SIF course will provide a space-focused 20-day training "top-off," which includes essential space topics not covered in the Air Force curriculum.[44] This course will be executed immediately after initial skills training and leverage Air Education and Training Command (AETC) infrastructure, but the Space Force will provide the curriculum and instructors.[45] Officer and enlisted guardian students will attend the SIF course before their permanent change of station (PCS) to their first operational unit.[46] Based on technical school student throughput, approximately 160–200 students will attend the SIF course annually.[47] This course will build on and link to the Air Force curriculum.

The space threat environment is quickly evolving; while the SIF course offers critical training for intelligence guardians, the course is only a temporary fix. Twenty space-focused training days is not the same as a six-month IST steeped in space-domain curriculum. It is not possible to cultivate a Service-wide culture through shared experience and learning when intelligence members are trained separately from their fellow guardians. Nonetheless, SIF is a vital first step toward instilling organic domain expertise in the Space Force's newest intelligence members.

Case Studies

As the Space Force considers improvements to guardian initial skills training, it should look to the initial experience of air intelligence professionals in the Army Air Corps, along with Marine Corps cultivation of an exclusive Service culture early in its members' training experience. These two case studies offer useful perspectives for how the Space Force should consider the future of intelligence training, with valuable lessons, if applied appropriately, that can fortify the Service in preparation of any conflict "in, from, and to the space domain."[48]

Lessons from the Army Air Corps

The role of air intelligence in the U.S. Army Air Corps, and later the Air Force, sheds light on how space domain intelligence impacts space operations and the future of the Space Force. Military intelligence as an organized War Department activity first came into existence in 1885.[49] However, with no significant threat to U.S. security between the Civil War and the outbreak of the World Wars, intelligence operations were seen as "negligible."[50] There was a

pervasive attitude of "polite indifference" toward intelligence, with the United States extremely inexperienced in intelligence operations as the country entered World War I.[51] The Army Air Corps' initial attitude toward air intelligence is reminiscent of early Air Force views on space intelligence. Historically, space has been categorized as a benign sanctuary. However, today it is a warfighting domain—with intelligence playing a key role in understanding the growing threat environment.

The Army Air Corps underutilized and neglected air intelligence throughout both World Wars. As the country entered World War II, leaders placed intelligence demands on American analysts who were either "poorly trained or not trained at all."[52] The Army often assigned "misfits" to intelligence duties, using the G2 (intelligence directorate) as a "dumping ground" for those officers poorly suited to line command.[53] As a result, personnel experienced in intelligence were "virtually nonexistent" as World War II commenced.[54]

As the war progressed, intelligence processes improved based on real-world lessons and best practices, but intelligence never "succeeded in completely satisfying the demands of strategic air warfare."[55] The necessity for a broader scope and volume of specialized air intelligence became apparent with a corresponding evolution of World War II aircraft and weapons.[56] At this point in American military history, Army Air Corps leaders recognized that trained personnel are vital to every staff function. This realization is especially true for intelligence operations due to the "great variety of skills required to support the intelligence mission" and the "inherent complexity of intelligence."[57] Germany's assault on Europe and Japan's success in the Pacific "shocked" the United States, forcing America to realize that its intelligence operations were inherently weak.[58] By the close of the World Wars, the United States recognized the need for an independent Air Force to fight and win in the air domain.[59] With the genesis of the Air Force, service leaders also recognized the need for air-centric intelligence. There was no more significant proving ground for air intelligence than the great air battles of World War II. At the close of the World Wars, missions accomplished with maximum success—measured by lives and equipment saved—demonstrated the true value of air intelligence.[60]

After World War II, General Henry H. Arnold wrote that "past concepts of intelligence needs are insufficient to cover the requirements of modern war."[61] General Arnold's final report as commander in chief of the Army Air Forces highlighted deficiencies and the need for future improvements for "superior air intelligence on a global scale."[62] To him, it was clear that the United States needed detailed and "moment by moment knowledge" of civilian and military air activity.[63] Strategic air warfare could not be planned for nor executed without a continuous flow of detailed air-centric intelligence.[64] While military intelligence consists of evaluated and interpreted information of military significance, air intelligence consists of military intelligence specifically required to employ airpower.[65] This specialized subset of military intelligence proved critical for the execution of modern warfare.

General Arnold's argument that past intelligence operations failed to meet the demands of air warfare parallels the modern disconnect between intelligence training and space warfare. Air intelligence played a pivotal role in the air battles of World War II, as the nation fought in a new domain. As the United States again finds itself operating in unknown territory, recently graduated intelligence guardians are responsible for providing intelligence with strategic-level implications—beyond what is primarily taught at a tactically focused Air Force technical school. Space operations span global satellite communications, missile warning, and precision, navigation, and timing, to name only a few mission areas. These operations are critical to America's ability to conduct global joint operations. The Space Force must provide its newest members with the skills and training to accomplish the mission expected of them. As demonstrated by the Army Air Corps, the Space Force should foster its own organic domain expertise. This begins in initial skills training—before conflict forces America's hand as the World Wars did, with air intelligence.

Lessons from the Marine Corps

The U.S. Marine Corps strips away any semblance of civilian identity at its initial training courses and builds a Service-specific identity unique only to Marines.[66] In its seminal doctrine publication, *Warfighting*, Marine Corps Doctrinal Publication 1, the Marine Corps reveals that "all officers and enlisted Marines undergo similar entry-level training which is, in effect, a socialization process."[67] Initial training provides all Marines with a "common experience, proud heritage, a set of values, and a common bond of comradeship."[68] This common experience is the essential first step in creating a Marine.[69] The Space Force would benefit from taking a similar approach to its initial training courses, bringing intelligence members to Vandenberg SFB and training them alongside space operators. The consolidation of space and intelligence training is vital to building a common experience for guardians, with future consolidation expanded to include all space career fields.

Marine Corps officers all attend The Basic School (TBS), a six-month course for newly commissioned lieutenants and warrant officers.[70] The material that young officers are exposed to during TBS is intended to "stay with them" for the entirety of their careers.[71] It instills in every officer a fundamental understanding of how the Marine Corps operates, giving graduates a "basic level of tactical competencies."[72] These universal competencies allow every officer to lead a rifle platoon, regardless of military occupational specialty.[73] While guardians require training that is very different from a Marine's "tactical competencies," there is incredible value in setting a training baseline for space "tactical competencies."[74] These would apply to all Space Force members at entry into the Service. Every guardian should have a basic understanding of what it means to operate and fight in space. Space operators are by no means the only guardians who should study launch operations, orbital regimes, and blue force space capabilities—to name only a few foundational space concepts. The new SIF course provides a

temporary means for instilling space fundamentals in intelligence guardians, but the long-term answer is ultimately a Space Force training pipeline separate from the Air Force schoolhouse. The enduring success of the Service depends on synergy across all career fields. Intelligence members must understand the space domain to provide relevant intelligence necessary for space operations.

A final Marine Corps lesson the Space Force should adopt is the persistent promotion of teamwork. Enlisted and officer training teaches Marines that "they have left a culture of self-gratification" in favor of a culture of "self-discipline and a focus on the group."[75] *The Guardian Ideal* already calls for the development of a team-centric culture.[76] Crew dynamics drive every Space Force operation. Unlike Air Force culture, with single pilots flying and fighting at its core, Space Force operations will fail or succeed based on the performance of its teams, not individuals. IST, whether it is executed by the Air Force or Space Force, reflects and reinforces this key difference in Service cultures. Thus, guardians should train how they fight—fully immersed in the space domain and integrated into teams (i.e., crews) that include both space and intelligence professionals.

Both of these case studies offer valuable lessons as the Space Force seeks to refine its initial intelligence training. First is the example of the Army Air Corps, with the genesis of its air intelligence expertise. The Army Air Corps recognized the need for domain-specific intelligence, which enabled America's ability to fight in an unfamiliar war domain. Next, the example of the Marine Corps' Service-specific culture and identity, built at the outset of training for all Marines, aligns closely with Schein's advocacy of shared experience and cultural DNA. This model showcases how guardians can perhaps best foster a unique "space-mindedness" in its newest recruits. The Space Force can and should look to the history and successes of other military branches to inform the professional development of its intelligence personnel.

Conclusion and Recommendations

Culture takes time to evolve naturally, but a holistic and inclusive guardian culture will not fully develop unless the Space Force separates its IST from the Air Force. In the Air Force, airmen attend various technical schools based on career discipline. However, pilots attend their initial training together (allowing for a common airmanship baseline prior to airframe specialization). With a Service built on support to pilots, this initial skills training construct works. In the Space Force, though, guardians from all career fields ultimately execute operations together as a crew. Therefore, it is imperative that trainees come together as early as possible in their careers to establish a common guardian baseline.

Schein's work on shared learning, internal integration, and cultural DNA offers the strongest argument for why initial skills training must transition from the Air Force to Space Force. This change allows for a much-needed common experience, laying a cultural foundation from the outset of a member's introduction to military service. Merging this analysis with the research conducted

on the Army Air Corps and Marine Corps offers further evidence for establishing space-centric intelligence training.

Historical analysis of the birth of air intelligence showcases the inherent value of a specialized approach to military intelligence in direct support of air warfare. The current Air Force curriculum provides an indispensable analytic backbone but fails to provide guardians with a much-needed space foundation—ultimately resulting in a lack of space-mindedness for the Service's newest intelligence members.

The Space Force must take ownership of its intelligence IST. The Service should introduce officer and enlisted trainees to their chosen domain immediately after entry into their career field specific training. While initial skills training must impart the foundational analytic skills that all members of the intelligence community require, the Space Force must also provide what no other training entity can—a foundation in space warfighting.

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Kim Jong United
How a Future North Korean ASAT Threat Makes Strange International Bedfellows and Novel Opportunity

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Abstract: While North Korea does not have a formal direct ascent antisatellite (DA-ASAT) weapon, its missile technology provides some baseline technology to make one, and a DA-ASAT program furthers the ruling Kim Jong Un regime's strategic goals. Thus, the United States should prepare for this threat now. This article argues that North Korean DA-ASAT weapon is a unique political-military challenge, in that China and Russia—traditional North Korean allies but major space-faring nations—are *also* threatened by this weapon because of the indiscriminate space debris it creates. This creates aligned interests between the United States, China, and Russia to stop a North Korean DA-ASAT program, and as this article asserts, the best way to do that is to cooperate in slowly advancing the North Korean space program with nonthreatening technology in return for the country abandoning DA-ASAT research.
Keywords: North Korea, antisatellite weapons, diplomacy, Indo-Pacific geopolitics, strategic weapons, space

Although North Korea's emergent space program currently lacks antisatellite weapons, the pariah nation can use its substantial missile technology to start development of a direct ascent antisatellite weapon (DA-ASAT) and this effort would likely advance the ruling regime's interests. In North Korea, the military is the state: Its supreme leader Kim Jong Un, a tyrannical dictator, leverages the nation's weapons and missile programs to pro-

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tect his own power, to deter international meddling in domestic affairs, and to secure international concessions. A legitimate DA-ASAT—which is a missile launched at a satellite—would undoubtedly bolster this leverage. This is because DA-ASATs—whether through tests against dummy targets or intentional use—create high-velocity debris on impact, which haphazardly threatens *any* critical satellites in proximate orbit. And DA-ASAT use is of such political and military concern worldwide that even a test by a rogue state like North Korea could be rapidly destabilizing.

But as this article argues, a North Korean DA-ASAT program would manifest a novel opportunity for world cooperation. Russia and China—who are traditional North Korean allies but also major spacefaring nations—are as equally threatened as the United States from any debris caused by a North Korean DA-ASAT test (or worse). Thus, all three of these "great powers" have a mutual interest in stopping North Korean DA-ASAT prematurely.[1] While there are many approaches to take, the best option now is to offer Kim's government nonthreatening and unadvanced support for his incipient space program in exchange for DA-ASAT abandonment. This allows his regime to build a relatively illusory space program in line with his political goals without threatening stability on the Korean Peninsula or the great powers' space assets.

Introduction

North Korea has been particularly effective at challenging U.S. political leaders for generations. Since the Korean War, the Kim regime has ruled tyrannically over its people, threatened allied forces in Korea, isolated North Korea from the world, and won aid from the great powers—all while maintaining its dictatorial rule.[2] The focal points enabling this are North Korea's nuclear and ballistic missile programs. After decades of secretive development, North Korea has a nuclear arsenal that experts assess totals close to 50 warheads.[3] And its ballistic missile program boasts numerosity and range—including multiple intercontinental ballistic missiles (ICBMs) that can reach America's West Coast.[4]

The primary purpose of North Korea's nuclear and ballistic missile programs is not the weapons themselves, but the political power they secure. They are strategic weapons that protect the ruling regime and deter conflict.[5] North Korea knows the United States, China, and Russia have far larger nuclear arsenals and more powerful conventional forces. But the Kim government is comprised of rational actors: He recognizes any offensive use of nukes or missiles would likely result in "complete annihilation" of his government.[6] Instead, these weapons earn the destitute state international leverage and recognition—invaluable tools for the tyrannical government. With these tools, the Kim family protects its own rule, fortifies political support, deters meddling in domestic affairs, and exerts diplomatic concessions.

Like missiles and nukes, DA-ASAT could fulfill these same objectives: On impact, these weapons obliterate the target satellite into thousands of pieces of small space debris, which travel at more than 15,000 miles/hour in orbit. That

debris field is unpredictable and—depending on the number of pieces, and the size and trajectory of each piece—can destroy more satellites. In fact, space debris is so dangerous it has a scientific name, the Kessler Syndrome.[7]

And while DA-ASAT weaponry may not threaten lives, its devastating second- and third-order effects are of grave strategic concern. Between the initial launch and the subsequent debris, a single DA-ASAT strike "could devastate a society [like America's] that increasingly relies on satellites for daily functions critical to the civilian and economic well-being."[8] Because the U.S. military knows its space assets are an integral first-strike target for adversary war planning, a surprise DA-ASAT launch—even a test—could be interpreted as the precipice of major war justifying an immediate large-scale mobilization or kinetic response. This is why DA-ASATs "possess a [great] capacity for transforming a crisis into a war."[9]

Fortunately, North Korea does not possess a DA-ASAT and it has not yet publicly announced an intent to create one.[10] But that is likely to change eventually: DA-ASATs enhance the Kim government's strategic objectives of regime protection and deterrence, and the country also has some baseline capabilities from its missile program to get started. But because of the indiscriminate nature of space debris and political instability from DA-ASAT use, a North Korean DA-ASAT uniquely threatens all the great powers—who right now are the largest players in space and beneficiaries of space operations—and thus incentivizes collaboration on stopping such a weapon.[11]

The Purpose of North Korea's Strategic Weapons

What motivates North Korea's strategic weapons programs? Above all, the top priority for Kim is regime survival, as it was for his father and grandfather—and the threat from their nuclear and missile programs are essential to this goal.[12] Kim has publicly linked these weapons to national achievement, for which the government should be rewarded with consolidated political support.[13] And the Kim regime based its "legitimacy" on the intertwined success of North Korea's economy and its strategic weapons, especially its nuclear program.[14] Heavy military spending is the backbone of the nation's economy and its military activities—whether that be missile tests, parades, or conflict—and they are also how Kim demonstrates strength.[15] This is why North Korea, a nation of only 26 million people, has the world's fourth largest standing military and spends one-quarter of its gross domestic product (GDP) on defense.[16] And Kim's belief in this military-first approach—and especially its emphasis on strategic weapons—hardened after dictators like Muammar al-Qaddafi in Libya lost power after relinquishing their nuclear weapons programs.[17]

Separately, North Korea's strategic weapons are a bargaining chip to limit international interference in domestic affairs and to win diplomatic concessions. North Korea legitimizes the threat of attack through tests, rhetoric, and operations. Cumulatively, North Korea's missile and nuclear programs are one big deterrence operation, designed to "discourag[e] states"—primarily the allied

forces—"from . . . military aggression."[18] The nuclear warheads also liberate North Korea to engage in provocations like missile tests without fear of significant military retaliation, as the threat of those weapons makes most escalatory behavior counterproductive.[19]

Allied forces are not the only target of North Korean leverage: North Korea and China have a complicated but friendly relationship—some call them "bitter allies"—due to China's history of diplomatic and economic pressure toward the Kim regime.[20] Now, North Korea's nukes and missiles discourage such political intimidation and protect Kim from being a puppet ruler for either China or Russia.[21] Further, these weapons elevate Kim in negotiations with Russia and China, whom North Korea still relies on for trade and aid.[22]

North Korea also meticulously promotes its strategic weapons to justify international accommodation of Kim's regime. Its nuclear program and stockpile are advertised publicly, unlike other smaller nuclear players like Iran and Israel who try to keep their nuclear assets covert.[23] And North Korean missile tests are orchestrated as veiled messages to the international community.[24] Then, in the press, Kim pits "diplomatic" and "hardline" members of his government against each other to argue over preemptive use, maximizing leverage in international negotiations.[25] This is theater; however, the crafted information operations associated with North Korea's strategic programs demonstrate they are political weapons just as much—if not more so—than they are military threats.

A Serious North Korean DA-ASAT Program Is Plausible

Given Pyongyang's strategic motivations, a North Korean DA-ASAT weapons program is a plausible if not likely risk, because it can create new international leverage and further fortify the regime's rule. While intentional use of a DA-ASAT weapon remains doubtful by North Korea, the capability or even the construction of sites and facilities that indicate an *intent* to start a DA-ASAT program would further Kim Jong Un's primary strategic objectives.

Moreover, North Korea already has a capable ballistic missile program to kickstart DA-ASAT development, and the political-military costs of such a program to North Korea are relatively low. The biggest challenge would be obtaining a tenable aiming device for the DA-ASAT weapon—something only the great powers and India have built.[26] And while China and Russia maintain friendly relations with North Korea, they would be unlikely to share this technology given the risk North Korean DA-ASAT poses to their own satellites. But North Korea could obtain the aiming technology through other means, since the nation is a criminal enterprise that has mastered black-market activity to achieve strategic objectives.[27] Accordingly, U.S. policy makers should prepare now for this new threat.

International Leverage

A serious DA-ASAT program would win North Korea additional international leverage. This is because space assets are critical to global markets and security,

especially for the United States, China, and Russia.[28] Without functioning satellite networks, the world stalls: Financial transactions, shipping and logistics, joint military operations, navigation, and communications would be at best ineffective and at worst impossible.[29] But North Korea is a rogue nation with nothing substantial "at stake in the global economy"—so its government lacks the same incentives to remain peaceful in space.[30]

And while the threat from North Korea's nuclear weapons and missiles is concentrated at the allied forces, the threat from its DA-ASAT would be comprehensive: Any debris from a kinetic North Korean DA-ASAT threatens the economy and national security of China and Russia, too, even if America or its Far East allies would be the likely primary target of an initial strike. Moreover, a DA-ASAT strike is much less likely than a DA-ASAT test, which threatens all the great powers equally as the debris effects are random. This contrasts with North Korea's nuclear threat calculus, which is a significantly larger concern for America than Russia or China because of the direct antagonistic relationship with the United States.

Thus, North Korean DA-ASAT deterrence is inverted in comparison to nuclear weapons. With nuclear weapons, the *individual* danger from retaliation after a first strike deters their use. But with DA-ASAT, the *shared* danger every space power has from its use creates the deterrence effect.[31] Therefore, while the United States is the only great power averse to North Korea, China and Russia nevertheless have a substantial interest—due to their satellite networks—in preventing Kim from getting a functioning DA-ASAT.[32] This gives North Korea precious political capital at the international table if it can threaten legitimate DA-ASAT capabilities.

Sustain the Regime and Manifest Domestic Political Support

Separately, a North Korean DA-ASAT program would further bolster the Kim regime and help foment, through propaganda, sustained patriotism.

A DA-ASAT would be a palpable scientific and military achievement for the North Korean government to champion. The military is the Kim government's most important messaging tool, and the nation's nascent space program is a centerpiece of the modern government's manipulation. North Korea's propagandists incorporate space both into dire rhetoric about the danger posed from allied forces as well as peaceful messaging about North Korea's excellence and Communist values.[33] A DA-ASAT would be especially strong fodder to compliment this propaganda effort: It would visibly project strength to the North Korean people and fit perfectly in Kim's infamous military parades.[34] Only four nations thus far have successfully tested a DA-ASAT weapon; Pyongyang doing so would put North Korea in elite company.[35] And finally, both the domestic and international reaction to a North Korean DA-ASAT would not only flatter Kim personally but be promoted relentlessly as proof he's an important world leader.[36]

Technological Capability

Currently, North Korea does not possess a DA-ASAT, and it has no publicly acknowledged plans to develop one.[37] Its nuclear program was a decades-long slog due to stiff international resistance, intense scientific research, the program's secrecy, and the materials and technology required.[38] But North Korea already has some of the baseline capabilities to start a DA-ASAT program, such as manpower, missiles, and a committed criminal enterprise for funding and technology smuggling.[39]

If a nation has a capable ballistic missile program, conversion to a *basic* DA-ASAT is—in the grand scheme of military research—not cumbersome.[40] Satellites in low Earth orbit (LEO), which includes the *International Space Station* plus American communication and intelligence, surveillance, and reconnaissance (ISR) satellites, are at risk from DA-ASAT using "missiles that are much less capable than the launchers needed to deploy the satellites."[41] North Korea has multiple missiles capable of reaching into LEO.[42] For example, its Hwasong-18 ICBM—with a ~9,300 mile range on Earth—can squarely reach any satellite in LEO.[43] And the nation maintains multiple space launch facilities where it could conceivably test and develop a direct ascent ASAT weapon.[44]

The major challenge for North Korean DA-ASAT is a reliable aiming device.[45] While "any space-faring nation should be able" to develop the sensors for sufficient homing devices, the lack of a formal DA-ASAT program in North Korea implies little to no intention of developing such technology itself.[46] In fact, only the great powers and India have successfully tested a DA-ASAT, implying this technology is still too complicated or costly beyond the world's most advanced military powers and economies.[47] North Korea is unlikely to be able to produce the technology. Its ballistic missiles—the epicenter of North Korea's military and economy—have significantly lower probability of kill than the missiles of advanced nations; any DA-ASAT from North Korea would likely have similar accuracy issues.[48] And even though both China and Russia are North Korean partners, they are unlikely to cooperate on or support a North Korean DA-ASAT homing device because a North Korean DA-ASAT would threaten their own satellites. However, North Korea has other means of obtaining this technology: The state is "more actively engaged in criminal activity than any other nation" and relies on its black-market enterprises to directly support state goals.[49] It could therefore employ a variety of tactics—espionage, hacking, kidnapping of scientists, bribery, or blackmail—to steal the technology from one of the great powers or India.

The Political Incentives for North Korean DA-ASAT Now

A DA-ASAT program aligns with North Korea's strategic objectives and the nation, through its missile program, has some of the capabilities needed to make such a weapon. So why has North Korea not started a DA-ASAT program yet?[50]

For one, North Korea is not a rich or developed nation with a surplus of resources to spread across swaths of military projects. And the Kim regime is rational about what it perceives as the best return on military investment.[51] As can be inferred by their decision-making, Kim believes a mix of nuclear and ballistic missile programs best served his nation's strategic objectives. And to some extent, these programs have effectively protected his regime.[52] But North Korea's nuclear programs are not as effective recently at winning international concessions, after a near decade of American-led diplomatic and military efforts to deter and reduce these threats.[53] In response, Kim has taken more aggressive postures and military action—and a DA-ASAT is a new and effective threat to recapture bargaining power.[54]

Separately, the Kim regime views the possession of a unique strategic weapon by another great power—especially the United States—as an urgent threat to its own security.[55] With "[m]ajor advanced countries engag[ing] in space development" in preparation for "space warfare," Kim knows North Korea is vulnerable in this domain.[56] And during the last couple decades, the United States, China, Russia, and India have all successfully tested DA-ASATs.[57] The North Korean regime will want to ensure it is at least competing in this relatively new domain of war, even if it cannot match the capabilities of great powers.

A DA-ASAT program also offers Pyongyang significant messaging benefits: ASAT development would support the perception that North Korea is building a competitive space program. An actual test would be even more damning for space and world stability. Just as nuclear weapons "began as the exclusive domain of the superpowers" before "spread[ing] gradually" to North Korea, Kim will likely want a DA-ASAT soon too.[58] DA-ASAT tests by Russia, China, and India during the last two decades generated significant political and military reaction worldwide, which is the type of adverse attention Kim enjoys and can use to his political advantage domestically.[59] In short, important nations develop DA-ASATs—and thus a DA-ASAT program is a way for the Kim regime to demonstrate its governing bona fides.

Finally, North Korea does not have much to lose in starting a DA-ASAT program. It remains isolated from much of the world and does not rigidly adhere to international law or norms.[60] Its economy has been decimated after decades of sanctions on its nuclear program.[61] And, China, Russia, and India's DA-ASAT testing offers implied permission to the Kim regime to start a program as well.

The Novelty of a North Korean Direct ASAT Threat

Since World War II, the United States has traditionally taken an active leadership role in any major international political or military conflict, with Russia and China either adverse or uninvolved.[62] While these nations have sometimes found themselves on the same side of a national security issue, like the negotiations for the Joint Comprehensive Plan of Action in Iran, the pertinent threat

usually is not directed at all three nations.[63] But a North Korean DA-ASAT program is a novel "tragedy of the commons" that threatens the security of all global powers jointly and simultaneously.[64]

Regardless of the initial target, the resulting orbital debris from any successful DA-ASAT strike by North Korea would "threaten or destroy space assets of all nations and not just the intended target."[65] If systems on Earth break down due to damage above, the global economy and functioning society are at stake.[66] Critical intelligence and military satellites for the great powers remain vulnerable to debris too.[67] This space debris does not disappear and it remains a threat without any human control "until the gradual effects of orbital decay terminate" its trajectory.[68] For China and Russia, the game theory of their approach to North Korean DA-ASAT is also simplified: Neither can rely on friendly relations to escape the consequences of North Korean DA-ASAT use because the resultant debris is indiscriminate.[69]

Separately, a North Korean DA-ASAT attack on U.S. assets could even be interpreted as a preemptive act of war, like a DA-ASAT attack by China would be perceived now.[70] Space is central to joint U.S. military operations and integral to U.S. early warning—and American adversaries prioritize space assets as early targets in any major conflict.[71] Even accidental damage to critical satellites from debris or an unannounced DA-ASAT test could require the United States to rapidly mobilize other military assets as a precaution.[72] And Russia and China, depending on the context and available information, could do the same in reaction. North Korean DA-ASAT use is especially volatile because it shares a border with Russia and China, and it has a direct adversarial relationship with the United States. If a North Korean DA-ASAT is ever launched, the security of all three great powers is at risk.

Responding to the Moment: Stopping North Korean DA-ASAT before It Starts

North Korea has a lengthy history of conducting ballistic missile tests and developing nuclear weapons in violation of international law and United Nations Security Council sanctions.[73] These provocations gave the foreign policy and military establishment in the United States, China, and Russia significant experience in dealing with and studying the Kim regime. And all three nations have tried different approaches at different times to mitigate the threats posed by North Korea.[74] Given a North Korean DA-ASAT is something to plan for and prevent now, what can the great powers do?

First, any law-centered solution to North Korean DA-ASAT is going to be difficult to agree to and unlikely to succeed. North Korea has already demonstrated it does not respect international law.[75] Plus, political friction over the Korean Peninsula between the United States on one side and China and Russia on the other often makes enforcement against the Kim regime, downstream of any agreement, difficult.[76] The infancy of space law is an additional handicap: The great powers have struggled to update the 1967 Outer Space Treaty or agree

on a new legal framework altogether for space, even though the importance of the domain has increased substantially since then.[77] And a narrower legal agreement specific to North Korean DA-ASAT is unlikely to ease negotiations, since the great powers would rightly be worried about precedential effects it would have on their own DA-ASATs and space operations. Finally, any permanent legal commitments by the great powers to stop North Korean ASAT requires spending valuable political capital—a difficult ask given North Korea's DA-ASAT program is still notional.

Second, the great powers could draw a "red line" and jointly warn Kim Jong Un that a North Korean DA-ASAT program is a nonstarter and would result in severe diplomatic and even military consequences. This approach could work given the overwhelming power and resources shared between the United States, China, and Russia. And these nations have demonstrated an ability to cooperate on North Korean sanctions over its nuclear weapons program and missile tests in the past.[78] The problem, however, is with enforcement: China and Russia cannot be trusted to enforce sanctions against the Kim regime even when they publicly support them.[79] So if North Korea challenged the red line, it would fall largely on the United States to impose consequences—similar to the current dynamics regarding North Korean nuclear and missile sanctions.[80] But the political cost to enforce a red line on North Korean DA-ASAT—particularly with military action—could be insurmountable for American leadership, because the voters have not internalized the risk from DA-ASAT as closely as they have for nukes.[81]

Third, the great powers could try making DA-ASAT programs "taboo" by creating a new international norm of nonuse.[82] In 2022 the United States announced it will voluntarily forego DA-ASAT weapons testing in reaction to Russia's 2021 direct ascent ASAT test, citing the national security and economic risks from space debris.[83] The goal of this policy is to set an example for other countries to pause their own DA-ASAT testing so that new debris is minimized. However, this approach has several fatal defects. For instance, Russia and China could gain a strategic advantage over the United States by doing more DA-ASAT testing and creating better weapons, although both could suffer negative international consequences from this. Additionally, North Korea is literally one of the last countries on the planet that cares about adhering to international norms and customs. Finally, North Korea does not have the same economic and societal consequences to fear from space debris as the great powers, so they do not "gain" much from nonuse. There is little incentive for Kim to respond positively to this policy. Accordingly, it is unlikely—even in the implausible scenario where Russia and China also decided to stop testing DA-ASAT weapons—that a nonuse taboo would on its own deter Kim from an ASAT program.

The great powers could try a "wait and see" approach where they do not take any new action against North Korean DA-ASAT until they detect indicators of such a program (or intent to start one). But this approach carries a heavy risk, because if Kim Jong Un starts such a program—especially publicly

—he will be unlikely to reverse course, given it could be perceived as backing down and thus threaten his legitimacy. Further, Kim Jong Un and his father went to great lengths to keep their nation's nuclear development covert; because DA-ASATs carry comparable strategic interest, Kim Jong Un could go to great lengths to shield indicators of DA-ASAT from the world, too, until the nation makes substantial progress on building one. The risks from waiting to address North Korean DA-ASAT are significant, and the great powers would likely benefit from a proactive approach.

Therefore, in the near-to-medium term, "carrot" diplomacy—trading the Kim regime assistance and/or technology to improve other facets of its space program in exchange for abstention from DA-ASAT development—is likely the best approach. Right now, North Korea has an incipient space program that Kim intends to advance and accelerate—but he has not made any public commitment to DA-ASAT specifically. There are other space capabilities North Korea can invest resources in: the country's single ISR satellite in orbit, for example, is unadvanced and some claim it does not work.[84] The great powers have an opportunity to trade to North Korea what the United States considers unadvanced and unthreatening satellite technology if it induces Kim to swear off a DA-ASAT program. North Korean leadership has accepted international aid before to fix its own governing failures, and it has also modified its weapons programs to win diplomatic goodwill.[85] Furthermore, since Kim's primary strategic goal is protecting his own rule, he gains from such a trade because he will still achieve progress for North Korea's space program by cooperating.

This approach has some challenges, but they do not outweigh its initial promise. For example, it would likely require either China or Russia to deliver the satellite technology and aid, given their working relationship with Kim and established supply chains to Pyongyang—plus the current strained political relationship between the United States and North Korea. Fortunately, China has demonstrated a recent openness to cooperating with the United States on Korean Peninsula policy when it brings stability to the region, which North Korean DA-ASAT disarmament would.[86] Separately, cooperating with North Korea on space will likely meet fierce political resistance in the United States, much as President Donald J. Trump's summits with Kim Jong Un initially did in 2018 and 2019.[87] But this is an issue of spending political capital. If the president believes preventing North Korea from getting a DA-ASAT is a worthy endeavor, then they can commit the nation to this type of agreement even if it is politically unpopular. President Barack H. Obama demonstrated this with his Iran deal in 2015 (formally known as the Joint Comprehensive Plan of Action).[88] Further, the great powers would have to decide how any North Korean DA-ASAT policy integrates into their individual strategic objectives with North Korea. But this is an issue under their control, and it is mitigated because DA-ASAT disarmament does not require the United States, China, or Russia to depart from their shared interest in stability for the Korean Peninsula.

Finally, the carrot approach would likely require "sticks"—e.g., punish-

ment—if North Korea does not uphold their end of any ASAT bargain, as has happened with both their missiles and nuclear programs. However, the North Korean space program is so new that the great powers can use incentives to have outsized influence on how it matures. Thus, prioritizing cooperation now and worrying about punishment later is a fine trade-off, especially since the space program—unlike the existing nuclear program—does not present any threat in its current form. Of course, punishments for DA-ASAT development should not be dismissed in case Kim does pursue these weapons—but they do not have to be addressed at this early stage when even Kim can benefit from cooperating on DA-ASAT disarmament.

Accordingly, while there are many approaches to consider for preventing North Korea from starting a DA-ASAT program, the best approach now for the great powers is to try to work with North Korea by trading some modest space technology to modernize its program in exchange for disarmament.

Conclusion

A North Korean DA-ASAT program is a plausible national security challenge for the great powers given the Kim regime's strategic objectives of protecting its own rule, deterring international interference in domestic affairs, and providing leverage for diplomatic negotiations. However, the debris and instability risk posed by North Korean DA-ASAT creates novel alignment between the United States, Chinese, and Russian interests and incentivizes cooperation among traditional geopolitical rivals. Given existing political realities and the nascency of North Korea's space program, the best near-to-medium term approach to preventing a North Korean DA-ASAT is for the great powers to trade Pyongyang nonthreatening satellite technology, which Kim can champion as evidence of his leadership on space.

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Characterizing Future Authoritarian Governance in the Space Domain

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Abstract: Traditionally, discussions of governance beyond Earth have largely been held to the purview of debates about space law and global governance regimes. Yet, the priority of space exploration among ambitious, tech-industry associated billionaires and its continued potential for militarization suggest that a more dynamic approach may be needed, given that state-sponsorship of extraterrestrial colonial projects may be more akin to partnerships between private and public actors rather than nation-states assuming traditional roles as sole sources of decision-making. Permanent settlements in space will require forms of localized government that may look distinct from contemporary models of political order. This article thus asks a provocative question associated with the empirical record of human colonization and settlement in prior eras: What sort of authoritarian governance is most likely to form in human space settlements during the medium term? Reviewing variations on political order in small-scale colonial settlements in light of recent conceptual work on authoritarian rule, the article identifies three theoretical models of governance that may emerge once beyond Earth settlements become permanent fixtures of human society.
Keywords: space governance, authoritarianism, political order, corporate space-faring

Introduction[1]

What will political order look like beyond the terrestrial domain during the course of the twenty-first century? Recent space-faring achievements by billionaires Richard Branson and Jeff Bezos beginning in the early 2020s, as well as the continued transition from government-led to private space flight, have captured the imaginations of policymakers, research-

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ers, and interested observers alike.[2] With NASA's stated mission to return to manned spaceflight, with the recent establishment of a U.S. military Service dedicated to the space domain, and with American billionaires such as Bezos and Elon Musk proposing permanent colonies in satellite orbit, on the lunar surface, and on Mars, questions of extraterrestrial governance are already arising across commentary, policy-practitioner, and scholarly communities, both in serious and more whimsical forms.[3] This issue-set is not limited to a focus on private or civilian actors but also importantly encompasses military and national-security concerns as well, given the recent institutionalization of a new U.S. Space Force under the Donald J. Trump administration and its continued development since its 2019 founding.[4]

Contemporary scholarly discussions of governance beyond Earth have often remained confined to the purview of important debates about space law, global legal regimes, and more recently speculative economics.[5] Yet, the oversize personality of figures such as Musk and the clear trend toward a de facto "oligarchization" of near-Earth space settlement provides new room for a greater variety of speculative questions to be taken seriously.[6] Musk, for example, has recently termed himself a "technoking," per the governing corporate documents of Tesla, which in a flippant way gestures evocatively toward some of the genuine, medium-term possibilities of what social life and political order in space may look like beyond the direct writ of terrestrial nation-states.[7]

While the 1967 Outer Space Treaty (OST) and its related General Assembly resolutions prohibit national appropriation by claims of sovereignty in extraterrestrial environs, scholars have increasingly noted the complication of nongovernmental actors in space, their likely significant future economic role, and the hybrid nature of government funding interacting with private ownership and contracting in the space domain that will be especially relevant for future manned and permanent installations.[8] To explore the shifting dynamic surrounding the renewed growth in beyond Earth investments, approaches, and interests, this article makes the partial assumption that corporations are as likely as not to be the driving organizational force for the medium term of future space colonization. These efforts may quite possibly be funded by governments and perhaps be restrained by a new OST or agreed on governance regulations, of course, although the argument presented here also works similarly in a world of more direct government control over future settlements instead.

A growing social scientific academic literature is now more fully emerging that seeks to tackle long-term questions regarding "space civilizations" and its potential social organization, yet what remains underemphasized is an approach relying on more medium-range, theoretically informed scholarship connected to the empirical patterns of real human governance models.[9] That is, quite simply, taking head-on the question of what governance may look like as long-term extraterrestrial settlement becomes a more actionable reality.

To that end, this article explores the implications of a basic, yet often unmentioned assumption about a nascent future space politics, which will loom

ever larger as humanity approaches decades during which permanent space colonization will likely begin in earnest. Such permanent human settlements beyond Earth will require local governance structures that must align with a social environment in which exit is difficult and in which intentional, rigid organizational patterns are necessary for both mission execution and general survival. For this reason, contemporary forms of democratic government found in the West may be relatively unusual and hard to achieve in the space domain. That is, human societies beyond Earth, once they achieve a certain population size and sustainable long-term prospects, will inevitably be governed in some way—but how? This is a question relevant to a plethora of ongoing debates about the economics of space colonization, its militarization, and its increasing dominance by private actors. All suggest that researchers and policymakers need to be sober and serious about the governance question beyond the terrestrial sphere. Taking on this analytical challenge directly, it is important to ask an uncomfortable question: What sort of authoritarian governance might exist in human space settlements during the medium term, and how can previous studies and historical examples inform and enlighten us to such possibilities in the future?

The provocation here is completely serious, as authoritarian rule is far more likely to be the norm for extraterrestrial colonial ventures than anything else—a prospect this article addresses directly by way of a framework based in social science theory and the history of small-scale, colonial political regimes.[10] Organizational theory posits a variety of forms for nonsovereign corporate entities, very few of which accord to standard democratic templates.[11] It is likely that the organization of space settlements on the small scales of tens to hundreds will operate similarly, and it is certainly reasonable to raise both the nature and prosaic practice of authoritarian governance as a serious potential that must be confronted by policymakers and queried by new scholarship on the subject.

Given this less than utopian likelihood, a corollary question presents itself as well: What sort of normative preferences should government policymakers, intergovernmental sponsors, and corporate decision-makers be cognizant of prioritizing—or even intentionally setting up—ahead of major space settlement missions? Although the question of extraterrestrial governance has often been posed in either a legal mode or as a trope of speculative fiction, lessons from comparative social science, political economy, organizational theory, and historical political studies are underutilized but well-placed to answer such issues in seriousness, especially as this new era becomes a reality.[12]

The argument briefly presented here is organized in three parts. The article first turns to the task of justifying the statement regarding likely authoritarian realities for political organization in permanent extraterrestrial settlement structures, making only modest assumptions about the size and self-sustainability of such communities over the medium term.[13] It then suggests what the de facto authoritarian nature of such colonial ventures means for the small, space-

based polities that will eventually characterize the near-abroad of our terrestrial world. Following this discussion, the article details a set of plausible historically and theoretically informed institutional models as illustrative vignettes that are more likely than not to develop, either organically or with intention. Finally, the article concludes with several relevant takeaways for planners and policymakers as they confront the complications of this governance problem-set in extraterrestrial conditions.

Why "Authoritarianism"?

Why should policymakers assume authoritarianism for a future in which the solar system is dotted with human colonies and long-lived settlement ventures? If authoritarianism is conceptualized in the residual and non-normative sense common to contemporary social scientific research, as any sovereign or subsidiary political order that is not identifiably an electoral democracy, it is clear why this governance structure is very likely most applicable to thinking about extraterrestrial governance.[14] *Electoral democracy* is a system of government in which the apex leadership is chosen through a competitive struggle for the peoples' vote under broad suffrage by way of competing parties (or individuals representing de facto factions) with uncertain outcomes.[15] In organizational terms, the composition of the leadership hierarchy of democratic regimes is definitionally uncertain, subject to regular political pressures from a wide selectorate of the voting members of the body politic. That electorate is understood to be broad (usually placing theoretical political sovereignty at the level of the national community) and their views integrated into the political process through formal voting in competitive elections.[16]

An *authoritarian regime* is one in which the apex leadership is not chosen through such mechanisms, and is therefore institutionally unaccountable to electorates, either formally (as in monarchies, military juntas, or ideocratic party-states, for example) or in practice (as in "electoral authoritarian" regimes that hold unfair elections or electoral oligarchies or aristocracies that restrict political input along one or more key democratic criteria).[17] As noted before, most corporate structures, as well as the leadership hierarchies of both civilian government and military bureaucracies, are analogically authoritarian, although as they do not maintain political sovereignty, they are not usually theorized as such directly.[18] One can and should readily admit that there may be normative reasons why authoritarianism is and should not be a preferred form of governance. However, for the purposes of clear analysis it is impossible to avoid thinking conceptually about this potential future reality. And as long-term space settlements will occupy a hybrid area between local sovereignty and external control, integrating polity-regime perspectives with existing organizational approaches is warranted. There are three primary reasons for the uncomfortable but reasonable assumption of taking authoritarian models of governance seriously as humanity contemplates space settlement issues.

First, permanent settlement populations in terrestrial orbit, on the Moon, on Mars, or on nearby asteroids, will be necessarily organized hierarchically from the start as a crewed mission.[19] Taking organizational cues from military, aviation, and extreme-environment exploratory missions, permanent settlements will likely already be endowed with a hierarchy of decision-making officers that will be embedded into a given localized governing structure for any meaningful space-based lifetime beyond Earth—especially during the slow construction and full establishment of any sort of permanent colonial base.[20] Such organizational forms—if expanded out to the size of a (very small) political community numbering in the tens and hundreds—would indeed have a de facto political order substantively similar to a terrestrial authoritarian regime, in which ultimate political authority would rest on apex leadership figures chosen exogenously based on the initial mission organization, rather than on bottom-up legitimating structures common to contemporary Western democratic polities.

Importantly, such mission-formatted organizational forms are a standard part of most government-sponsored exploration patterns, which rely on highly trained mission crew hierarchically organized and ultimately responsible to mission decision-makers embedded in executive bureaucratic structures in the sender state. Thus, it is unlikely that in a world where governments maintain control of future, medium-term space settlement activities, rather than corporations, they would impose alternative organizational patterns simply because they may have more democratic political regimes at home. Neither U.S. military bases nor U.S. crewed exploratory missions exhibit democratic governance structures, nor are they expected to. It is true that the existing OST stipulates that signatory nations authorize and supervise their nation's space activities, including private sector ones. Yet, that is no reason to assume that a government-monitored settlement (either corporate or government-run) would automatically mirror the home state's governance structure.

Second, should a permanent version of the mission format be considered (by a sponsoring corporation, by inhabitants, by public relations offices, by funding governments or intergovernmental organizations) to be an unacceptable medium-term organizational structure for whatever reason, the nature of corporate leadership in designing and undertaking significant settlement projects will still trend toward de facto and de jure authoritarian models.[21] After all, corporations themselves are hierarchically structured around a top-tier, decision-making C-suite of officials, chosen by an oversight cabal or oligarchy (a board of directors, regents, or trustees) made of the most prominent share-holding elites supporting the venture.[22] While corporations are not polities in the modern era, corporate-style governance functions if extrapolated to permanent human settlements would indeed be classified as authoritarian. While corporate structures vary and may indeed have oversight and elective mechanisms embedded within their hierarchical schema, these accord with classical oligarchic patterns (of a

more open variety, such as through the regulated board representation of workers) rather than national electoral democracies with fluid, competing political parties as understood in the twentieth and twenty-first centuries.[23]

Importantly, a corporation on Earth, while in the ways suggested above is in some ways analogically similar to authoritarian ruling hierarchies, is also bound to national regulations with neither a claim to a monopoly on the use of legitimate violence nor a significant, sovereign physical territory—the key elements of political sovereignty or subsidiary sovereignty that is the critical distinction between political and merely organizational order.[24] On the Moon or Mars, however, the organizational characteristics of corporate structures, which are naturally authoritarian, would look far closer to full states, as decision-making cannot be fully exported to terrestrial patrons. In this sense, space settlement futures likely involve governance forms closer to the British or Dutch East India Companies, both of which could be plausibly characterized as authoritarian pseudo-polities (albeit with less clear "stateness" in full), and without the complications that arose in the seventeenth and eighteenth centuries from dealing with previously existing political entities in the new territories.[25] In these historical examples, private entities with their own internal hierarchies of authority governed physical territory directly and exercised a monopoly over the use of (state-like) social coercion and decision-making, although chartered by sending state governments and ultimately responsible to their oversight at a distance.

Historical analogies only go so far, of course, given the far faster communication infrastructure available in the modern era that would exist between space settlements and an Earth-based sponsor. Yet, the costs of policing terrestrial legal regimes in colonial ventures will remain prohibitively expensive and bound by the hard limits of materiel availability and jeopardizing settlement viability through antagonism and the extremely high societal costs of detention in such a small polity. To that end, as this article will show from an institutional perspective, authoritarian solutions will not only be attractive at the settlement level but will also find merit for sponsoring entities as well.[26]

And third, a final answer for taking authoritarian forms of governance seriously in the case of long-term space settlement can be found using the simple framework of collective action pioneered by Alfred O. Hirschman, regularly used in political economy and organizational studies research, which suggests that any given action-set for a group of people in a bounded society can be divided into categories of loyalty, voice, or exit when presented with collective governance problems.[27] Simply put, there is no exit in space, at least not for permanent settlement structures in the medium term, without considerable technical breakthroughs largely relegated to the more distant future.[28] And voice, which can be understood as the ability to express disagreement, dissention, and critique in an organizational setting, will run up against concerns for unity, mission focus, and deference to decision-making in a hostile environment.

Given this, the option set is reduced to remaining loyal to a given organiza-

tional structure or opting for a costly voice option that may engender hostility and recrimination in a closed environment (and either genuinely endanger or lead to obvious perceptions of endangerment and threat) which in turn simply lends itself to disincentivizing options for voice in the first place. In a series of wide-ranging anthologies edited by Charles S. Cockell in the mid-2010s, despite being partly informed by classical liberal and libertarian philosophical traditions (among others), hard constraints and limits on freedom, liberty, and autonomy were nevertheless highlighted as key and sustained characteristics of space settlements across a variety of domains and dimensions.[29] As Cockell states plainly, conditions in such locations are "instantaneously lethal," rendering the cost of dissent spiraling out of control as potentially being an existential threat to both the individual and the wider settlement society.[30]

In this same vein, democratic governance forms—which are designed to bring forward sincerely held disagreements into a competitive and vibrant public sphere—are likely suboptimal solutions for the precarious nature of a first-, second-, and third-generation set of colonial settlement ventures beyond Earth. Competitive pluralism amplifies voice as a primary means of both political form and social order, and is central to strengthening the overall legitimacy of the society and its leadership. This may prove especially difficult in extreme environments with considerable technical challenges and pressures to maintain internal harmony. As exit changes from impossible to merely hard or difficult, these pressures may abate somewhat, but they are likely to remain high given the unchangeable environmental conditions of outer space.

Initial permanent human settlements will be pioneered by exploratory and colonial missions organized in hierarchical fashion for functional purposes. Further, they will likely interact with existing nondemocratic corporate governance structures and may even be directed by them. Finally, they will have strong incentives to limit political-social pluralism based on the settlers' voice due to the lack of exit for operational reasons. Consequently, policymakers are likely to find themselves with some variation on de facto authoritarian governance models for any successful permanent space settlements in the medium term. Of course, as authoritarianism is a capacious concept that describes the organizational and institutional features of political order at a high level of abstraction, this is merely the beginning of the question rather than its end.

Insights into Extraterrestrial Governance Patterns

Given that humanity should plan for the possibility of authoritarian rule in any space venture of a nontemporary nature, what are some outcomes? Speculation about the nature of governance in permanent human settlements beyond the Earth is an old staple of science fiction narratives, which have traditionally been productive inspiration for subsequent scholarship.[31] These speculative fiction narratives, indeed, often assume a dystopian (or utopian) form of autocracy as being particularly likely beyond terrestrial confines. Putting aside full, fictional star-faring empires such as those in *Dune, Star Trek*, or *Star Wars*, intra-

solar governance has often been portrayed as fundamentally authoritarian.[32] These fictional worlds are, admittedly, mostly quite far removed from the initial expected experience for future human settlement—which will involve much smaller populations that are much closer to our terrestrial home. Yet even so, authors have been quite consistent in their assumptions that governance in beyond-Earth settlements will hardly be strongholds of developed democracy in the contemporary mode.

A point of particular interest is that popular fictional speculations that remain marginally closer to actual twenty-first century medium-term settlement plans have often also relied on a private-sector angle, from the despotic corporation running Martian colonies in Philip K. Dick's *Total Recall* to James S. A. Corey's *The Expanse* and its asteroid belt-wide mining conglomerates under a duumvirate between rival solar powers on Earth and Mars. Per the discussion in the previous section, it is indeed quite likely that future political rule beyond Earth will heavily rely on the translation of corporate governance practices to settled populations in growing, yet confined, territorial zones beyond the realistic remit of terrestrial governance. As the organic growth of corporate-backed space ventures in the 2010s and 2020s make clear, this is not an idle fantasy, but rather variations on a very real pattern emerging in the contemporary period.[33]

The billionaire entrepreneur Elon Musk has been at the forefront of more esoteric and controversial ideas about twenty-first century governance.[34] In 2020, for example, he claimed that government itself was simply the "ultimate corporation."[35] Although stated idly, this is not at all dissimilar to what the economist Mancur Olson once wrote about the state as a "stationary bandit" or political sociologist Charles Tilly referred to when terming the state rather "a protection racket."[36] Similarly, the logistics empire of Jeff Bezos's Amazon has a greater than usual resemblance to core state capacities that penetrate disparate territories and check bureaucratic (read: Amazon employee) autonomy significantly. Given the outsized impact of these oligarchic figures on the emerging private space ecology, it is notable that the more state-like features of behemoth private enterprises run by Musk and Bezos are regularly cited as evidence of their growing political and economic power by concerned observers already.[37] It is likely that they, and their broader legacies of burgeoning private space development, will strongly contour the nature of extraterrestrial space governance—perhaps only second to the mission-based nature of initial, small-scale settlement ventures.

Indeed, although initial colonial efforts on the Moon and Mars will likely resemble military/space aviation mission structures (in the same way that nonpermanent space ventures have all done so for the last 50 years), once populations are large enough to no longer fit within standard mission crew organizational schemas, questions of local political authority will inevitably rise. Given the permanence of settlement, a mission structure that functions even for large groups of people for short periods of time—such as a U.S. Navy Carrier Strike

Group—will face pressures given dynamics of family formation, the renewal and sustainment of leadership legitimacy, the development of new generational cadres from within the society (or their integration from without), and so on. Similarly, it is very likely that corporate oligarchs organizing such ventures will require compacts and charters from future space-based populations to anchor and structure their internal workings, akin to the colonial charters written by the Puritans or the various commercial endeavors that ultimately settled much of British North America.[38] This will likely encode an authoritarian political structure chosen from the set of interests that corporate owners deem most critical for a successful long-term settlement venture, such as economic efficiency and responsiveness, workforce productivity and health, and intracolonial social stability and order.

Even so, as governance moves from mission-based colonial teams to lunar and Martian settler-colonists proper, it is unlikely that preimagined corporate documents and paper charters will long survive—after all, political rule is fundamentally different from corporate governance and will furthermore be in locations blocked from easy access should crises or power disputes arise. To that end, it is expected that while there will undoubtedly be a significant endowment of structures derived from mission-oriented and corporate organization, local context will trend over time toward a mixture of sui generis governance developments and existing structures imposed exogenously by initial mission criteria and state or corporate sponsor goals.[39] That sponsors will have a strong interest in ensuring their human capital and financial investments are safe will also lead to other outside pressures that will additionally shape settlement governance.

Modeling Authoritarian Institutional Forms beyond Earth

What are the likely forms of political authoritarianism in a constrained territory beyond Earth? This article provides three brief illustrative vignettes suggesting distinct modeling frameworks for extraterrestrial authoritarian governance, intentionally taking cues not from technofuturist musings, but rather from a background synthesis of the social science literature on authoritarian regimes themselves as well as overlaps with common arguments found in organizational studies.[40] This approach has the benefit of relying on case sets from contemporary and earlier eras of human social and political organization, rather than unconfirmed propositions crafted with an eye to a hazarded effectiveness or efficiency in an extraterrestrial environment.[41] That is, this article uses empirical data—which in turn has driven and informed medium-range theory on political regimes—to then extrapolate to the unique conditions of space settlement, with the particular characteristics noted in the above sections. This is still, of course, an exercise in speculative proposition, but one that remains at least properly tethered to empirical human societies. And undoubtedly the unique nature of exitless and voice-constrained space settlement will powerfully complicate any such speculation regardless.

To this end, this section will make three relevant restriction conditions here. First, that the population of the hypothetical settlements we are speaking of are too large to remain as traditional mission crews and are intended as long-term societies with a minimal expected chance for return to Earth. These large settlement populations will number in the tens, and eventually hundreds of members. Second, that long-term political governance will require on-location decision-making and social organization that cannot rely on a model of franchised rule-from-Earth in any real capacity. This latter condition would be—and has been—perfectly acceptable under mission-based criteria, but untenable for longer stretches as any given colonial society will require far quicker and more direct lines of authority and decision-making.[42] Third, that space settlement ventures in the medium term will be limited to major nation-state powers (the United States, China, India, Russia, etc.), supranational (EU), or oligarchic-corporate (Musk-SpaceX, Bezos-Blue Origin, etc.) entities that prepare, invest, and execute such permanent missions for prestige, research, or economic exploitation reasons. Alternative motivations, which would include ventures due to emigration pressures or ideological settlement projects, require technological advancements and greater accessibility than plausible for a medium-term temporal band.

Given these conditional assumptions, this article proposes here that a functionally militarized organization, an exclusive oligarchic decision-making cadre, or a more permissive vocational-corporatist structure are likely to be among the more plausible models of authoritarian rule in beyond Earth societies over the medium-term future. These are of course not the only options, and mixed forms among these three ideal-typical presentations are likely. Yet, they should provide a guide as policymakers seriously consider the realities of space settlement beyond Earth.

Militarized Authoritarianism

One potential outcome of the ubiquitous use of contemporary space mission structures largely taking their organizational forms from military and other command-oriented setups is that this structure will be replicated later on as the model form of space-based settlement governance. That is, the societal model of a permanent settlement would mimic the strict hierarchy of mission-organizational forms, with clear separations across functional roles and singular lines of ultimate authority with no institutionalized place for voice beyond the sponsoring entity. In this sense, the problem of transition from a crew hierarchy to a broader population-wide hierarchy would be eased by simply incorporating most of the settlers' professions and roles into that same crew structure, with decision-making authorities clustered just as they were in a mission-style format.[43]

Thus, one might find a functionally militarized settlement regime—that is, a political order in which the strict organizational hierarchies look more like military organization than anything else, even if there is no actual military

Table 1. Plausible authoritarian governance patterns in long-term space settlements

Style of authoritarian governance	Organizing principle	Emergent conditions	Implications for settlement planning
Militarized authoritarianism	Mission hierarchy, strict crew/position role	Path dependence from mission-based hierarchical structures	Planners must ensure mechanisms for leadership succession/turnover
Exclusive oligarchy	Closed but semiflat council body of decision-making officers	Assertion of corporate-style governance patterns by sponsoring entity	Planners must make clear the boundary between those with and without governance authority
Vocational corporatism	Self-regulated groups in formal hierarchy of function, with institutionalized means of ensuring deliberation	Pressures of representation and voice demands within high-status, democracy-accultured settlement populations	Planners must think explicitly about how the settlement is legitimated through popular input, and how to ensure such input is constructive

Source: courtesy of author, adapted by MCUP.

in the colonial venture. This sort of model is in certain ways akin to Frederick the Great's "army with a state," the de facto governance situation on some of the largest forward-deployed U.S. military bases, or the permanently mobilized and stratified populations of interwar-era totalitarian or "movement-regimes."[44] These latter polities, which integrated high state involvement in society with strong ideological content, did so through mechanisms that encoded organizational hierarchies onto all levels of society.[45] Critically, the model prioritizes top-down obedience to authority, decision-making is highly concentrated at the apex of the regime, and there is an explicit social hierarchy with formalized delimitations and echelons.[46]

This model of authoritarian political order would not be a military junta proper, insofar as the settlement did not derive from an actual uniformed military taken from the extraterrestrial society that launched it, but would indeed solve questions of voice by simply fitting all, or almost all, society members into a strict, top-down organizational network.[47] Decision-making would be limited to a core cadre of officer-class leadership, and all other roles would fit within a pyramidal, subordinate organizational complex.[48] Although policing power is an asymmetric force for the maintenance of political order in any society, the militarized model would likely rely even more heavily on a scrutinizing and coercive apparatus to bolster decision-making legitimacy. This sort of organizational form, of course, may find difficulty once populations reach a size where professional duty or role is no longer a full heuristic with which to categorize all individual settler-colonists.

Furthermore, dependent on relations between terrestrial sponsors and extraterrestrial settlements, leadership succession may become difficult if the upper hierarchy is expected to defer to Earth-based superiors and also be regularly rotated separate from lower-level settlers, who may be in space permanently. Thus, a form of militarized political order in long-term space settlement becomes less likely to be a stable political equilibrium over time, and especially as the mission becomes more societal sustainment rather than taking direction from the sponsor-principal. One way in which this could be solved would be through ersatz party-hierarchical models, sometimes found in militarized revolutionary groups that successfully seize power, where a rigid structure of organizational cells permeates the settlement society, organized by officers arranged in a clear chain of command upward. Examples might include China post-Mao Zedong or revolutionary postcolonial movements such as in Zimbabwe (where military officers were given privileged power). In these instances, however, the second model below may be a more appropriate conceptual approach as the settlement matures.

Exclusive Oligarchy

Another form that authoritarian governance in potential space-based, permanent settlements might take is as an explicit, decision-making oligarchy.[49] Dispensing with either the complication of organizing all of settlement society through a militarized hierarchical form or even acknowledging a supposed right of political participation for settlers, it may be the case that rule is explicitly cordoned off from the larger settlement population and comes to reside explicitly in the person of a few key officers of the colony organized collectively rather than answering to a single apex figure, as in military organizations. This would have the practical effect of creating an exclusive, oligarchic form of governance akin to restricted republics such as historical Venice or small medieval city-states, as well as more modern party-states with active and relevant party apparati.[50] This also would look closer to trade company models from the early modern period, which entrusted governance to a small core of corporate and state-adjacent figures to manage the settlement, otherwise disconnected from the broader population.

How the decision-making and decision-confirming set of de facto oligarchs would be acknowledged as such would depend on the nature of the venture—this model would most easily fit within a corporate governance structure, although the oligarchs would have to be space-based. Thus, we would not be talking about shareholders or C-suite figures, but rather what we would conceptually understand as the actual oligarchy on-base. Indeed, what we would term oligarchs in an abstract sense would be reframed as the central stakeholders or permanent, officer-like positions in the settlement entity. Colonial governors and administrators in a variety of historical European empires, especially those governing far outlying territories, fit this archetype well.

This form of an oligarchic corpus of high officers within the colonial society

could also be derived from a variety of positions internal to the settlement (such as those charged with localized decision-making authority in fields such as plant maintenance, population support, and research capacities), or externally imposed and chosen by a corporate venture-sponsor from Earth. The membership of existing oligarchies (historically or today) has tended to be based in a form of substantive power contextual to the given society—wealth, blood, economic leadership, and so on—and so it will likely be that any oligarchic group will undergo membership changes as the space colonial venture evolves and matures over time. Again, historical analogies are useful, if only partial illustrations of this dynamic—with the closest fit deriving from the experience of merchant republics or mercantile-oligarchic free cities of the European late Middle Ages and Renaissance as well as trade companies and colonial governorships.[51]

In most oligarchic authoritarian regimes, hierarchy may be more or less diffuse and more or less formalized but will maintain some sort of institutionalized council or assembly body to coordinate the key political elites of the polity. In a space settlement under this model, rather than strict roles assigned to leaders in a single pyramid of social order, as in the militarization format, consensus or majoritarian decision-making within the institutional confines of such a ruling council would be more likely—at least in accordance with the empirical evidence in existing and preexisting human societies.

Here, there is no apex succession to manage outside of factional or personality disputes within the oligarchic body. This creates a semiclosed elite that is more likely to be self-perpetuating. However, this depends on the means of support for those at the heights of decision-making authority, which would be initially inorganic given the nature of the settlement. Furthermore, how this oligarchy would come to be established in the first place would contour its full features. One option here would be through the direct assertion of corporation-like structures (such as a board of directors, stakeholder voting mechanisms, and so on), which may indeed be a possible option given the potential private-entity sponsorship of any such settlement venture.

Vocational Corporatism

Finally, it is possible that long-term colonial societies will be unable to resist some form of popular—that is, whole population—input into its localized governance proper. This will be a consistent tension, given that democratic societies and elite, high-education/high-wealth backgrounds will likely supply much of any space-settlement's population in the medium term. Not only will likely populations be used to living in societies outwardly justified through elections, but they will be privileged specialists that will expect a degree of voice in the broader society given their high status within their own communities on Earth.

To that end, and keeping in mind the strong restrictions on actual voice and the lack of exit options, practical authoritarian rule may take the form of a population-encompassing structure of vocational corporatism.[52] Pioneered in the early twentieth century by authoritarian and democratic governments

alike, this would involve the division of a given colonial society into constituent groups based on their professional or social role in the polity—akin to mandatory, exclusive unions today or guild structures in the past. These groups would self-regulate as much as possible and send representatives to a plenary chamber or executive cadre to negotiate and provide a form of voice, if not decision-making authority proper. Indeed, the relatively high labor power of individuals in the political economy of a permanent space settlement would plausibly incline it toward the institutionalization of voice in this manner, not dissimilar analogically to a sort of guild system. Where labor is skilled and people are scarce, incentives for bargaining increase as well, which in the conditions of outer space may very well be contoured toward institutionalized and regulated channels as much as possible.

Corporatism, and its historical predecessor of strong guilds in sovereign chartered town and cities in the European medieval period, may again be a particularly natural structure of rule in the small, confined territorial and social space of extraterrestrial colonial ventures. While historical analogies to the Middle Ages are perhaps unexpected in application to the domain of space settlement, Anthony Kennedy has written of potential feudal orders being natural elements in the speculative political economy of outer space.[53]

For our purposes related to the question of political regime proper, the provision of voice opportunities as expressed through a vocational chamber, while also gaining the benefit of hierarchy and regularized organization, may indeed square the circle of a "small d" democratic culture in the settler population under the requirements of an overall authoritarian political order. Not only do these have real, empirical models found in European and Latin American corporatist experiences, but also variations along the lines of the consultative councils that gather together key societal elites often used by Arab monarchies as well.[54] The reality of having to face the likelihood of authoritarian rule as a necessary condition of avoiding the suicide of social breakdown in a society one cannot leave nor justifiably undermine in core, decision-making competencies is a difficult one. For these reasons, such structures may be attractive as an intentional and institutionalized effort to mitigate discontent.

All of the models presented here make assumptions that due to exit impossibilities and harsh sociological constraints on voice, authoritarian governance of one form or another is most likely for small- to medium-size space settlement ventures in the medium term. Yet, should more optimistic accounts come to pass and space settlement becomes technically and financially feasible for more than just nation-states or supranational entities with scientific and prestige goals, or corporate entities with economic goals, the authoritarian criteria may be relaxed due to the possibility of more ideologically driven ventures.

That is, should space settlement look less like a mission-focused, research, prestige, or extractive enterprises, but rather a means of terrestrial emigration or ideological self-expression in the long term, then a wider set of governance models is certainly plausible. Indeed, for those seeking beyond Earth settlement

due to religious, ethnic, or ideological purposes, or for fleeing disasters such as wars, climate change, or other cataclysmic events, democracy (or relatively unusual forms of authoritarianism such as theocracy or ideological party-states) may indeed be alternative plausible models for extraterrestrial colonial ventures.[55] Yet these too, in time, will discover similar pressures due to exit absence and voice difficulties—which will render the theoretical framework developed in this article nevertheless quite applicable to such alternatives.

Concluding Discussion

Although this article has stayed in the realm of the speculative throughout, it is certainly the case that genuine recommendations follow for planners and policymakers alike as the future of beyond Earth human settlement looms closer. Taking a less naïve, even cynical view of the likely realities of colonial governance over the medium term is a useful antidote to the obscuring clouds of utopian planning and unreasonable expectations. To that end, there are three relevant policy-oriented takeaways from this exercise that will apply to both government and corporate analysts working on extraterrestrial projects.

First, the discussion foregrounds the importance of thinking through how the organizational forms of a given initial, crewed mission may replicate themselves down the years through the weight of path dependence and the particular legibility of hierarchical patterns of authority and command. Although this is an obvious downstream effect of priming a tabula rasa settlement with a particular organizational structure, it may be mistakenly described as an unintended consequence by planners. Settlement planners must already take such processes into account, especially if corporate or government sponsors intend on forcing a shift from a tight, militarized hierarchical structure. This advice applies as well for more purely corporate ventures, which may be surprised when certain organizational forms become quite sticky and resistant to restructuring when placed in the context of an entire society rather than a workplace.

Second, the examples above remind us not to assume that terrestrial forms of societal governance favored by advanced democracies can be replicated in extraterrestrial contexts. Indeed, the dissonance between Earth-based polities and space-based microsocieties may be quite difficult to overcome, and possibly the source of considerable concern and consternation by planners and public relations departments at home, among others. Recognizing this inherent tension from the beginning is important, if only to develop mitigating strategies both for assuaging concerns among potential beyond Earth settlers as well as messaging for audiences elsewhere. Settlement missions focused on resource extraction, research missions, or even prestige colonies will also likely interact with structural choices that will impact the resultant form of authoritarian governance over time. Setting expectations early and clarifying the important differences between social life on Earth and in space will ease the jarring reality of a new kind of human venture into the unknown.

Finally, the vignette illustrations of plausible organizational patterns should

allow for planners to read more broadly into historical examples as well as scholarship on comparative authoritarianism for insights into how political authority, decision-making, societal legitimacy, and advise-and-consent dynamics function outside of party-based electoral democracies—which is a form of government simply unsuitable to space-based endeavors. From the above potential models, an oligarchic form of rule seems most plausible for medium-term ventures, especially given the corporate patterns that may very well set the initial organizational endowment. While planners, at a normative level, should think of how considerations of voice and quasidemocratic procedures may play a role in beyond Earth governance, it is far better to survey the full range of human social patterns than assume that all shall simply work out for the best.

Endnotes

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Space Technology and Its Military Application
Options for Pakistan

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Abstract: Space technology has aided military operations and has established its place in national defense. There is a dire need for Pakistan to exploit this military tool for the balance of power in the region. Space technology is changing the face of military warfare and the contest for dominance in space has increased its pace. The same has been a neglected part of the national policy of Pakistan and has not received its prioritization yet despite having an early start on this front. This article focuses mainly on the current performance comparison of Pakistani-leased satellites with Indian indigenous developed satellites. If Pakistan does not plan to keep pace with India's fast-growing space technology, it may result in disastrous results in the future, keeping in mind the history of wars between the two countries. The authors suggest that an inclusive, steady, and strong national space policy on the part of Pakistan should be articulated and executed.

Keywords: militarization, space technology, space program of Pakistan

Introduction

With the launch of the first artificial satellite, *Sputnik 1*, in 1957, the Soviets set the stage for the space race. Cold War rival America followed suit by launching *Explorer 1* four months later.[1] This started

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the never-ending queue of satellites. In the initial stages, national prestige was the predominating factor that motivated nations to explore the new front of warfare and later critical military applications of satellites and missile developments led nations to pursue the development of satellites and satellite launch vehicles. The Sino-Pakistani nexus in the space domain covers intelligence, surveillance, and reconnaissance (ISR) and satellite navigation services. While Beijing has extended cooperation to Pakistan in the areas of space exploration, science, and astronaut training for many years, the Chinese plugged Pakistan into their indigenously built BeiDou Satellite Navigation (BDS) system since 2013, which is China's equivalent of the American-built Global Positioning System (GPS) network.[2] Conversely, Russia and India have undertaken joint ventures in missile development. Russia and India have a relationship that has endured for decades, benefiting India in its space exploration and its attempts to widen its portfolio of defense and strategic partnerships. There is a legacy of Russian military equipment in the Indian inventory, across all the services including nuclear systems. In the following years, many civilian and commercial applications of satellites were identified and extensively developed.[3]

On one hand, civilian satellites are used to generate awareness and uplift the socioeconomic conditions of people living in far-flung areas.[4] On the other hand, military satellites are used for providing real-time reconnaissance about important enemy installations, intelligence about enemy deployment, battle damage assessment, missile launches, or even hunting down terrorists.[5] Satellites have enabled military commanders to get firsthand information about the likely target.

Recognizing the growing potential of satellites and satellite launch vehicles, many nations of the world initiated their national space program, and Pakistan was no exception. It is vital to understand the role of space technology and its military applications with particular reference to Pakistan.[6] Considering its Indian-centric approach toward national security, Pakistan needs to reevaluate what it considers to be a national security concern. If Pakistan is unable to introduce a cohesive and comprehensive national space policy, it will be difficult for the country to match Indian space efforts in South Asia, especially when India, with its hegemonic designs, aims to use space as another pawn in the regional gamble for dominance. As space technology is a vast field, however, efforts are being made to understand the importance of satellite technology for Pakistan to counter a potential threat from India's fast-growing space technology.

Pakistan's Space Program: History and Steps Forward

Pakistan's space program was initiated with the establishment of the Space Sciences Research Wing under the Pakistan Atomic Energy Commission (PAEC) in 1961. The wing was set up on the advice of the scientific advisor to the president, Professor Abdus Salam, the only Nobel laureate from Pakistan.[7] However, in July 1964, the wing was detached from the Pakistan Atomic Energy Commission and placed under the direct control of the president of Pakistan. Later,

in March 1966, it was reconstituted as a separate organization and functioned under the administrative control of the Scientific and Technological Research Division.[8] Space organization was granted autonomous status and the Pakistan Space and Upper Atmosphere Research Commission, commonly also known as SUPARCO, finally came into being in 1981. The same year, the Space Research Council was set up and headed by the president of Pakistan, who was later replaced by the prime minister as head of the council, while SUPARCO remained under the administrative control of the cabinet division for almost 20 years from May 1981 to September 2000.[9] It is interesting to note that during this period, only one meeting of the Space Research Council was held in 1984. Afterward, no meeting was conducted until the dissolution of the council. Finally, in December 2000, the Space Research Council was replaced with the Development Control Committee (DCC) and SUPARCO was transferred from the cabinet division to the National Command Authority.[10]

Pakistan's launch capability started when a batch of Pakistani scientists trained by the National Aeronautics and Space Administration (NASA) became involved in building sounding rockets.[11] Pakistan was able to launch the meteorological rocket Rahbar-I within one year of its inception and became the 10th country in the world and 3d in Asia to attain such a capability.[12] The two-stage rocket, Rahbar-I, was sent 130 kilometers in the atmosphere carrying 80 pounds of payload.[13] After a month, Rahbar-II was also successfully launched. The data received from these rockets enabled scientists to gather information on wind shear, cloud formation, cyclones, and weather formations over the Arabian Sea and, by 1972, Pakistan had carried out 45 rocket launches.[14]

As compared to launch capability, Pakistan's journey in the field of satellite technology started quite late. SUPARCO first built a small radio satellite, named Badr-1, in the late 1980s with the help of the Pakistan Amateur Radio Society.[15] Since the satellite was planned to be launched from the *Challenger* (OV-099) space shuttle, the launch was delayed due to the explosion.[16] Badr-1 was finally launched into low Earth orbit by a Chinese launcher in July 1990. It weighed 52 kilograms and was inserted into a 205 kilometer orbit.[17] Although Badr-1 could not complete its designed lifespan of six months due to technical malfunction, the voice and data communications from the satellite were successful. SUPARCO could not maintain pace with further developments of the second satellite due to the economic sanctions of the 1990s.[18]

Badr-II was launched in December 2001, from Kazakhstan, on a Russian launcher. It weighed 68 kilograms and was inserted 1,050 kilometers above the Earth into orbit.[19] The progressive improvement in Badr-I and II enabled scientists to develop basic expertise in the field of satellite making. Then in 2003, Paksat-I was relocated to an orbit over Pakistan.[20] Paksat-I was a third-hand communication satellite originally bought by Indonesia. Later, it was sold to Turkey and, in 2002, it was hurriedly purchased by Pakistan to occupy its only slot in space.[21]

Out of 360 space slots allocated by the International Telecommunication

Union (ITU), 320 slots are already in use by various countries. ITU allotted five slots to Pakistan in 1984, but Pakistan failed to launch any satellites until 1995.[22] That year, Pakistan was granted an extension; however, Pakistan again failed to meet the deadline and lost four of its space slots.[23] However, Pakistan managed to protect its last slot by relocating the Turkish satellite and renaming it Paksat-I, with fairly successful progress.[24] Since becoming operational in January 2006, it has grown its customer base in the fields of broadcasting, communication, and internet use throughout the Middle East, Africa, South Asia, and Europe.[25]

A review of the developmental period reveals that during the initial years, Pakistan remained committed to developing launch capability. However, after a lull period of almost 10 years, the focus shifted toward developing satellite capability during the 1980s and 1990s. This disorganized development strategy delayed satellite development by 20 years. Moreover, the rocket capability did not result in any progress in the flight of satellite launch vehicles.

Pakistan's Present in-Space Technology

The present capability of Pakistan mainly consists of Paksat-1 and several application programs based on data from foreign satellites.[26] Paksat-1 is a communication satellite, which was relocated into Pakistan orbit in the year 2003 and became operational in 2006. It is being used for broadcasting, internet, and telecommunication purposes, extending coverage to South Asia, South East Asia, and parts of Europe.

In the sphere of remote sensing or Earth observation, Pakistan does not have any satellites of its own and remains dependent on foreign satellites.[27] However, a data processing infrastructure has been established to exploit Earth observation data received by foreign satellites.[28] Data is received from the acquisition zone of a satellite ground station and later it is processed for the application that it is being used.

National Satellite Development Program

After the last restructuring of SUPARCO under the Strategic Plans Division (SPD), renewed efforts have sought to revitalize the program to achieve self-reliance in the field of design and development of the satellite. The government of Pakistan approved the National Strategic Development Plan (NSDP) in the year 2003 to develop one communication satellite, two remote sensing satellites, and human resource development programs.

To replace Paksat-1, SUPARCO designed a prototype of a communication satellite, Paksat-1R. This project was completed in 2005. As a next step, SUPARCO was in the process of developing a small-scale engineering qualification model (EQM), a non-fly-worthy model, before building the actual satellite Paksat-1R.[29] Paksat-1R was launched in 2011, built for a lifespan of 15 years and can carry 1,000 kilograms of payload. It provides coverage to the entirety of Central Asia, the Middle East, South Asia, and parts of Africa and Europe.

Pakistan launched its first indigenous remote sensing satellite system (RSSS) in 2014.[30] The satellite had been designed for a lifespan of five to seven years and a revisit time of two to four days. Certain subsystems of prototype RSSS-1 have also been developed including a high-resolution camera, onboard computers, and satellite propulsion subsystems. After the success of the Badr series of experimental satellites, Badr-1 and 2, Pakistan launched a high-resolution remote sensing satellite system (RSSS) for satellite imagery.[31] The Badr family of satellites were all low Earth observational satellites that can take low-resolution, low-quality images of the Earth. Badr-II carried Earth imaging payload on an experimental basis, which was a success.[32]

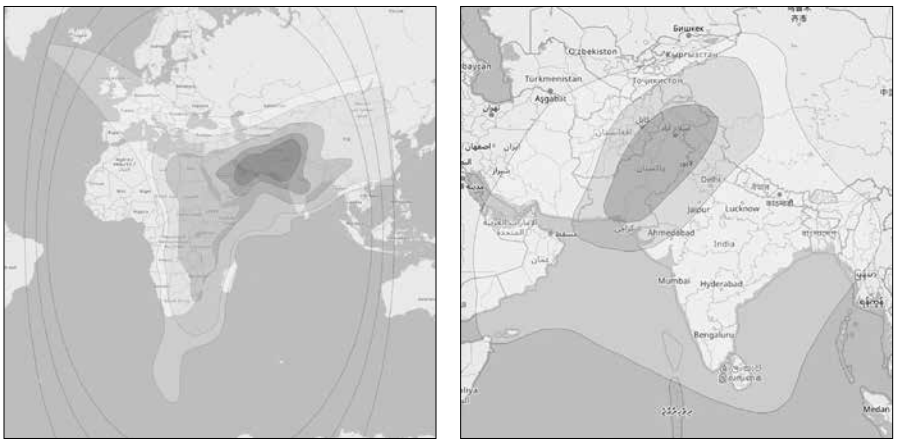
Badr-B is a follow-up microsatellite project of SUPARCO to its original Badr-A microsatellite project.[33] Badr-2 was developed in collaboration with UK industry and science institutes. Instruments monitor clouds at high resolution as well as atmospheric atomic oxygen. Badr-B is box-shaped with side dimensions of 51 cm x 51 cm x 46.5 cm and features a gravity gradient stabilization system. The satellite weighs 68.5 kg and is built and designed in Pakistan with some foreign subsystems. The camera was developed by Rutherford Appleton Laboratory (RAL) in the UK. Besides the Earth observation mission, Badr-B also used a radiation dosimeter to measure the exposure of the Sun's ionizing radiation and also studied the electromagnetic field of Earth. Additionally, Badr-B conducted studies on battery charge when it is exposed to solar flares and solar winds.

Badr-B was launched with the Meteor-3M no. 1 meteorological satellite on a Zenit-2 launcher from Baikonur Cosmodrome on 10 December 2001, into a 996 by 1050 km Sun-synchronous orbit inclined at 99.7°.[34] Other piggyback payloads on the same launch were Kompass, Maroc-Tubsat, and Reflector.[35]

Pakistan's first communications satellite, PAKSAT-1R, was launched on 11 August 2011 on board China's satellite launch vehicle, the Long March 3B, from the Xichang Satellite Launch Center. The 1R has a total of 30 transponders, 12 in the C-band and 18 in the Ku-band. The satellite will be deployed at 38.0E in geostationary orbit and it has replaced the existing satellite Paksat-1.[36] Paksat-1R has a design life of 15 years and will provide TV broadcasting and internet and data communication services across South and Central Asia, Eastern Europe, East Africa, and the Far East. This satellite now enables the extension of communication services to all areas of Pakistan.

SUPARCO launched the high resolution RSSS in 2018.[37] It will be a constellation of optical and synthetic aperture radar (SAR) satellites. RSSS is a progressive and sustainable program.[38] Initially, it was an electro-optical satellite with a 2.5 m resolution at 700 km Sun-synchronous orbit that was launched in 2011, followed by a series of optical and SAR satellites. It has a revisit time of two to four days with more than five years of a designed life.[39] SUPARCO's future projects also include the satellite launch vehicle in four phases, which can carry a payload of 200 kg to one ton up to 36,000 km.[40]

Figure 1. Satellite footprint of Paksat-1R



Source: "Satbeams—World of Satellites at Your Fingertips," Satbeams.com.

Military Applications

SUPARCO established a satellite ground station (SGS) at Rawat near Islamabad in 1989, which is presently acquiring remote sensing data directly from U.S. Landsat and French SPOT-2 and SPOT-5 series of satellites of 30m, 10m and 2.5m resolutions. The acquisition zone of the station covers 26 countries wholly or partially including Central Asian and Middle Eastern countries, Western China, Iran, India, and Bangladesh. Satellite images are being used for the identification of military targets, monitoring, mapping and information updating. This station provides images of multiple resolutions from 2.5m to 30m.[41]

Reasons for Slow Development

Despite having early momentum, the Pakistani space program is still at a very initial stage and lacks the desired level of technology and technical infrastructure. One of the major reasons for the slow pace is the isolation of the space program from the public sector. India involved its commercial sector in the space program from the start. Pakistan's space program is kept isolated from the private sector and is entirely handled by state-owned SUPARCO.

There is no sound industrial infrastructure available in the country to support such large research projects. Most of the time, the space program remained dependent on the personal interest of the individual head of state. It flourished very fast in the era of Prime Minister Zulfikar Ali Bhutto and the rest of the time it remained dormant.[42]

As a government organization, SUPARCO provides fewer chances for a competitive atmosphere and healthy environment, which are the foremost requirement for research and development projects. Little incentives and limited opportunities are being offered to the scientists and researchers involved in such projects.

Comparison with the Indian Space Program

Though the Indian space program started a year later than Pakistan in 1962, the Indian program was soon institutionalized with the formation of the Indian Space Research Organization in 1969. This was later augmented by the formation of the Space Commission and Department of Space in 1972 under the auspices of the prime minister.[43] It has been almost 40 years, and the integrity of the Indian space organization has been well maintained. India achieved self-reliance in the field of satellite development with the launch of Rohini in 1980. This was followed by a series of indigenously built experimental satellites in the field of communication, metrology, and remote sensing. Today, India's major satellite programs include an Indian national satellite system (INSAT) and an Indian remote sensing satellite system (IRS).[44]

Indian National Satellite System

Presently INSAT is the largest communication system in the Asia-Pacific region for telecommunication, broadcasting, and meteorological services including disaster warning, satellite-based education, and medicine systems.[45] To date, 22 satellites have been launched out of which 12 are operational. Major Indian communication satellite series are INSAT-2C, INSAT-2D, INSAT-2E, INSAT-3A, and INSAT-4. These satellites are used for telecommunication, television broadcasts, and for meteorological purposes.

Indian Remote Sensing Satellite System

India's remote sensing satellite system is one of the largest constellations of remote sensing satellites in the world, providing data in multiple disciplines.[46] At present, it consists of 11 operational satellites providing images up to 5m resolution.[47] This program was initiated to develop an indigenous capability to image Earth, the Indian Ocean region in general, and Pakistan and India in particular. Its civil utilizations include groundwater exploration, land uses, and forest and flood mapping. Some important IRS satellites are IRS-1C/1D, IRS P-3, IRS P-4 (OCEANSAT-1), IRS-P5 (CARTOSAT-1), and Technological Experiment Satellite (TES). Cartosat-2B is an Earth observation satellite launched on 12 July 2010 in a Polar satellite launch vehicle (PSLV) rocket from the spaceport at Sriharikota. The latest IRS-R2 (ResourceSat-2) satellite was launched successfully by PSLV-C16 on 20 April 2011 and is under trial.[48]

India's progress in the field of satellite launch vehicles (SLVs) is even more promising. The Indian launch program has progressed steadily since the first launch of a satellite launch vehicle in 1979. To date, India has conducted 22 launches with a success rate of 84 percent. The launch program started with satellite launch vehicles and progressed steadily to geostationary SLVs or GSLVs. However, it has been the Polar SLV that is considered the workhorse of the Indian space program. The Polar SLV removed India's dependence on Russian launch vehicles for deploying its remote sensing satellites. In space science, India

is preparing for two important scientific missions. Chandrayaan-1 was India's first scientific mission to the Moon carrying optical imaging and laser ranging instruments.[49] The satellite is completely designed and developed indigenously. Astrosat is a nationally developed scientific mission, which will enable multi-wavelength studies of a variety of celestial sources by using a cluster of X-ray astronomy instruments and an ultraviolet (UV) imaging telescope.[50]

The same is the case in the reconnaissance field. India has been trying to improve the accuracy of its satellite imagery since the launch of the Cartosat series of satellites in 2001. The latest Cartosat-2B satellite, which was launched on 12 July 2010, has finally enabled India to have the satellite capacity to provide imagery to the accuracy of approximately 1m resolution. It is believed in military circles that this satellite was specifically developed to keep a watch on developments in neighboring Pakistan and China. Besides these indigenous developments, India has also been collaborating with technology and information-sharing deals with Israeli space agencies. Israeli satellite Ofeq-7 can provide half-meter resolution images that can bring qualitative improvements to India's intelligence database. India is also planning to convert SLV-3 into an intermediate-range ballistic missile (IRBM) with a range of 1,500 km.[51]

The Indian Regional Navigation Satellite System (IRNSS) consists of a constellation of eight satellites, with two additional satellites on ground as standby. IRNSS provides accurate real-time positioning and timing services comparable to other global constellations like GPS.[52] The first satellite of the proposed constellation was launched on 1 July 2013 while the other six were launched between a time frame of April 2014 to April 2016. However, the eighth satellite failed to deploy on 31 August 2017 as the heat shields failed to separate from the fourth stage of the rocket. Another satellite was launched on 12 April 2018 to replace it.[53]

Pakistan's Available Response Options

Space technology is the perfect tool for gathering intelligence and early warning about future threats. A country possessing such capability enjoys a great advantage while using this technology. They can be used to monitor enemy force structure and nerve centers, especially their warmaking potential. It is also helpful in area mapping and tracking asset movements. Knowledge gathered through satellites helps military planners not only assess the enemy's force structure and deployment pattern, but with very high-resolution imagery being provided by the latest reconnaissance satellites, the targeting process has also become very effective. This is further augmented by data from remote sensing satellites that can determine the exact construction of the target, thus asserting the right type and number of loads required for its neutralization.

The Implication of Indian Satellites

India has launched communication and remote-sensing satellites several times. Apart from their commercial use, these satellites, in a military role, are utilized for intelligence, surveillance, and reconnaissance (ISR) as well as communication and weather monitoring roles. Cartosat-2A/2B with high resolution presents spot imageries with a swath of 9.6 km.[54] This satellite has a revisit time of four days, which can be improved to one day as well. The ability to maneuver the orbit will provide a tremendous boost to ISR capabilities under the net-centric operations scheme of the Indian armed forces. Although no dedicated military satellite has been launched so far, the Indian Air Force has in the past made use of Indian Space Research Organization (ISRO) satellites for ISR, communication, meteorology, search and rescue, as well as imagery.[55]

The Indian remote sensing satellites integrated with ground-based surveillance stations will support surveillance on Pakistani territory with focused attention on logistic supplies, missile stores, and mobilization of military forces. Satellite surveillance and reconnaissance systems would considerably increase the Indian ability to monitor security interests and military developments in the region. Indian satellite imagery is likely to be upgraded by the installation of infrared sensors and radar in the future, which will increase India's night satellite imagery capability.

Implications for Pakistan's Strategic Assets

India is also planning to integrate long-range missiles with satellite guidance. The reliability and accuracy of these missiles will increase manifold, thus assuring Indian second-strike capabilities. Indian satellite Cartosat-2A/2B, while getting images of Pakistan's strategic nuclear assets, has significant implications for Pakistan's strategic nuclear deterrence. Pakistan needs to understand the fact that, after achieving nuclear and missile technology, the next logical front should be space technology. This technology is vital for making the nuclear command and control mechanism "credible." Pakistan would need to reenergize its space program on a war footing to reduce the technological gap between the two nuclear-armed rivals in South Asia.

While continuously monitoring Pakistan territory by satellite, India can gain information on logistics lines that can be later exploited for strategic targeting.[56] Additionally, this technology will help Indians obtain intelligence of all types of equipment and infrastructure, especially relating to coastal defense, jetties, and harbors for countermaritime operations. Moreover, Indian spy satellites can detect any major mobilization of troops, naval, and air force assets by continuous surveillance of the region.

Implications on Tactical Fronts for India

India currently has a good command and control system of modern force that enhances its fighting efficiency.[57] India's improved command and control system supported by the satellite network will enhance coordination through the

network-centric capabilities of the Indian armed forces, thus giving an edge over Pakistan's military forces.[58]

Future Indian satellites with electronic warfare and signals intelligence payloads would be posing the greatest threat to Pakistan.[59] It can effectively intercept and in the future will jam microwave and digital communications signals and even radar transmissions.[60] In maritime air operations, satellites as force multipliers ensure information about the war theater. Thus, dominant situational awareness enhances operational plans and helps in tactical decisions.[61]

In the future, India may be able to detect submarines with blue/green lasers with the collaboration of U.S. space agencies.[62] A potential missile attack by the Pakistan Navy submarines can be monitored, thus providing early warning to India. The satellites can also provide essential guidance data for Indian long- and short-range missiles thus enhancing their credibility, especially on land targets.[63]

Tactical Options Available to Pakistan

Pakistan's response option for military applications of the Indian space program can be discussed under two broad considerations.[64] They include passive and active measures to deny, disrupt, degrade, or destroy the space capability. The most viable response against military applications from space-based assets under the prevailing environment can best be generated by developing a potent space capability. The current economic state of the country does not entail heavy spending on military space programs. The availability of requisite financial resources for even the ongoing projects has become questionable. Initially, the first focus is on the part of Pakistan's response through which it can minimize the military use of Indian satellites against Pakistan. As already discussed, the main military application of Indian satellites is in the domains of communications and ISR functions.

There are various passive and active measures that can be adopted to limit or reduce such applications. Camouflage and concealment is a passive measure to deny electro-optical and infrared imaging by satellites. Military installations are painted in camouflage paints and sensitive buildings have earth backfilled over roofs for denying infrared signatures and visual acquisition. This second technique seems more viable. Besides that, infrared absorbent paints are also available. These techniques can be applied as a standard operating procedure on all new infrastructure and old sensitive installations. The construction of buildings at strategic sites and transportation of strategic assets need to be masked. However, for effective masking, the availability of data regarding the trajectory and orbital timing of enemy imagery satellites is a prerequisite. Lastly, there is a need to construct replacement dummy structures, aircraft, or radar antennas with fake infrared signatures, etc. to deceive the enemy.[65]

INSAT series satellites are commercial satellites that are being used for communications by the Indian armed forces satellites that, like any civil satellite, can be jammed from the ground or in space. The close vicinity of communi-

cation satellites might cause jamming spillover on neutral satellites.[66] However, for its effectiveness, accurate fingerprints about the concerned satellite by electronic intelligence measures are essential. Localized antisatellite communication jamming can be conducted through the readily available off-the-shelf jammers in the international market.[67] Computer hacking is the biggest dilemma faced by the United States even today.[68] Cyber warfare is considered to be an essential element of information warfare. With proper hardware, software, and human expertise, any computer-based system in the world can be infected. Depending on the expertise, computer viruses can cause significant corruption and disruption even in the presence of advanced safety features. Satellites and their functions can also be disrupted by computer hacking.[69]

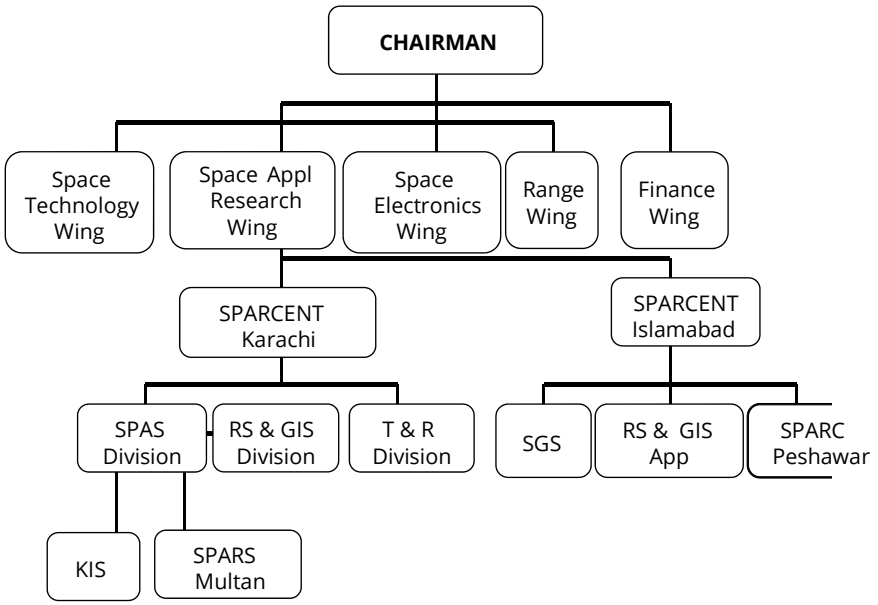
The United States, Russia, China, and India have already tested antisatellite missiles. Destruction of a satellite is the most potent means to deny the enemy strategic high ground.[70] While the destruction of medium Earth orbit satellites is difficult, the LEO satellites can be destroyed, which would deny real-time surveillance capability.[71] The makeup of this capability includes a satellite tracking system and an antisatellite missile. Pakistan already partially possesses these components in the shape of the surface to surface missile rocket motors and SUPARCO's Satellite Telemetry, Tracking, and Command Station located at Lahore.[72] It would be prudent to initiate the preparatory work on Pakistan's end to achieve this objective during the war. Indians have two satellite mission control centers (MCCs) and seven satellite ground receiving stations (GRSs) located in Indian territory. All of these facilities have fixed locations. However, most of these facilities lie outside the Pakistan Air Force's existing strike range. However, the targeting of these facilities can deny India the military application of its space assets to a great extent. The other option is targeting these sites through conventional surface to surface missiles.

The available information about the Indian space program is only through open-source material. In the case of the Indian space program, Pakistan needs to develop a more complete picture of its capabilities, which can be accomplished by developing multiple human intelligence ingresses into the system. India, being a poor country, offers a wide scope for such undertakings due to an abundance of workers. Moreover, there is a large turnover of ISRO employees who tend to move to Western countries to explore high-paid job opportunities. The employed workforce can be exploited on these lines to disclose desired information. The development of human intelligence ingress into ISRO permanently is the most vital requirement for developing all aspects of Pakistan's response to preparing the most appropriate response option against any given space system.

Response Options at the Government Level

It is practically difficult for Pakistan to develop an indigenous satellite for commercial and military use due to budget constraints. However, multipurpose satellites (military and civil) are the most suitable option available for a country

Figure 2. Organizaion of SUPARCO



Source: courtesy of authors, adapted by MCUP.

like Pakistan. Private ventures can easily be formed to develop communication satellites as it is a speedy and reliable means of communication. Having an indigenous satellite provides Pakistan with total control over the satellite. Indigenous-built satellites cover the security aspect and also ensures availability during wartime.

At the national level, Pakistan should seek partnerships with China and friendly Muslim countries for which the forum of Inter-Islamic Network on Space Sciences and Technology (ISNET) already exists.[73] Moreover, consistent efforts at the government level to strengthen SUPARCO to gradually increase the strength of its imaging satellites should also be undertaken.[74] The availability of more satellites owned by SUPARCO could be the first step toward self-reliance. Continuation of hiring satellite services is a short-term solution for Pakistan, which only provides temporary relief, not a cure.[75] Moreover, its operating cost is very high, and at the same time the country has to be dependent on others, which gives less assurance during wartime.[76] This option may also lead to security compromises.

Recommendations

The following recommendations are highlighted for Pakistan's space program. SUPARCO should carry out extensive efforts to gain sufficient expertise in space-based technologies. India is known to have inducted a large number of experts from the former Soviet Union, Yugoslavia, and the Czech Republic.[77]

Pakistan can adopt a similar assistance package. Better coordination should be developed among military headquarters and SUPARCO for the exchange of satellite information. SUPARCO should be part of or at least have a fair representation in the planning and conduct phases of military operations.

Pakistan needs to develop extensive, all-directional bilateral space cooperation with other countries. In particular, Pakistan must fully exploit Chinese space potential expertise and support from the Islamic countries. The space program requires long-term partnerships and continuous assistance from collaborating countries until it matures. Therefore, focused diplomatic efforts should be made in this regard. Diplomatic policies toward these countries should also be steady. There is an urgent requirement to collaborate within international consortia for the development of a remote sensing system with at least a one-meter resolution to correct the regional technological imbalance.

So far as strategic surveillance is concerned, studies relating to classified areas with some time delay can be provided by SUPARCO using data from U.S. Landsat/IKONOS and French SPOT satellites.[78] However, to maintain continuity in strategic data acquisition, Pakistan must possess a remote-sensing satellite of its own. This need was amply demonstrated during the Afghan War after the 9/11 events when a ban was placed on the supply of these data to the world user community.[79] As a result, Pakistan could not receive data for more than three months, which was a "black-out" period for the SUPARCO.

While indigenization in satellite development may continue at its logical pace, Pakistan must augment the potential of its only geosynchronous satellite by replacing it with a multipurpose satellite with foreign assistance. This quick-fix solution may bring in some form of balance in space capability with India. On the ISRO–Defense Research and Development Organization model, SUPARCO should also have indirect collaboration with the Dr. A. Q. Khan Research Laboratories for the development of space launch vehicles from expertise in intermediate-range ballistic missiles or medium-range ballistic missiles.

The Indian government has improved the middle-class status so that their contribution to the development of the country has increased.[80] Pakistan should also adopt the same measures to encourage middle-class talent in this field. Incentives must be introduced to talented people to encourage them to develop national projects instead of having talent drained toward other countries. Major reforms are needed in education systems to be at parity with other countries.[81] Strong technical and IT infrastructure needs to be developed, along with heavy industry to support the indigenous space program. Sufficient funds are needed to undertake various space projects.

Conclusions

Information and space have prompted a revolution in which neither mass nor mobility will decide outcomes; instead, the side that knows more can turn the tide in their favor. Despite the immense benefits for the economic well-

being of a country, space has also become the new high ground for future conflicts. Space technology now promises to resolve many traditional problems of a military commander by becoming their eyes and ears. India has achieved its space capabilities in a steady and sustained manner. At present, there is no comparison between India's and Pakistan's space program. The tremendous achievements made by India in its space program have given it the capability against which Pakistan can do very little to hide its activities, which are strategically or tactically geared to bolster offensive or defensive design. To offset this advantage and maintain equilibrium in this very important field, Pakistan has no choice but to accelerate its indigenous satellite program to prepare for potential conflict. This fact needs to be recognized and addressed. This may be a very long-term solution and results may not be visible shortly, yet its importance cannot be overstated. Under the present circumstances, it may not be viable for Pakistan to run an expensive indigenous development program so the key lies in diversifying its bilateral space cooperation.

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Breaking the Newtonian Fetish
Conceptualizing War Differently for a Changing World

Ben Zweibelson, PhD

Abstract: Explaining what a military's social paradigm concerning conflict and war is requires a theoretical approach to both frame the core constructs and offer feasible alternatives. This article introduces social paradigm theory for military application and how most modern, technologically advanced militaries sustain a Newtonian-styled worldview concerning warfare and what constitutes war. The Newtonian-styled war paradigm gained prominence during the last five centuries, yet is now becoming increasingly insufficient and possibly irrelevant. The integration of ever-increasingly sophisticated artificial intelligence into nearly all aspects of warfare will require new ways of thinking and how teams of humans and AI systems collaborate in complex security contexts immediately. The new combination of the space domain, cyberspace, those military forces associated with these new domains, and special operations activities are of increased focus for how and why conflict may change, particularly within an overarching traditional nuclear deterrence between state competitors. This requires a military paradigmatic shift, moving away from Newtonian constructs.
Keywords: emergence, complexity, artificial intelligence, warfare, strategy, design

Modern militaries declare without hesitation that war is complex, especially when a conflict features a vast array of actors, intents, and abilities set within a dynamic sea of changing contexts. Militaries, as extensions of nations entangled in competition, cooperation, and conflict are

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called on to secure, defend and, as necessary, inflict organized violence through time and space across multiple domains such as land, sea, air, and now increasingly through what is termed cyberspace and the celestial space encompassing Earth, and beyond. The inhospitable and until recently unreachable space beyond the atmosphere now is teeming with commercial, societal, and military activities, while just in the last few decades Homo sapiens have conjured up an entirely new plane of existence that is virtual, yet increasingly critical for the same commercial, societal, and military activities. Artificial intelligence at the *general* level, capable of matching or exceeding human capabilities in all endeavors, was previously considered a science fiction possibility decades away. At the time of this writing, humanity might be under a decade away, or possibly less than a few years. Applications for artificial intelligence toward all security activities are boundless and likely transformative in ways people struggle to comprehend. Now more than ever, the prospects of future warfare are increasingly complex, dynamic, and elusive. Tomorrow's reality will exercise emergent and unexpected developments unlike anything curated in institutional histories of all the wars of yesterday.

Modern society has no shortage of policy makers, military leaders, or wise strategic sages sounding alarms about the need to think critically, creatively, and incorporate new and different ways of learning so that militaries can fight and win in these complex future security challenges. Yet, there is a paramount disconnect between the calls for change and the response of institutional rigidity, fixation on self-relevance and identity drawn from earlier conflicts, and the modern facet of bureaucratic insulation from real transformation. Before many leaders finish exhaling on the need to innovate and change our ways of thinking in war, they immediately attack anything that does not conform to existing processes, doctrine, or favored practices. Innovation is killed before it gets started within bureaucracies because change is not considered valued if it requires significant destruction and unlearning of what was valued investing in before our system changed so that those values are now obsolete.

If military organizations are asked to drop favorite tools to be able to realize what new, alien tools might emerge that are necessary for tomorrow's challenge, the changes must first occur at the institutional level where one often cannot even question, "why this tool?" If wars of the past did require simpler, Newtonian-based (inspired from earlier Platonic "theory of forms") metaphors for armies and navies to readily understand warfare concepts of those periods, should military institutions continue to extend many of these concepts beyond their value simply because they are well established and familiar? This becomes the foundation for bureaucratic rejection of innovation and new ideas merely because the hand already has a favorite "tool" in use that has a long record of working seemingly well, or well enough for continued self-relevance.[1] By tool, this includes not just the tangible and explicit artifacts employed in warfighting, but the conceptual, abstract, and often tacit things as well. Tacit knowledge is near impossible to convey, but it is what represents deep understanding and

mastery. In other words, one can assemble a bicycle if read instructions over the phone (explicit knowledge), but no one could ever teach a child how to ride a bicycle without training wheels by telling them the finer points of balance over the phone (tacit knowledge).[2]

This article first focuses on the military fixation on Newtonian constructs and how this organizational fetish prevents radically new and transformative constructs from being taken seriously by warfighters. While select terms and models are often plucked from these important emerging areas of human endeavor, they are immediately sanitized, stripped of their meaning, and forced to comply within what might be framed as a Cartesian and Newtonian frame or "style" that rose to dominance in the seventeenth through nineteenth centuries.[3] It is in this fertile period that war "modernized" and militaries of the Middle Ages professionalized through significant changes in education, training, organization, theory, and practice.[4] Yet, despite such change, a surprisingly strong institutional force would preserve many ascientific practices, beliefs, and constructs that continue unimpeded nor seriously examined through today. While some paradoxes and tensions are exposed within the established domains of land, sea, and, more recently, air warfare that have been mastered, it is in the space and cyberspace areas of development as well as the peculiar and exquisite areas of special operations that Newtonian, Cartesian, and even Platonic conceptualization of modern warfare are arguably insufficient as well as oversimplified. Lorraine Daston offers valuable summary:

> Throughout the early modern period, European thinking about natural laws and the laws of nature had evolved in parallel. There were obvious contrasts: natural law held only for human nature and compelled by reason rather than physical necessity; laws of nature could be called such only metaphorically and had to be discovered by empirical inquiry rather than thought experiments about a hypothetical primordial state. Yet their commonalities dwarfed these differences. Both embraced a foundational model in which vast and varied consequences could be derived from a few simple, general laws; both contrasted the universality, uniformity, and immutability of these laws with the mosaic of local customs and local natures.[5]

Innovation takes time and a willingness to challenge not just the institutional status quo but critically consider beyond the very boundaries of what one's shared belief system declares is or is not valuable, relevant, factual, validated, historically proven, and otherwise so well understood that questioning such things seems absurd. General Stanley A. McChrystal and his coauthors addressed this challenge in the book *Team of Teams: New Rules of Engagement for a Complex World.* The title specifies a social reality that is now complex, implying that previous periods of conflict and war in comparison are less complex, or otherwise had narrower cognitive requirements for achieving desired outcomes. This is not merely the ritualized process of updating military doctrine and de-

bating over terminology, or updating a methodology with a new subroutine that otherwise sustains the original logic and belief system concerning war. Social paradigms are representative of how groups of humans believe the world exists, why it is as such, and the ways that one can achieve some harmonious or useful engagement within this reality as we move toward the future and further from the past.[6] McChrystal and his coauthors indicate the military necessity of recognizing what particular social paradigm is employed, the limits therein of what we are conditioned to think and do, and whether we need to break free of such thinking to gain access to what would otherwise be unimagined or unappreciated alternative belief systems. Shifting one's war paradigm requires destruction of existing institutional and individual conceptual barriers, with little to do with actual destruction of physical objects in reality:

> We had to unlearn a great deal of what we thought we knew about how war—and the world—worked. We had to tear down familiar organizational structures and rebuild them along completely different lines, swapping our sturdy architecture for organic fluidity, because it was the only way to confront a rising tide of complex threats.[7]

Although few military leaders and theorists clearly articulate the existence of social paradigms and how military organizations rely upon them for defining what we believe war is (and is not), those advocating this approach tend to use sociology, philosophy, and organizational theory to buttress McChrystal's position that complexity cannot be deciphered using the proven tools that control and manage simplistic and complicated systems.[8] Without starting at a level of abstraction sufficient to comprehend multiple social paradigms where militaries and their respective societies know reality as such, two negative outcomes occur that essentially kill any useful debate. First, operators within their preferred paradigm will deny any value or logical feasibility to concepts that supposedly exist beyond their paradigmatic limits, with operators of different social paradigms holding similar arguments, resulting in both groups talking past one another. This is termed *paradigm incommensurability* and is why military doctrine and institutionalized belief systems cater exclusively to one social paradigm and not others.[9] The second logical failing is that, when confronted with this paradigmatic tension between groups of humans waging war in the same physical reality (while disagreeing through different social realities), an operator of one paradigm will demand that any new concepts or theories must be articulated exclusively using the language and underpinning beliefs and values of their original paradigm. This produces another logical paradox, such as attempting to explain planetary geometry to a flat earther, or how Marxists and democratic, Westphalian capitalists might disagree fundamentally on how and why conflict occurs. We ignore McChrystal's guidance and instead refuse to unlearn, in that the act of unlearning becomes a new form of learning that cannot be guided or controlled by the institutionalized concepts that define what learning and unlearning must be.

In the second part of this article, alternatives to the traditional Newtonian stylization for modern war paradigms are presented. This article challenges the Newtonian physics based, reverse-engineered ends-ways-means and collective rationalization of Cartesian geometric logic found in all military doctrine, models, and methods that otherwise dominate how we understand and decisively act in conflicts. This article will illustrate both of the paradigmatic tensions explained above and illuminate potential pathways that we as humans and future human-machine teams might capitalize on the opening up of new opportunities that are otherwise inaccessible. This is no easy task, and institutional defenders will be ready to chase away such heresy with mobs of pitchforks and flaming torches. People tend to hold to the single, preferred war paradigm at the expense of gaining any new knowledge that also contradicts what is foundational to our belief systems, values, and existing theoretical base of knowledge. Even at our training centers and in our military wargames, performers are evaluated on "how well did you conform to established practices, processes, doctrine, and objective criteria" instead of "might you experiment by violating all institutional norms and preferences by attempting something previously unexamined, unimagined, or unexpected?"[10]

When critically confronted with the cognitive boundaries of our war paradigm and that of potential alternatives, we default once more to demanding these alternative perspectives must adhere to the corresponding beliefs, values, logics, and methods already operating within the dominant worldview on conflict. Modern Western militaries generate doctrine that articulates specific theories, illustrated through certain models and terminology grounded in particular belief systems that otherwise operate invisibly and behind the scenes. By maintaining this, one can neither imagine nor dare to seriously entertain anything that violates this sacred war paradigm. Modern warfare doctrine, methods, and models rigidly adhere to a geometrically styled rendering of warfare, one that remains governed by a Newtonian style of thinking defined below by complexity theorist Haridimos Tsoukas:

> The Newtonian style of thinking operates by constructing an idealized world in the form of an abstract model, in order to approximate the complex behavior of real objects. For example, Newton's laws of motions describe the behavior of bodies in a frictionless vacuum—a mathematically handy approximation, good enough for several real-life occasions. Moreover, the core of the Newtonian style consists of two assumptions. First, the extremal principle; namely, that the objects of study behave in such a way as to optimize the values of certain variables. And, second, prediction is possible by abstracting causal relations from the path-dependence of history.[11]

In the relatively new fields of quantum theory, open systems theory, sociology, complexity theory, as well as postmodern philosophy, there are any number of entirely new ways to conceptualize many of the exceedingly complex and

difficult military concepts of modern warfare that do not support the models and metaphoric constructs dominant in earlier seventeenth century institutionalized habits and patterns. Only in a Newtonian reality could one effectively break something down such as war into universal, enduring principles of war, plan against "centers of gravity," or make the broad claim that "war has an enduring, unchanging nature with a contextually fluid character," as found in all modern doctrine.[12] Newtonian styled reasoning, as applied by the military profession toward complex warfare, seeks the universal, the general, so that outputs accomplish a timeless quality to cast forward on future, unwaged wars a predictive shadow that also spans in reverse so that every historical battle is also in keeping with the constructs. At the ontological level (what is and is not war), war phenomenon, according to this Newtonian worldview, must consist of discrete, objective elements, and their law-like associations expressed can then be identified by a military analyst through a construction of an abstract model. These models are subsequently used for predicting, and, if possible, "controlling the phenomenon at hand. The Newtonian view assumes an *objectivist* ontology, works with a *mechanistic* epistemology [theories of knowledge], and enacts an *instrumental* praxeology [theory and study of human action and conduct]."[13] It is the formation of models and metaphoric devices where militaries engage in what is argued here as a purely Newtonian styled approach to modern warfare, exercised in virtually all doctrine, training, as well as education.[14]

Triangles, trinities, and triads abound today across the Department of Defense just as they did in 1722 when Sébastien Le Prestre de Vauban first published his highly influential book on military fortification, artillery, and geometry for warfare.[15] Vauban was an early and influential military theorist to draw from Newtonian physics to conceptualize military models on what warfare was and how to properly wage it. While modern, complex warfare today demands a flexible, creative, and adaptive military profession to outthink and outperform adversaries, the Newtonian style demotes these so that hierarchy, rigidity, standardization, and uniformity are prioritized—all accomplished through conceptual models reliant upon fixed geometry, systematic logic, and a mathematical approach reliant on laboratory conditions that are best suited for the natural sciences.[16] War in the Age of European Enlightenment became one measured and controlled through scientific endeavors, articulated through the language of mathematics.

Linear, sequential concepts for explaining military affairs, whether in strict logical lines like formulas or recipes, mirroring natural science constructs such as centers of gravity, or arranged in iterative loops such as John R. Boyd's observe, orient, decide, and act (OODA) model, continue to dominate how militaries think and act, as well as think about their thinking. This overdependency on Newtonian styled warfare should be critically challenged, but only through disrupting and challenging the models and metaphoric devices with alternatives. Strange concepts such as a Möbius strip, Klein bottles, and other mathematical metaphors might better support an explanation of complex warfare and

how space, cyberspace, and special operations generate nuanced and different security phenomenon. Further, the integration of sophisticated artificial intelligence with humans provides an expansion in how AI can conceptualize in multiple dimensions differently, yet potentially translate new insights over to the human operator. This teaming could be conceptualized differently if the Newtonian style preferences are tempered, and we begin to play to the cognitive differences and interplay between biologically limited human beings and their artificial counterparts.[17] None of these will come to light unless the institution first realizes what favorite tools they cling to, why they do this, and only then might they deliberately drop some so that they can pick up strange and new ones to experiment with further.[18]

This cannot be accomplished by replacing one manner of graphical representation with another that still must be depicted in two-dimensional space, as humans still largely process these concepts by positioning them as such whether in printed format, on display screens, or other physical manifestation. In other words, replacing ends-ways-means logical arrangements with something such as "successive football plays to get us to the end zone" is merely a metaphoric replacement with the same overarching paradigmatic assumptions remaining in place.[19] Humans comprehend at times in multiple dimensions, but when articulating or communicating to others, our species is most efficient and comfortable working from a two-dimensional plane. However, the contemporary Newtonian styled war paradigm used by most Western, modern organizations does not rely on complexity science or acknowledge war beyond original Newtonian and adjacent constructs designed prior to the twentieth century.[20] Thus, in the arguments leveled below, the modern military as an institution cannot sidestep the problems of only embracing Newtonian constructs by replacing some graphics with non-Newtonian ones, if they still are relying exclusively on the original Newtonian constructs that define the war paradigm from others. To illuminate this challenge, we need to fully explain what social paradigms are and how the modern military currently uses one that rationalizes the perpetual use of Newtonian constructs over others. This will also create new pathways to how and why future human-machine teams with advanced artificial intelligence cannot continue to remain grounded in such outdated and potentially obsolete frameworks.

The Modern War Paradigm and How to Challenge It

When we hear the term *paradigm*, many readers might think of Thomas Kuhn's original treatment of how science progresses through iterations of new paradigms challenging and replacing popular ones that nonetheless are increasingly fragile and problematic.[21] Kuhn specifically addressed science and how he posited it changed through "paradigmatic shifts" that completely transform how reality is understood via science over time. The rise of a Newtonian worldview gradually replaced the earlier feudal and ancient, prescientific frame that contained scientific logic such as astronomy and mathematics, but readily paired

them with astrology, superstition, or alchemy. The Newtonian scientific understanding of the physical world reigned for roughly four to five centuries, but it was replaced in the early twentieth century by both quantum mechanics and the general theory of relativity. This was where our species discovered at the grandest scales down into the smallest particles composing reality, there was not the stability and hierarchical orderliness theorized by natural scientists and most associated with Sir Isaac Newton.

For war, as something entirely designed and exercised by humans against other humans in physical reality, it requires a social reality for which it can manifest that transcends the physical world.[22] Social paradigm theory, produced in sociology for extending Kuhn's original focus on scientific paradigms, posits that a paradigm "offers coherent assumptions regarding how the world should be studied."[23] These are the conceptual worlds where we can think differently about the same phenomena in reality, often in positions that are incommensurate with others operating beyond the paradigm limits that one actor subscribes to while denying alternatives.[24] In premodern periods, societies of humans readily believed that war itself was orchestrated and controlled not by fellow humans, but by deities, spirits, or other external supernatural powers. This does not change the overarching declaration that humanity created and generated the various rationalizations concerning war. Once we as people converge and organize into some definable group that shares certain values and beliefs, we generate and sustain a social paradigm that guides us through an otherwise chaotic, dynamic reality. This occurs whether we are agreeing on social reality with or without science, or whether we converge on a Westphalian, capitalistic system, or that of a Marxist one. Historian Yuval Harari speaks of "imagined order" in this vein:

> We believe in a particular order not because it is objectively true, but because believing in it enables us to cooperate effectively and forge a better society. Imagined orders are not evil conspiracies or useless mirages. Rather, they are the only way large numbers of humans can cooperate effectively.[25]

The external world, the individual internal reality for each of us, and the collectively shared "social" reality we organize to share and maintain also manifests forms of conflict along with the ability to action such violence. All of these forces shape the societal configurations we experience and rely upon to explain why reality is as it seems.[26] Gibson Burrell and Gareth Morgan introduced social paradigms, which thus include any inferences concerning war as another aspect of how humans socialize through competing belief systems.[27] To quickly identify and frame what one social paradigm consists of, and how it will differ from another competing social paradigm, we need to introduce the philosophical terms of ontology and epistemology. Using these concepts, readers can subsequently explore why our modern militaries adhere to a Newtonian stylization

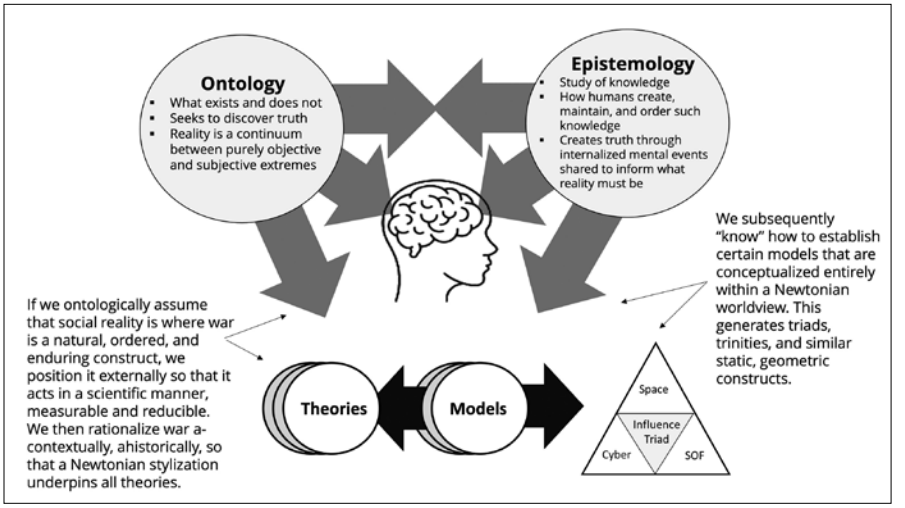
for war and how such a framework intentionally excludes certain things while also making other content inaccessible.[28]

Ontology addresses what people believe is and is not real.[29] Assumptions of reality that are ontological "concern the very essence of the phenomena under investigation" in that the world and what we perceive is us within our heads should be defined in some sort of clear relationship.[30] The accuracy of such constructs is irrelevant here, as humans construct ontologies and hold them in various convictions that are self-serving in maintaining the belief system that created the ontological assumption. For example, people agree on what a table is and is not, despite many different types of tables existing around the world that reflect different cultures, values, geography, and available materials. The abstract and absolute idea of "table" is shared collectively across our minds in an ontological configuration that cannot possibly be realized in a single table found on the planet. No single table possesses all the absolute ideas that "table" encompasses. However, if someone rode an elephant into the classroom and exclaimed, "everyone put their homework here on my table please," the students likely would declare that such a thing was not a table. Ontological assumptions become a collective feedback loop that sustains a certain reality. Actors within that construct use the social paradigm's ontological assumptions to go about their lives and not endlessly have to discover, examine, or question these basic tenets on what is and is not. The world makes sense (enough), and one can then go about the business of living in it, to include how and why to wage war.

While ontology is directly linked to the human experience within complex reality where plants, insects, and animals interact, epistemology is entirely a mental construct that remains in that same continued abstraction for human beings. Epistemology remains in our heads in that it addresses the way we design and curate knowledge itself. It addresses how we attempt to understand phenomena of interest, and how we know the forms and function of such knowledge, while also informing practitioners of a paradigm and subsequently developing that same paradigm via user inputs.[31] Epistemological assumptions work the abstract foundations of knowledge that remain entirely within our collective understandings, passed on to each subsequent generation. If we "know" through our ontology about reality, we also understand how the world is supposed to work within our belief system, even if we rarely take an interest in what that belief system is or how it establishes just as many limitations as it does declarations.

The modern war paradigm hosts many epistemological assumptions concerning war, such as the belief that war can be compartmentalized generally into a hierarchical arrangement of strategic, operational, and tactical levels. Yet, no soldier can point to where the tactical level becomes the operational level on a map or on the ground. We hold these concepts entirely in our minds, yet believe they are "real" in the sense they represent how the world functions. Centers of gravity, lines of effort linking ends with ways and means, principles

Figure 1. Challenging our belief system



Source: courtesy of author, adapted by MCUP.

of war, and many other constructs are epistemological assumptions about war. Epistemological assumptions are about ideas, such as how we know we can go about engaging in war against adversaries, what acts of war are and are not, how one can evaluate forms of knowledge on war, how one might distinguish between "true" and "false" statements concerning warfare methods, and also what war manifests as.

In figure 1, a simplified arrangement of ontological and epistemological assumptions acts entirely within our minds so that the foundations of our social paradigm can develop. These ontologies and epistemologies are formed based on a shared belief system where we have subjective values, logics, and cultural and social functions that collectively define our identities and distinguish us from others in this world. Based on these philosophical and abstract foundations, we then produce theories and models that together allow us to employ methodologies to act on reality in a deliberate, coherent fashion. Theories form the logical frameworks that we use within a social paradigm that, when exercised, offer us outcomes and consequences that validate whether the theory is true or false, or in complex systems, accurate or inaccurate.[32] For example, in the Napoleonic era of European warfare, military theorists Antoine-Henri Jomini and Carl von Clausewitz presented different theories about war. Jomini posited that war obeyed external natural laws and that core principles of war, mirroring those found in the natural sciences, existed in every and each conflict; the cunning general able to configure strategies and tactics to exploit these war principles could win every battle.[33] Clausewitz combined the same Enlightenment natural science concepts as Jomini would, but also integrated German

Idealism and Romanticism, where war could not be reduced down with laws or principles, and this trinity of passion, chance, and reason would become the focus of any aspiring general to develop new ways of outwitting an opponent through decisive battle.

Theories link to models, where the model is created drawing from the same ontological and epistemological assumptions to relate how the data generated by applying a theory to reality is similar or familiar with respect to the model itself. For example, Clausewitz's model for explaining the critical hierarchical arrangement of military instruments of power was a gravitational metaphor drawing from Newtonian science. A "center of gravity" was the key thing, person, or construct that gave strength and the will to resist; destroying or defeating it would collapse the adversary and provide victory. Theories and models are interchangeable within a social paradigm, where for example physicist Niels Bohr presented his mathematical theory on atomic structure in 1913 using sophisticated formulas. For the layperson, he paired the theories with a model that explained all atomic matter as operating like the solar system; the nucleus representing the Sun and the electrons orbiting just like the planets. Physicists later would identify atomic elements in the universe that violated Bohr's 1913 theory, and they would replace his formulas with new, superior theory. But they kept his model, and often the operators of a social paradigm switch out various theories with new ones, and/or change models as they attempt to employ useful methodologies to think and act in complex reality.

The above figure has a recent "Space-Special Operations Forces (SOF)-Cyber" trinity model created as part of the military's exploration of how these three domains and forces assigned to the domains offer new developments concerning conflict.[34] Julian Jaynes, in explaining this relationship between theories and models, offers that "a model is neither true nor false . . . [but] only the theory of its similarity to what it represents."[35] One thing for readers to reflect on is how figure 1 places the ontological and epistemological assumptions (including what those positions ultimately reject as not part of reality) as the superstructures orchestrating all valued theories and models available to the military organization, including what could be brought into reality. When we call for innovative thinking, new ideas, or disruption to the institutional norms, those tend to also be strictly regulated by these overarching social processes.[36] We might take a blank slate, attempt to innovate on a difficult military topic, and generate something new, provided that the new concept is both useful to the organization and recognizable or susceptible to the same rationalization used for all related theories, models, and methods within that particular war paradigm. Anything outside or beyond those barriers face a far more difficult, if not impossible, journey to gaining acceptance and approval within the institution. This is how we often end up "pouring old wine in new bottles" as the biblical parable goes.

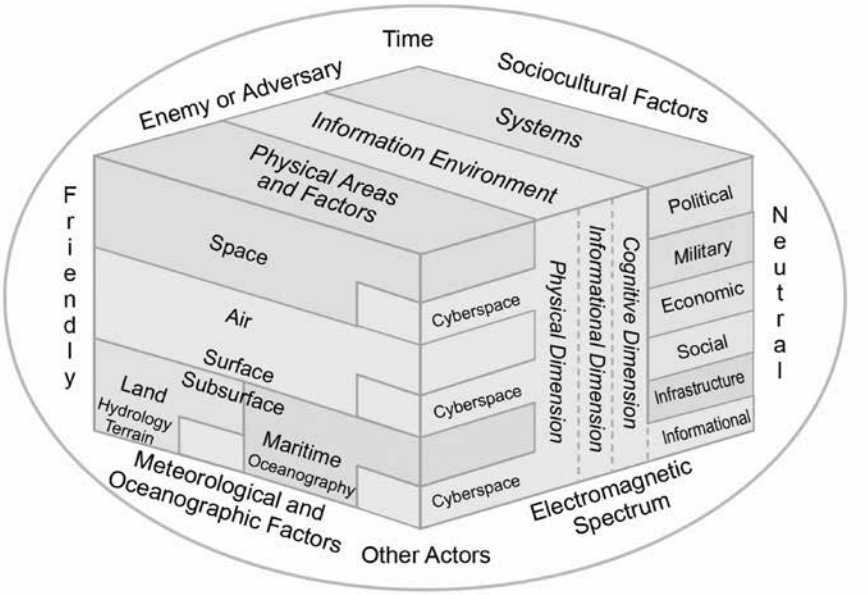
Of Triads, Linear Loops, and Three Ball Charts: A Newtonian Fetish for War

Modern militaries feature extensive training methods, educational programs, and a professionalized community of practice that seeks to equate military service with the same degree of specialization and unique knowledge curation such as the professions of law, medicine, or public policy. Militaries promote the notion that their decision-making methodology is founded on theory and models of sound, proven scientific reasoning, while they publish doctrine that describes how all military conceptualization, direction, and management of action should be conducted in uniform, universal, standardized, and predictable forms of exercise.[37] We declare ontologically that what we do in warfare is scientifically grounded, rationalized through clear reason and fact, and generally able to be tested and proven through some quantitative or qualitative treatment. War certainly can and does become chaotic, certain leaders with the "genius psyche" rise above others, and ultimately for Newtonian, Westphalian, Baconian warfighters of modernity, war remains a natural and enduring process exercised by nation-states in perpetual competition and cooperation.[38] Herbert Rosinski summarized this conception of warfighting:

> The classical doctrine of the balance of power as a dynamism of objective forces and necessities had *an exact parallel* in the theory of a natural balance of forces that was simultaneously developed in the field of natural science. Just as Newton succeeded in tracing the order and harmony of the celestial constellations back to the balance of the gravitational forces operating between the elements of the solar system, so the exponents of the balance of [social] power strove, *in the same spirit and with analogous concepts*, to grasp the nature of the conflicting forces and national interests in the political constellation of Europe in such a way as to achieve a balance between them and thus assure order and harmony in the European state system.[39]

In the U.S. military, one can quickly spot a pattern of Newtonian metaphoric devices in how the Services and commands conceptualize their concepts for warfare. Geometry, presented in this Newtonian style of conceptualizing warfare, dominates how the military profession attempts to understand and act in security affairs. This is how we ontologically understand social reality and the organization of state directed violence. Virtually all military doctrinal graphics demonstrate this Newtonian stylization through arrows, linear constructs, spheres, triangles, squares, cubes, or other configurations where "A plus B leads to C." This is described as *systematic* logic where reality is logically framed in isolation, with one part of the larger whole frozen in time and space so that it can be reduced, defined in a casual input leads to output dynamic, and then reassembled back into a whole. Geographic shapes retain a clear, readily understood form and function to illustrate the military concepts therein. The rigidity and order of these two-dimensional abstractions reflect the same certitude gen-

Figure 2. Holistic view of the operational environment

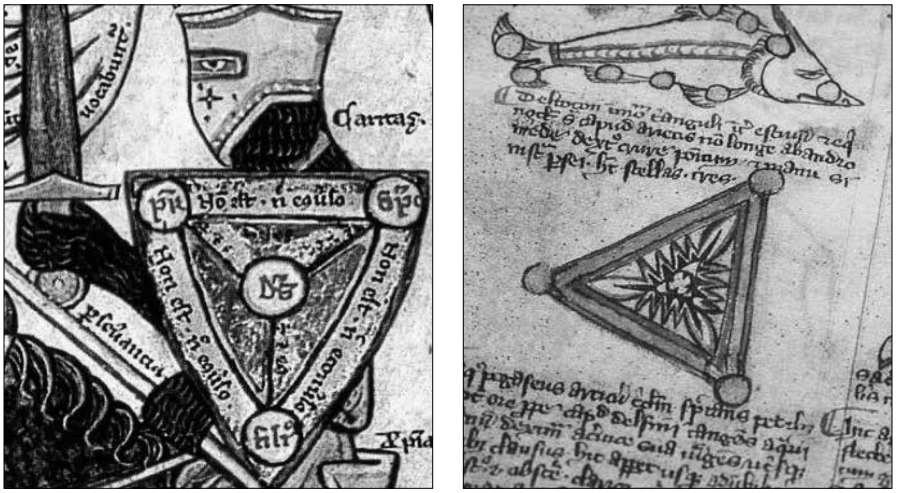


Source: *Joint Planning*, JP 5-0, 164.

erated at the ontological and epistemological level for our institutions. Clear epistemological assumptions on how one might visualize all of war in a clear geometric, ordered, stable relationship is illustrated below.

The graphic above comes from the U.S. military's *Joint Planning*, Joint Publication 5-0, and provides a telling example of how significant a grip Newtonian physics and similar natural science inspired constructs have upon modern armed forces.[40] These geometric metaphors have several origins, with recent centuries contributing scientific reasoning while earlier periods contributed ascientific and ideological implications instead. The modern, scientific ontology on war and what is best described as a positivistic epistemology (the world can be broken down, analyzed, reassembled, and universal laws applied to the whole) toward an enduring nature of war would emanate from the European Age of Enlightenment as it cast off earlier, prescientific and feudal-based beliefs on conflict. While the Middle Ages hosted a world governed not by humans, but a divine power and permanent societal norms and rules, the scientific paradigm shift toward a Newtonian world carried the construct of war along with it.[41] The Newtonian universe was deterministic, where "all events [were] the necessary results of a sequence of causes and reducible to the transmission of a single and invariant motive force. Such processes were also necessarily reversible: the original state of any system could be restored simply by applying the reverse of any dynamic changes it had gone through."[42] For conceptualizing war with enduring principles and structures, such positivistic theories needed to be universally applicable in some degree; the Newtonian war theories must

Figure 3. Medieval examples of triangles, triads, and geometric shapes



Source: British Library (left); and Berlin National Library text catalogued as "Codice di testi astronomico-astrologici, Francia (?)" (right).

exist within all past and future conflict, able to be teased out of any war given sufficient measurement, data, and time. Further, it could be simplified into formulas so that the entire military institution could readily grasp and apply it repetitively, otherwise it would be considered useless.

Yet, several centuries ago before this grand paradigmatic shift to Newtonian thinking, European militaries were quite unlike the modern versions of today, although many of the symbols, tools, and tactical constructs remain generally constant.[43] The Middle Ages militaries were organized differently, led by titled elites that were largely uneducated in any formal war education, staffed by trusted family members, friends, and business partners seeking profit.[44] They would conceptualize warfare not from any scientific rationalization, but from either divine positive law set down in scripture or determined through human reason and experience that would be reinforced by cultural or societal practices.[45] This often was due to largely agrarian based societies, the immense costs and time required to raise, train, move, and employ an army, as well as the significant risks if one was not exceedingly sure of a successful outcome in advance.[46] Rival nobility, despite competing fiercely through violence, trade, and marriages through constant preservation or expansion of their family wealth would agree to generally established rules for war that were often intertwined with religious edicts and regulation. Premodern military officers neither attended school for war nor were they required to study books or take examinations for advancement in rank or position.[47]

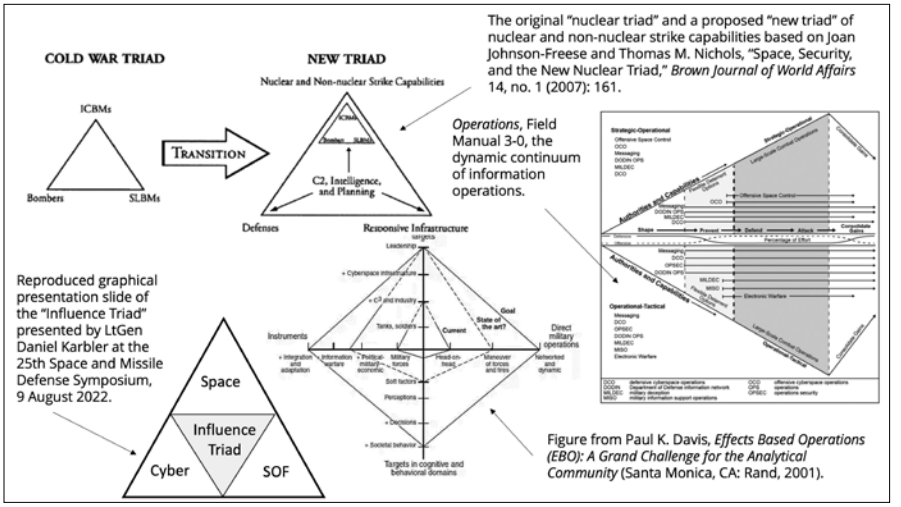
For feudal militaries prior to sixteenth and seventeenth century natural science developments, war and the conduct of armies and navies in warfare would be conceptualized through eclectic and often locally curated knowledge and training based on religious, cultural, and experience-based constructs. Triangles

and other geometric symbols in these times came not from the careful measurements of Vauban's fortification manuals, but from long-established metaphoric devices for reason such as from Saint Augustine. Chad C. Pecknold, in describing Augustine's development of a trinity concept for early Christian church doctrine in the fourth century ACE would occur in response to the regulative needs of an expanding bureaucracy seeking standardization. Pecknold, writing on how Augustine sought to standardize early Christian concepts including the Holy Trinity, would pursue clear rules and regulation to prevent misinterpretation and heretic deviations: "Trinitarian doctrine was moving towards formalization because it quite simply needed rules. These developments were primarily about how the church was going to think properly and worship God, and on that basis, it had a gatekeeping function."[48] This is *not* to suggest that mathematical rigor did not exist, as it stretches back to ancient Greek astronomy, mathematics, and the study of weights as well as early medicine.[49] But the high illiteracy, cost of education, and the difficulty to access both the knowledge and the printed information prior to innovations such as the printing press meant that prior to the Middle Ages, such knowledge was specialized, exclusive, and scarce.

Learned war knowledge abounded in the antiquities, but the collapse of the Roman Empire produced multiple long-term effects that would stymie any organized, formal education from continuing until the twelfth through fourteenth centuries of European renewal.[50] Common sense, experience, and the widespread gospel of dominant faiths provided much of the bulk of knowledge for how to exist in civilization, to include the "what, how, and why" of waging war. Additionally, premodern societies would blend various logics and offer a complex belief system where the analytical rigor of mathematics could manifest in highly accurate astronomy, yet the court astronomer would stand beside the court astrologist there to compliment the interpretation of when, how, and why the planets were moving. Royal elites might make significant political decisions including when and why to wage war based on both the accurate predictions of when Mars would be in a specific point in the sky, and the understanding that the god of war could assure them military victory if the people obeyed and offered proper offerings during key times or seasons. On the battlefield, even the best general could be defeated by an adversary, yet the rationalization of whether one is victorious or defeated largely rested in supernatural justifications. Rituals mattered as much as sound practices, and only the proper adherence to both in the prescientific world could lead to victory in battle.[51]

In the seventeenth century, Europe changed radically and quickly transformed the rest of the world, often to the detriment of those on the receiving end of these newfound powers and technology. In 1644, the French mathematician René Descartes (latinized name of Cartesius) inspired the modern scientific movement as well as a dramatic conceptual shift away from the Christian medieval period where "what is true, what is real" transformed from the external authority of a supreme deity to that of inquisitive, rational, and analytical

Figure 4. Trinities, triads, and pyramids

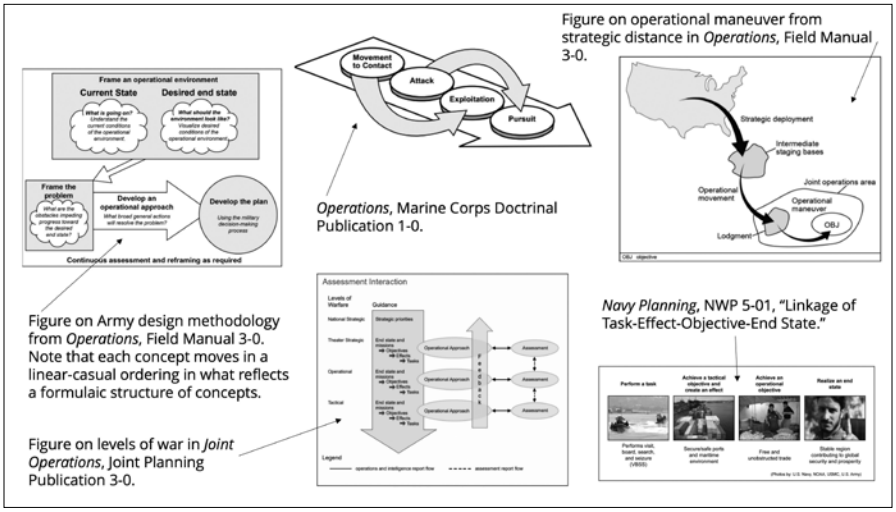


Source: courtesy of author based on elements from Paul Davis, *Effects-Based Operations: A Grand Challenge for the Analytical Community* (Santa Monica, CA: Rand, 2001); and Joan Freese and Thomas Nichols, "Space, Security, and the New Nuclear Triad," *Brown Journal of World Affairs* 14, no. 1 (Fall/Winter 2007).

oriented humans. Descartes' expansive work on (what would become known as Cartesian) geometry would use algebra as the foundation for forming a system of knowledge. This would in turn inspire further scientific research, including the inspiration to propel a young Isaac Newton to write his 1687 *Philosophiæ Naturalis Principia Mathematica* that contained his natural laws of motion as well as the law of universal gravitation. Newton's and Descartes' approach would be best understood within the context of natural sciences, where physics addresses aspects of reality in a scientific manner unlike all previous efforts of theologians, philosophers, and tinkerers. In the race to professionalize, militaries would seek to extend a Newtonian style to warfare and assimilate select terminology, metaphors, models, and methods to establish new form and function for understanding warfare.

Contemporary military doctrine forms the foundation for how militaries think and act in modern warfare. Doctrine is defined as "fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives."[52] Chris Paparone, in highlighting how modern militaries mimic natural sciences to impose particularly mechanistic, engineering-oriented worldviews, questions how any military doctrinal *principles* are indeed *fundamental*? In modern military usage, there is a clear and intentional effort to resemble "the logic, grammar, and rhetoric of Sir Isaac Newton's *Principia Matematica,* advocating a view of the world through a machine-like precision of algebra."[53] U.S. military science, as expressed in doctrine, training, and decision-making methodologies, is structured around what James

Figure 5. Linear causal relationships (A plus B leads to C logic)



Source: *Joint Operations*, JP 3-0 (Washington, DC: Department of Defense, 2011); *Navy Planning*, NWP 5-01 (Norfolk, VA: Navy Warfare Development Command, 2021); *Operations*, ADP 3-0 (Washington, DC: Department of the Army) 2-3; and *Marine Corps Operations*, MCDP 1-0 (Washington, DC: Headquarters Marine Corps, 2011), 9-4.

Der Derian artfully termed the "Bacion-Cartesian-Newtonian-mechanistic" model.[54] Paparone goes on to argue that "this architecture-like superstructuration of military episteme has arguably become a constricted frame," where modern military science continuously invents and recycles terms, concepts, and models to mirror the natural sciences.[55] The geometric triangle modeling above is reinforced by the linear-causal arrows, sequential and systematic logic depicted below, as well as the next illustration with spheres, orbits, loops, and centralized hierarchical relationships. Again, the graphics are two-dimensional, but the meaning behind how they are composed remain Newtonian due to our ontological and epistemological assumptions on what war must be.

The way militaries attempt to illustrate the complex and dangerous phenomenon and constructs of modern warfare undertook a gradual transition from an earlier Napoleonic era understanding that would, historically speaking, show clear dependence upon natural science concepts from geology, physics, engineering, biology, and other available fields of successful scientific progress. We would recast war using natural science, where the enduring nature that made all chemistry able to be measured and validated universally would be extended into war. The certitude of gravitational fields and planetary bodies would be projected into how nation-states and their instruments of military power featured stable, ordered centers of gravity, and conflict would be explained using borrowed scientific concepts such as "spectrum of war" relying upon the spectrum of light.[56] J. F .C. Fuller, a twentieth century military writer and veteran of World War I, would use epistemological positivism as a foundational logical underpinning of what a scientific foundation for war *must include*.

Frustrated with the vast devastation and static trench warfare of World War I, he would argue in the interwar period: "[By] means of the inductive method we attain to science by collecting facts, by sorting these into categories, by extracting their values, and on these values erecting theories. By putting these theories to universal tests, by degrees we can extract laws which form our working principles, our weights and measures of war."[57] Fuller's reliance on Newtonian styled, positivist ideas would shape many aspects of how modern militaries in the twentieth century would understand war using scientific rationalism and natural science constructs.

War, over thousands of years, was unscientific and thus all existing theorization of war was, for Fuller, some similar manifestation of an alchemistic approach to warfare that might generate some useful effects and processes, but without a scientific transformation, fools were just attempting to turn lead into gold on battlefields without any analytical rigor or scientific reasoning. Fuller argued that a truly scientific way of rationalizing war would not just help use military artistry to deal creatively with events on present battlefields that remind us of past conflicts, but that a scientific methodology will permit us to deal with new and emergent circumstances on future battlefields never before experienced. His work in the early twentieth century would largely define most modern military doctrine, to include this extensive fixation with defining and explaining war in clear, natural science constructs. He clarifies this tension:

> Here, then, is the supreme difference: If we can establish a scientific method of examining war, then frequently shall we be able to predict events—future events—from past events, and so extract the nature and requirements of the next war possibly years before it is fought.[58]

Fuller sought a "machinery of rational thought," using those exact words, drawing from philosophers such as the French positivist Auguste Comte, the philosophy of Francis Bacon, and Descartes' positivistic process of separating everything into the simplest component parts and working upwards.[59] Newtonian ideals were sought, with Fuller oscillating between Newton and Charles Darwin, particularly social Darwinism, as primary sources of inspiration for how a scientific foundation for war ought to look like.[60] Fuller held to a deterministic ontology that reality required us to start all thinking based upon established facts and scientifically rigid methodologies, whether one was pursuing greater process improvement or attempting imaginative divergence from the existing order. "Imagination must be controlled by method and founded on fact. . . . Imagination works by hypothesis."[61] Thus, all effects are linked to some causal phenomenon, whether we realize it or not as it happens, and the world can be frozen in time, deconstructed, analyzed, reassembled, and the future of that system predicted with ever-increasing clarity if a scientific methodology is established and improved on. The ontology and epistemology that generates this Newtonian styled war paradigm continue to dominate, where modern doc-

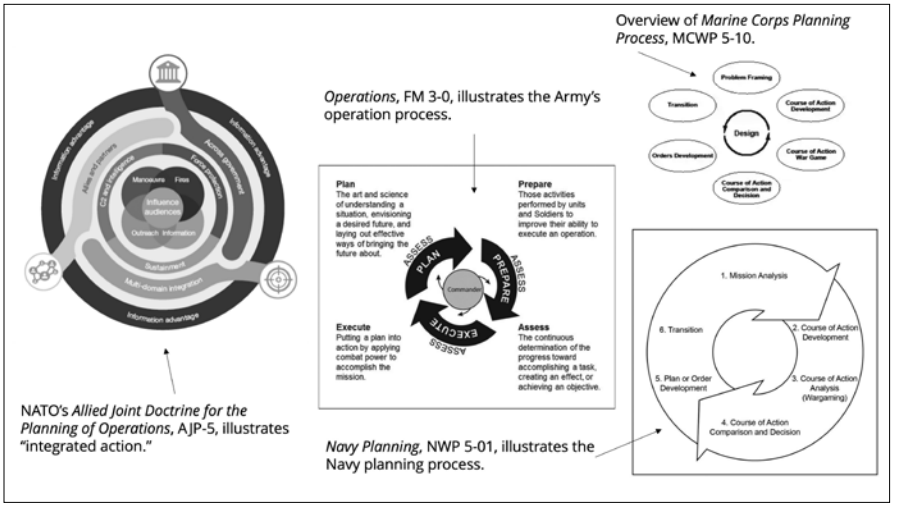
trine simply integrates new terms and concepts while simultaneously stripping them of anything that violates these overarching war beliefs.

Thus, despite the twentieth century ushering in entirely new war domains (space, cyber) intertwined with emerging fields of quantum, complexity, and systems theory, the military forces of the twenty-first century continue to extend the Newtonian style popularized in the seventeenth through nineteenth centuries into contemporary wars and beyond. "Centers of gravity" clearly hark from Newtonian origins, while "levels of war" appear to draw inspiration from geology (which would also influence psychology and other nonnatural science disciplines).[62] Warfare, regardless of maneuver on the fields of battle, are conceptualized within a linear, sequential, formulaic logic of A plus B leads to C formulation. Shimon Naveh, Jim Schneider, and Timothy Challans described this military assimilation of Newtonian or natural science metaphors to transform the understanding of warfare out of the Middle Ages and into the Modern Age:

> The Renaissance at last provided the strategist with the intellectual planning tools with which to bridge the gap between worldly perception and mental conception. This new conception as nothing less than the "geometrization" of military space and time. *It meant that a common military "chessboard" would define the conduct of military operations. . . .* The physics of Sir Isaac Newton would set the strategic chessboard in motion. Newtonian physics was a direct consequence of the three-dimensional worldview wrought by the Renaissance. Newton's three laws of mechanics provided military strategy with which to plan campaigns. The metaphor was the idea of mechanical force. Once having grasped the nature of mechanical force, it became only a matter of time before the practical aspects of the idea would surface. Napoleon, an artilleryman, with a solid background in mathematics and physics, was one of the first classical strategists to recognize that to use force effectively you had to *concentrate* it.[63]

The spheres, orbits, loops, and logical arrangement of concepts into centrally arranged hierarchical models is shown below in the next figure. These few selections dwarf the vast number of similar arrangements available throughout nearly every single military doctrine, regardless of service, domain, or area of specialization. Virtually everything in modern warfare can be articulated and illustrated using models, metaphoric devices, and terminology that not only can be universally understood by almost every single member of the armed forces today, but likely many previous generations of similar servicemembers going back centuries. Our Newtonian stylization could, if we had a working time machine, make sense to military professionals a century ago or further, if we could carry modern doctrine with us and show them.[64] Simplicity and universal convergence on foundational warfare knowledge is important and cannot be

Figure 6. Spheres, orbits, loops, and centralized hierarchies



Source: *Allied Joint Doctrine for the Planning of Operations*, AJP-5, (Brussels, Belgium: NATO Standardization Office, 2019), 2-6; *Operations*, FM 3-0 (Washington, DC: Department of the Army, 2017) 2-25; *Navy Planning*, NWP 5-01 (Washington, DC: Department of the Army, 2013), 1-4; and *Marine Corps Planning Process*, MCW 5-10 (Washington, DC: Headquarters Marine Corps, 2020), 2.

understated, yet change advocates across the military today raise fair objections that contemporary warfare is *outpacing* the depth, sophistication, and value of the doctrine and models being provided. If entirely new domains such as cyberspace, space, and the nuanced "gray zone" areas where special operations can create peculiar and exquisite effects lend increasing complexity (if not chaos) to the already robustly complex traditional physical domains that defined both World Wars, then how might it be possible for earlier Newtonian styled war concepts to accurately explain emergent, increasingly complex (or chaotic) war contexts?

This emphasis on conceptualizing warfare models in a Newtonian styling extends beyond military doctrine, arguably into broader war philosophical framings such as what retired Army Green Beret Grant M. Martin sees as a bifurcation of all security affairs into a "peace" or "war" bucket.[65] The multiple examples presented may work in specific contexts provided the situation is stable enough for a military force to apply the geometric construct and manage their decisions and activities with engineering-like precision. Yet these models are rigid, adhering to the natural laws defined in natural sciences such as gravity or motion. Categorization into war or peace becomes like a light switch or a coin flip. However, in complexity theory, systems theory, quantum theory, and some postmodern disciplines there is a disruption or blurring of these clear and stable constructs. The Newtonian war models reliant upon particular and simplistic geometric devices should give way to alternatives that, while mathematical, force a profession to think differently about warfare.

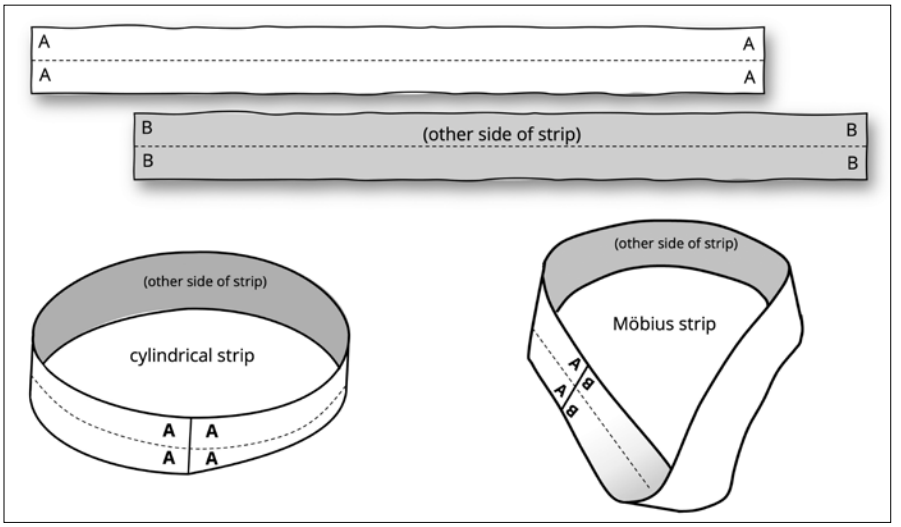
From Orientable Geometric Shapes to the Möbius Strip: Complex Warfare Reframed?

This section introduces some decidedly non-Newtonian constructs that still must be depicted on two-dimensional renderings, including this article on a computer screen or printed on paper. This tension is one of recognizing the ontological and epistemological dependencies our modern military paradigm is wedded to, and that of arguing over models and methods that already subscribe to such beliefs. To offer an example spanning thousands of years, the earliest depictions of "infinity" featured shapes or creatures such as the ouroboros—a serpent or dragon eating its own tail—which presented the idea of an infinite loop for premodern societies. In modernity where the fields of mathematics have invested significant research into how infinite properties can be used through sophisticated formulas, the idea of "infinity" is rendered in a similar symbol, but manifests through quite different ontological and epistemological structures. Or if we return to the celestial and societal arguments on whether Earth exists in a geocentric or heliocentric universe, the drawings for both included planets and stars moving in various orbits, but the ontological and epistemological differences between the two could not be greater. In this section, new constructs will be presented that break with the past military fixation on a Newtonian styled war paradigm, yet they too need to be presented in the same two-dimensional space. They require different ontological and epistemological assumptions on war, and thus represent a paradigm shift in how our forces might think differently in complex reality. The fundamental issue becomes: Is this even possible?

How might military forces shift from oversimplified conceptual models of warfare to ones that might more readily take the weight of full multidomain, complex, and emergent security challenges in today's hyper technological, fluid, and networked reality? Often, a useful form of immersion is to present something tangible that carries with it some intangible, abstract qualities. Consider a simple challenge involving a narrow strip of paper in the shape of a long rectangle with a centerline drawn down the long axis. The challenge is to give this strip of paper to a military audience and ask them how one might turn that into something that can double the length without any rips, tears, or destruction of the strip of paper (drawn on *both* sides of the rectangle strip). Many might turn the strip into a simple loop, as illustrated below. Yet the centerline and each newly formed outer circular edges remain the same length, thus failing this exercise. Clearly, there must be some trick here to accomplish this task. The trick is shifting from a particular dimensional logic to one that extends beyond the simplistic.

For those willing to put one twist into the rectangle before connecting the opposing ends, they will notice that the centerline still lines up, forming a continuous unbroken centerline that remains the same length as the original rectangle. Asking the audience to then start at any point on the outer edge and trace along this curious shape, they will soon discover that at one lap around the

Figure 7. The paper strip challenge



Source: courtesy of author, adapted by MCUP.

twisted loop, they arrive at the opposite side they started on! They must complete two full laps to return to the starting point, indicating that this curious object does "double the length" of the original object. There are more unusual properties to this object, which is defined in mathematics and the specific field of topology as the Möbius strip. This isn't a new concept, but it remains something divorced from modern military doctrine, models, and theories. Additionally, the institutional defenders of the Newtonian style might object that such things overcomplicate what ought to remain as simple as possible for the maximum audience. This is not only a total misunderstanding of complexity (to include how war is inherently the most dynamic and complex thing humans are capable of doing), but an excellent example of paradigm incommensurability. For those willing to violate the dominant war paradigm, figure 7 provides the first key.

A Möbius strip is a *nonorientable* surface, meaning that unlike orientable surfaces such as a sphere, rectangle, or triangle, the Möbius lacks any clockwise or counterclockwise properties. If a traveler within a Möbius strip moves through the form and follows the loops, they return to the starting point but are now transformed into a mirror image of the original, reflecting earlier societal depictions of infinity. Continuing further with another loop and the transformation flips once more, occurring infinitely and without any ability to orient to directions such as navigating on a sphere (such as our planet). All nonorientable surfaces, when visualized in three dimensions, only have one side. Essentially, if one is within a nonorientable surface such as a Möbius strip, attempts to move clockwise or counterclockwise beyond a single isolated "trip" are impossible to impose some order of consistency to orientation. The trip inverts into a mirror image at the end of the journey, which is also the starting point para-

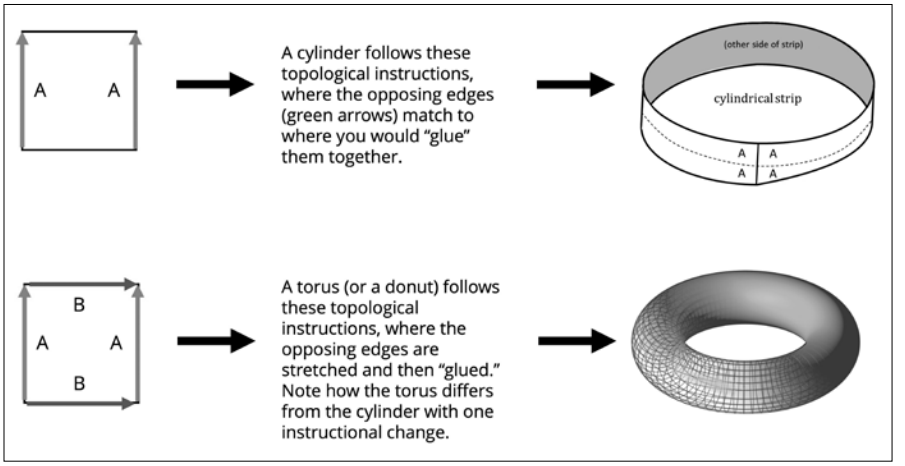
doxically. Nonorientable surfaces are still Cartesian, yet the metaphoric value of these concepts differs from the dominant Newtonian styled models that are simple, orientable, and less dynamic. Fans of classic video games can quickly distinguish the flat, two-dimensional scrolling environments of *Super Mario Brothers*, *Double Dragon*, and games like *Spy Hunter* with those of modern three-dimensional games as one useful way to understand topology; players can only move left-right, or up-down that correspond to an *orientable* two-dimensional game surface.

In a two-dimensional world like *Centipede* or *Donkey Kong*, the player's icon as well as all other things in the game can only interact in this same flattened, two-dimensional world. Yet, in games like *Pac-Man*, the player can move "magically" from one edge of the screen to the opposite one instantly by using one of the tunnels that link to the other side. A Möbius strip features this sort of nonorientable phenomena that will be expanded below. This seems confusing because most of the world (outside of some mathematicians, physicists, and philosophers interested in topology) conceptualize reality in the traditional Newtonian styled worldview. Modern military doctrine explains entirely in two-dimensional *Donkey Kong* styled illustrations and graphics on every aspect of warfare conceptualization. While the often-overlooked topological abnormalities of those magical *Pac-Man* connected tunnels to opposing sides of the map offer a useful steppingstone out of the strictly two-dimensional, Newtonian-styled conceptualization to different, novel ways to reimagine complex security affairs.[66]

Topology requires a little more explanation on how "surface" is significant, so that militaries can begin to think about the metaphoric preferences in current doctrine and modeling (the space-cyber-SOF triad, centers of gravity, integrated deterrence, or the gray zone) and how they all adhere to what is still a Newtonian styled framing of warfare. A surface is a space where every isolatable point has a "neighborhood" that appears to be a two-dimensional disc. If you take an orange or pumpkin and slice it right in half at the equator or anywhere else, you still will end up with a flat disc shape. Some surfaces have boundaries, while others in topology do not. The Earth is a sphere object and does not have any edge where an explorer might fall off, thus it is topologically a single surface stretched into a topological sphere.

Topological objects that pair nicely with traditional military models and constructs do not involve much stretching at all, as they follow quite simple rules and are devoid of any of the curious properties of something like a Möbius strip. The triangle has a long and storied history in military affairs, from adorning shields of Medieval knights to the strategic framing of the circuitous trading of slaves, sugar, and rum between West Africa, the West Indies, and the seventeenth/eighteenth century northern colonies of British North America, to the nuclear triad underpinning American strategic deterrence throughout the second half of the twentieth century into present day. From the most minute technical and tactical to the grand strategic, military forces and their political

Figure 8. Basics of topology and familiar shapes (the Cartesian-inspired military frame for war)



Source: courtesy of author, adapted by MCUP.

leaders conceptualize through models that are depicted in these clear, flat, and static geometric forms.

Taking the rectangle challenge once more, the rectangle can be made into a cylinder by connecting two sides together as shown below. The top and bottom of the cylinder are boundaries that would act as edges that an explorer could fall off, if they were on the cylinder topography moving about. Topologists use mathematical formulas to draw surfaces because beyond the simplistic, well-recognized shapes of triangles, cubes, and rectangles, many objects that bend or even break dimensional properties are hard or impossible to draw. Readers might consider that in military doctrine, every single conceptual model depicted is drawn in a flat, two-dimensional plane, meaning that anything in three, four, or more dimensions must be simplified (or at times, oversimplified) to be depicted. The admitted vast complexity of modern warfare is unavoidably reduced toward conceptualization in a *Mario Brothers* flattened world. Figures 4–7 present this as how we attempt to visualize the complexity of modern war. It is not just the convenience of two-dimensional rendering of symbols and artwork, but the Newtonian stylization of our entire war paradigm that requires such an ontological and epistemological framework for war to be broken down, analyzed, reassembled, and subjected to other pseudo-scientific processes.

The figure below helps demonstrate this by showing the mathematical framing on the left and how those shapes would be drawn in illustrations on the right. The cylinder shape is quite easy to conceptualize and draw into two-dimensional space, despite it being a three-dimensional object. The torus or donut shape in topography is also depicted below and features a slightly more complicated mathematical framing. A torus starts like a cylinder with the edges of two sides corresponding to one another glued together, yet the other two edges also must be stretched and glued together. Picturing this in the reader's

mind, the sphere must be warped so that the two long, circular edges at the top and bottom of the cylinder are glued together, forming a donut or what might seem like the inner tube to a bicycle tire. The mathematical formulas and topographical instructions from this point become increasingly difficult to visualize, and eventually they cannot be drawn in two dimensions or even third dimensional spaces without sacrificing some essential properties.

Why might this be useful to modern military forces? When considering the thousands of years of military theories, methodologies, organizational forms, techniques, terminology, and shared belief systems of different military groups, there are some significant patterns across cultures, societies, and geographies concerning conceptual models that are either ascientific in origin (Augustine's Holy Trinity as a triangle) or inspired more recently by natural science constructs. For instance, almost every military task organization chart mirrors the ancient Greek treatment of how cities, families, and organizations are arranged in centralized hierarchies, like tree branches stemming from a larger trunk. The tree-form conceptual model "for nearly two millennia . . . has been an Aristotelian hierarchical model of concepts divided into mutually exclusive categories."[67] Greek and Roman prescientific rationalization of war would have the strongest influence upon later Medieval and early (European) modern militaries, yet across the ancient world military theorists would conceptualize and introduce natural world causality, universality, and patterns of historical precedent in order to deduce rules or principles that govern warfare. Sun Tzu's writings from more than 2,300 years ago in China demonstrate this with universal war tenets drawn from natural phenomenon:

> The onset of troops is like the rush of a torrent which will even roll stones along in its course. . . . The quality of decision is like the well-timed swoop of a falcon which enables it to strike and destroy its victim. . . . Energy may be likened to the bending of a crossbow; decision, to the releasing of a trigger. . . . Hiding order beneath the cloak of disorder is simply a question of subdivision.[68]

The ancient world would correlate inputs with outputs systematically, drawing from the apparent natural order of the world, while religions would institute divine laws and rules to explain the governing of societies. The gods might be fickle and difficult to predict, but elites that could interpret their actions or articulate their rules for humanity would frequently be an integral part of how and why militaries would go to war. Yet, even priests or oracles had to show some proof and translate so that fellow humans could comprehend the supposed order and rationale. Conceptual models from antiquity, whether ideological or philosophical in origin, suggest common mathematical, geometric, and natural world inspired arrangements used to represent abstractions such as war theory. Later still, the Renaissance would introduce scientific reasoning and usher in natural laws that offered testable proof of a hidden order of the world. Militaries have perpetually attempted to link these laws and rules,

regardless of origin, to the application of warfare, with a dramatic shift in European militaries toward a military science coinciding with the rise of natural sciences as well as a rebirth of earlier Roman state-centric drill, organization, and discipline.[69] The declaration of a war rule within this Newtonian styled war science provides a desired certainty, stability, or predictability in what has always been the most chaotic, unpredictable, and dangerous of human endeavors. When one can arrange cause and effect in clear, even predictive arrangements, it should not matter if the inspiration comes from divine decree or a mathematical formula explaining planetary motion if reliable results can be accomplished on the battlefield. Antoine Bousquet frames this scientific way of warfare:

> The successes of modern science in uncovering seemingly external laws of nature and developing or perfecting technological contraptions to take advantage of them has unsurprisingly proved highly attractive to military thinkers and practitioners seeking to dominate the battlefield and render their activity as predictable as possible.[70]

Contemporary military strategies extend from a clear, linear-causal rationalization of ends-ways-means that are regularly depicted formulaically in lines of effort, plunging forward in time toward predesigned objectives and goals frozen in an imagined future state.[71] Newtonian laws of physics aid most everyone in regular daily activities such as throwing a ball or driving a car. The question to ask military theorists and educators is whether all military doctrine and the theories, methods, and techniques of military doctrine should be so utterly dependent upon simplistic two-dimensional rendered Cartesian and Newtonian constructs *alone*? Might the emerging complexities of cyberspace, space, and special operations—peculiar activities in competition, in which deterrence and different types of warfare require conceptualization *beyond* this ever-dominant Newtonian style for conceptualizing modern warfare?

A Möbius strip is the first useful example of a model that disrupts the cognitive limits of the Newtonian style, and thus might become a useful metaphoric device for various complex military topics. Möbius strips have already been widely used in many fields and disciplines beyond mathematics, working as a conceptual model or metaphoric device for understanding complex business relationships, in literature studies, political science and psychoanalysis, archeology and history, postmodern philosophy, and even gender studies.[72] Many of these applications are metaphoric, where the qualities of the Möbius strip are reapplied toward nonmathematical, nongeometric contexts so that practitioners of entirely different disciplines might gain new perspectives and inspiration. Military forces could do as these diverse communities and disciplines have, yet this would require a significant disruption of the pervasive Newtonian styling depicted across all modern military doctrine.

The Möbius strip could be an exceptional concept to apply toward military challenges through modeling, metaphoric device, or even methodological construction. It features the ability to move in a path that traces all boundary

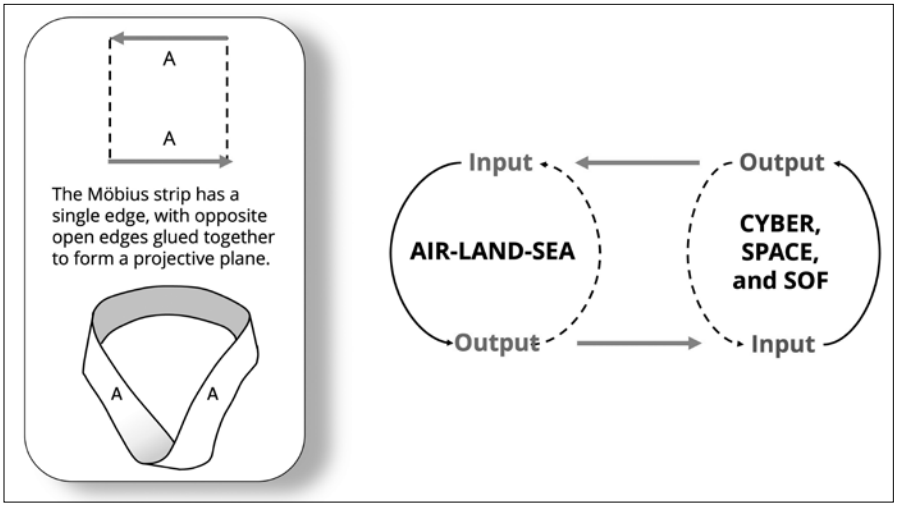
points in a single continuous curve, linking start point to end point and able to infinitely continue in this sequence perpetually cycling between mirror flipped forms. Due to the Möbius strip's unique properties, it also is an example of a chiral object that is distinguishable from its mirror image. The word *chirality* derives from the Greek word for "hand," and if someone attempts to shake the right hand of another person with their left hand, they will directly experience how hands are chiral objects. This is another departure from the Newtonian styling of military models and concepts that all remain uniform, reversible, and proportionally equivalent such as in the earlier figures of spheres, cycles, lines, and triangles. Although the strip is printed in two dimensions, it must be comprehended so that a third dimension is integrated due to these unusual properties that cannot be accomplished with traditional loops, spheres, cubes, or pyramids.

Möbius strips abound, metaphorically, in modern society. The popular science fiction movie *The Matrix*, which draws from postmodern origins, provides a wonderful example of Möbius phenomena where the main characters that exist outside the simulated Matrix digital world can hack into the system, entering the false digital reality where those that are conceptually "trapped" engage in their lives. The heroes are physically at risk inside the simulation as computer agents attempt to kill them inside, while other enemies and risks threaten their physical bodies as they lay vulnerable outside in the actual dystopian landscape that is reality. The conceptual struggles of Neo, the main protagonist, provide a telling example of a Möbius strip journey throughout the first movie as he questions which world is real and who he is or is not. Again, the strip is presented in two-dimensional space just as the static geometric constructs of figures 4–6, but we require a cognitive leap from our Newtonian style of thinking about modern war to one that breaks existing doctrinal and theoretical barriers.

How might Möbius strips replace the more rigid, simplistic Newtonian stylings for complex military affairs?[73] Once a Möbius strip is formed, one can cut along the entire centerline and instead of producing two new and smaller Möbius strips as one would get with cutting a rectangle in half (longways), the result is one longer strip with two half-twists. Mathematically, in orientable planes such as a map of the United States or a square illustrated below, the four color theorem proves that no more than four colors are required to color the regions of any map so that no two adjacent regions share the same color. Yet, the Möbius strip violates this due to its unique properties.[74] It breaks a host of rules that Newtonian inspired constructs must follow, making these nonorientable objects worthy of consideration for complex military contexts. Why limit oneself to conceptualization of a rigid Newtonian stylization when so many other options and ways to break out of those conceptual barriers exist? Complex warfare ought not be conceptualized within such explicit, quantitative, and systematic representations.

In figure 9, the topological instructions for creating a Möbius strip are adapted into a conceptual model for how military organizations, as the directed

Figure 9. Graphic representation of a Möbius strip through a metaphoric device



Source: courtesy of author, adapted by MCUP.

extension of their national political, social, and cultural desires, engage in a wide range of security activities to complete, cooperate, deter, and engage in organized violence perpetually, iteratively, and in an emergent, nonlinear fashion. Complexity theory requires careful consideration of nonlinearity, systemic relationships (nonreduceable), and how emergence largely prevents such dynamics from being depicted in Newtonian stylized approaches.[75] Even below and in subsequent illustrations, forcing a Möbius strip into two-dimensional space carries the risk that some readers might misinterpret the concept, oversimplifying it into a cylindrical shape where an OODA loop, campaign planning formulaic, ends-ways-means linear-causal relationship could be inferred.[76] Militaries need to shift away from *Donkey Kong* static and flat concepts to topological alternatives, even though printed mediums still insist upon a two-dimensional rendered construct. The *meaning* of those constructs and the theoretical underpinnings is how one can pivot from one conceptual frame to another less explored. Figure 9 again renders the construct in two dimensions, yet readers able to conceptualize the ontologically and epistemologically different rendering of the Möbius strip in their heads can follow along to the simplified graphic and consider the space-SOF-cyber dynamic differently than with a triangle, interlocking geometric shapes, or a Venn diagram.

Figure 9 acts as a bridging device to introduce non-orientable topological objects as potential metaphoric devices and new conceptual models for militaries desiring to break out of this "Newtonian fetish," as this article's title intentionally provokes readers with. In order to prevent strategists and planners from assimilating nonorientable, peculiar topological concepts back into a linear, *systematic* (reductionist, A plus B leads to C in preconfigured input/output relationships) mindset, additional explanation and illustration is required. The

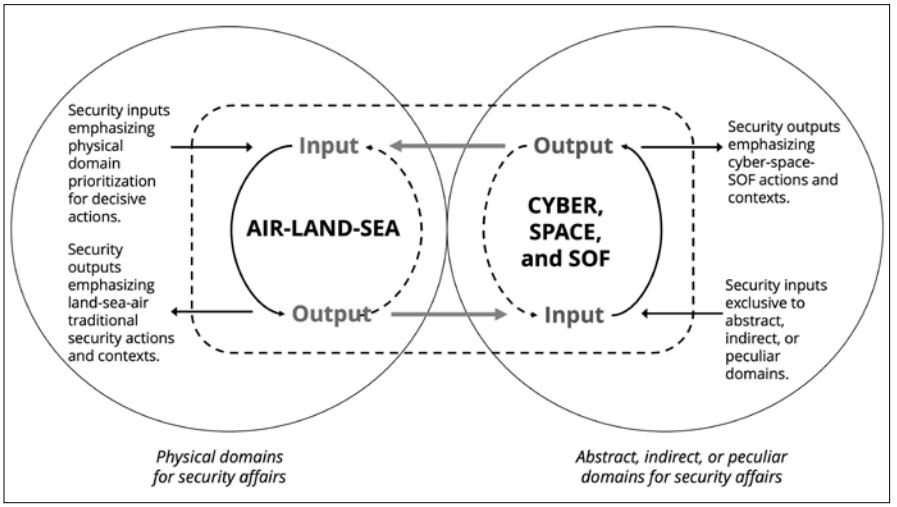
Möbius strip expands in the next figure below, gaining additional graphical depictions that attempt to pull viewers further into topological constructs that reject any oversimplification of complex warfare through exclusively Newtonian geometric rationalizations. This is where we continue to conceptualize in a decidedly non-Newtonian style, working with these two-dimensional graphics but thinking about complex warfare in ways that better match with complexity science, quantum, and how the space and cyber domains cannot be appreciated exclusively using terrestrial (air, land, sea) constructs and theories.[77]

The boundary of the Möbius strip in topological terms is equal to a circle, despite the strange shape and twisting. As the Möbius edge is unknotted, the entire strip can be stretched without crossing itself. Mathematically, the simplest knot possible is what is called the unknot or trivial knot, which is a topological circle. This is represented above both on the left where the dotted lines are in the topological instructions to create the Möbius strip and is further illustrated in the two separate frames below of air-land-sea and that of cyber, space, and SOF. Traveling through a Möbius object, one cannot leap off an edge, as they carry right over to the other despite being drawn in the topographical instruction to look like opposing ends of a square. Returning once more to *Pac-Man*, one traverses immediately from one side of the screen into the other side, despite moving away from the game board. This is how nonorientable topology offers new, arguably complex ways to explore, define, and explain complex warfare *beyond* Newtonian limits. How the Möbius strip forms a single topological surface yet exercises movement of the traveler on both sides provides the framing device to consider the physical domains (air, land, and sea) for security affairs and how conflict, competition, and deterrence exercise in abstract, indirect, or peculiar domains for security affairs.

Below, different inputs and outputs enter consideration depending on what part of the Möbius strip is being traveled, as well as how the traveler has experienced previous passages where a collection of different inputs and outputs have acted *systemically* (holistically, nonreducible, framed with increasing abstraction toward larger and larger system relationships). What is interesting about figure 10 rendered unavoidably in two dimensions is that one can opt to travel in a variety of paths just as any journey in an actual Möbius object would feel like. Applied to modern complex warfare and dynamic security affairs, one could cycle through iterations of just one or either side, or mix activities traveling the entire pathway in myriad, nonlinear cycles. This may approximate modern complex security affairs in that some phases of international competition, cooperation, deterrence, and acts of organized violence across state, nonstate, commercial, group, and decentralized movements may exercise exclusively in just part of the Möbius below. A conflict featuring covert or clandestine special operations with significant cyberspace and space operations may avoid any traditional patterns (physical domains, declarations, and clear acts of war) and in some situations might transpire without any external awareness of the societies being acted on.

In the configuration above, the Möbius strip is depicted in one of many

Figure 10. Expressing multidomain competition, deterrence, and warfare as a Möbius strip



Source: courtesy of author, adapted by MCUP.

possible alignments.[78] Arguably, there is not going to be a best configuration, as the nature of complex warfare prevents any sort of objectivity, stability, or predictability therein. Instead, readers might consider the topological opportunities for reconceptualizing the suggested Möbius strip above with something else. The above Möbius strip addresses core tensions between the well-established, historically recognizable arena for Westphalian nation-state warfare and politics that has exercised through air, land, and sea for centuries, spanning peaceful and cooperative/competitive contexts to that of total war efforts of annihilation.

The other side of the Möbius strip above addresses the emerging, rather abstract, and peculiar domains of cyberspace, space, and how modern special operations forces are able to operate in exquisite, unique, indirect and alternative ways both in times of apparent peace and that of active, recognized warfare. For instance, special operations forces work in unconventional warfare (UW) applications that may span years or decades of slow, nonlinear, often invisible, or incredibly gradual efforts that are emergent and hardly the sort of operations that make the front pages of the news. Indeed, perhaps the best UW operations are never discussed due to the nature of their obfuscated, invisible transformation succeeding. Yet, a highly successful UW campaign might lead to significant long-term security goals, and even accomplish them in a way that is nonattributable or obfuscated from societies realizing who did what to whom when and why. The shadowy, complex, and tangled worlds of cyberspace as well as the unique aspects of an emerging space domain for security affairs are even more difficult to comprehend, much less articulate clearly in crisp, two-dimensional graphics and models for militaries and policy makers to feel certain of.

The Möbius strip is but one of many interesting and non-Newtonian forms

for reconceptualizing complex warfare anew. Indeed, skeptics of the above graphics might argue that the Möbius strip, as rendered in two dimensions, is too like the Newtonian styled triangles, cubes, arrows, and other simple geometric models used today to conceptualize all aspects of warfare. Yet the Möbius strip might be considered a gateway drug to strategists and planners in order to explore a whole new world of increasingly sophisticated ways to truly introduce complexity theory, systems theory, and postmodernism into the security affairs debate on why the current system is failing. Another fascinating topological object, the Klein bottle, is an object without any inside or outside, yet as a single non-orientable surface, is able to pour into itself.

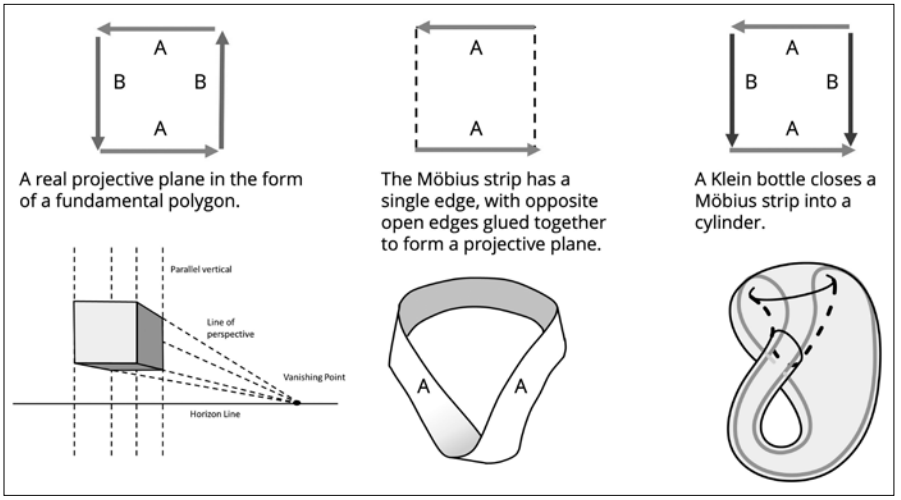
Moving from Möbius Strips to Klein Bottles: Further Newtonian Dismantlement?

The Möbius strip had as one of its unique properties an unknotted edge where the boundary is equal to a circle, stretching without crossing itself. However, if two Möbius strips are glued together edge-to-edge, a Klein bottle is formed that possesses a one-sided surface with no boundary that cannot be embedded in three-dimensional space. A Klein bottle is tricky to conceptualize, and while they can be created in three-dimensional space including boutique wine decanters for mathematically minded wine lovers, topological mathematician Maia Averett offers a convenient summary:

> The only way to imagine [a Klein bottle] is to imagine pulling one end of the cylinder through the surface of the cylinder and matching up with our circle from the inside. The resulting representation of the surface doesn't look like a surface, but it really is. Its funny appearance is just a consequence of the way we had to realize it in our three-dimensional world.[79]

Mathematically, Klein bottles are a paradox when rendered in three-dimensional space, as they are not really contained in space as they are paradoxically containing themselves; a topologically imperfect model created in three-dimensional space has a hole produced "so that its construction already introduces singularities which then through the in-formation flow produces the whole structure, so that the whole structure is produced from a hole, and this returns to the singularity to complete the flow."[80] Many readers no doubt are scratching their head at this, and for applications to complex warfare, this is where a distinction must be made between analogies and metaphors. Complex warfare is not analogous to how a Klein bottle exists mathematically, just as that same complex warfare is not actually the integrated cube first shown in figure 2 as depicted in *Joint Planning*, Joint Publication 5-0. Metaphorically, there are patterns and behaviors within complex warfare and security affairs that can be conceptualized using either an integrated cube or with the Klein bottle, and it is up to the organization seeking greater understanding to determine which metaphor might be more useful.

Figure 11. Moving military metaphors beyond basic geometry



Source: courtesy of author, adapted by MCUP.

In the above figure, topology works with what are called real projective planes that are nonorientable two-dimensional manifolds, so that mathematicians can generate relationships and instructions to build a host of topological objects, many of which simply cannot be illustrated in two- or even three-dimensional spaces without certain compromises of the illustration (but not the mathematical formulation). These concepts are centuries old, and one can find the societal transformation in thinking about reality to one of topological consideration when viewing paintings from Renaissance artists in a museum. While Medieval and older paintings seem flat and strangely wrong in composition of perspective, Renaissance artists were among the first to compose artwork using real projective planes to create in two-dimensional artwork the illusion of three-dimensional space and objects. Hence, the painters broke out of older, less useful ways to conceptualize on how to create more realistic works of art, and by playing with topological concepts, they could develop entirely new ways to create two-dimensional art. For military professionals considering the Möbius strip, it is the simplest nonorientable three-dimensional object that can be depicted in two-dimensional space without losing much of its unique qualities. The Klein bottle should be considered the next level of conceptualization using this technique, except the Klein bottle can somewhat be depicted in three-dimensional space while still maintaining most of the unique nonorientable qualities that make it quite unlike a regular glass pitcher.[81] An immediate security example of Klein bottle-like behavior is found in the U.S. State Department's "Moscow Mechanism Report" press statement released on 22 September 2022:

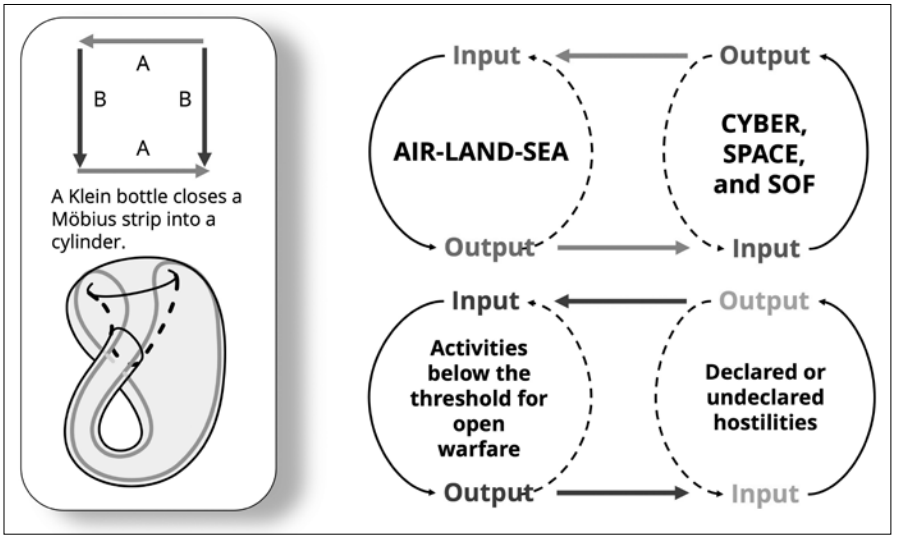
> The United States and 37 other countries invoked the Organization for Security and Cooperation in Europe's (OSCE) Moscow Mechanism on July 28 to examine the Russia's adherence to its OSCE Human Di-

> mension commitments on human rights and fundamental freedoms. . . . Specifically, this report documents that the Kremlin has centralized all federal and regional law enforcement authorities under Kremlin control; used so-called "foreign agent" laws to impose draconian penalties and fines on individuals and civil society organizations with any foreign contacts; effectively silenced freedom of expression, including independent media and criticism of the government through harsh censorship laws; and "created a climate of fear and intimidation . . . that is not in line with OSCE standards based on a pluralism and a strong and independent civil society." The report also makes clear that Russia's "(r)epression on the inside and war on the outside are connected to each other as if in a communicating tube."[82]

Again, metaphoric devices are what individuals, groups, and societies employ underneath all language so that terminology reflects into a rationalization of accepted theories, beliefs, and conceptual models that contribute to the formation of decision-making methodologies used to engage in complex reality.[83] This constitutes the social paradigm, and critical examination of the metaphoric devices as well as the conceptual models used can help any organization or person think differently when a paradigm is failing them in reality. We are working with our ontological and epistemological assumptions on war, but we are always as humans depicting these concepts in some two-dimensional graphic for sharing our ideas. How these graphics differ at the ontological and epistemological level are what matters. In figure 12, the Klein bottle construct is demonstrated on the left with the topological instructions as well as an approximation in two-dimensional space of what a Klein bottle looks like. On the right, the original Möbius strip configuration of the earlier figures is doubled, just as a Klein bottle can be produced by gluing two Möbius strips together in topological space.

Metaphorically (again, not mathematically analogous), militaries could combine two Möbius strip adaptations to further deepen a myriad of possible configurations on complex warfare. The many paradoxes of complex warfare such as how progress in eliminating terror group leadership would, often unavoidably, generate surges in societal resistance against "occupiers" and "infidels" in Iraq, Syria, and Afghanistan. In another Klein bottle example from Afghanistan, a military unit sought to improve a mountain village by digging a well close to town so that the local women did not need to walk an hour a day to collect water. The unit celebrated their humanitarian project, but soon found the well destroyed and suspected that enemy Taliban were responsible. Later, that unit learned that the women of that town sabotaged the well because those long walks were their only reprieve to socialize and get out of the house.[84] Military units search for schools to build, wells to dig, and enemies to kill, without often realizing that their own efforts "pour back into itself" and create some of the very problems they are seeking to solve. The popular military

Figure 12. Further along the Möbius: using a Klein bottle for doubling the Möbius



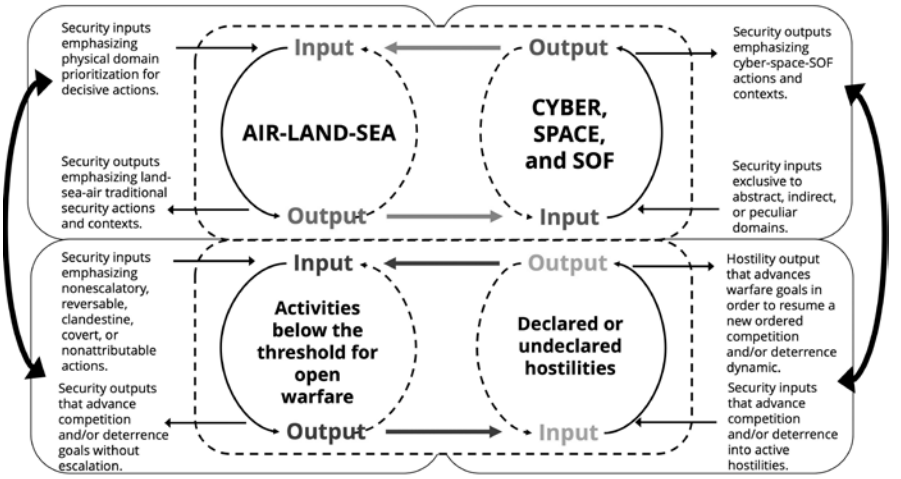
Source: courtesy of author, adapted by MCUP.

expression of "a self-licking ice cream cone" works here and illuminates Klein bottle properties.

Above, the "air-land-sea" and "cyber-space-SOF" dynamic of a single Möbius strip is paired in the same nonorientable topology of a Klein bottle with another Möbius strip security metaphoric device. Here, the spectrum of warfare of original Newtonian styled construct is reimagined in a Möbius fashion where activities below the threshold for open warfare interacts with declared or undeclared hostilities.[85] In earlier metaphoric efforts, the original spectrum of warfare optical, the visible light spectrum entertained a gray zone, which also used the metaphoric device of visualization, or the cones and rods of human perception to explain complex security contexts. The Möbius strip changes that, while the Klein bottle depicted above and in greater detail in figure 12 takes that even further.

Figure 13 must be conceptualized not in a Newtonian stylization where spheres and arrows interact in linear-causal, formulaic, and mechanistic fashion, but *reimagined* through the nonorientable topology of a Klein bottle. The doubling of a Möbius strip may be useful as a metaphoric device so that, as depicted above, the two strips can introduce multiple complex security phenomena that are otherwise oversimplified in Newtonian military doctrine such as the cube example from *Joint Planning*. Figure 13 shows the tensions between the traditional physical domains of air-land-sea and corresponding primary military Services and geographically oriented commands that focus on these interact with the cyberspace, space, and special operations domains/entities/effects that are different, but increasingly significant in explaining contemporary security challenges. In a parallel depiction, a second Möbius strip functions within this

Figure 13. Further along the Möbius: using a Klein bottle for doubling the Möbius (expanded)



Source: courtesy of author, adapted by MCUP.

Klein bottle where cooperation, competition, deterrence, and recognized hostilities (organized violence) moves back and forth, reconceptualizing all the above security concepts into one topological surface stretched and morphed so that it can pour back into itself; security affairs across humanity *need not be arranged exclusively* in a flattened *Mario Brothers* imagined world bound in Newtonian certitude.

With Klein bottles, the outside world has been turned inside, in that the paradoxical, nonlinear, and emergent phenomena of complex reality to include security affairs is no longer oversimplified into categorization buckets such as how the military currently deconstructs complex warfare objectively into reductionist models that are prolific across modern doctrine and training. Militaries continue to seek systematic rendering through Newtonian rationalization such as filtering a complex security challenge into formulaic analysis of political, military, economic, social, informational, and infrastructure (or PMESII), and areas, structures, capabilities, organizations, people, and events (or ASCOPE) as depicted below in a recent U.S. Marine Corps training command graphical aid. Complex warfare is expected to be categorized within the rigid hierarchical, standardized, and mechanical framework found in a 2022 military training illustration. The Klein bottle and other nonorientable topological objects provide an alternative where systematic optimization through objective, analytical reductionism is not the only approach to comprehension and conceptualization.

Klein bottles, as nonorientable surfaces, lack edges or bounds.[86] The bottle dissolves the distinction between inside and outside, as everything that contains the Klein bottle is also contained by it. The Klein bottle is a paradox but also

Figure 14. U.S. Marine Corps Training Command, 2022

	P Political	M Military	E Economic	S Social	I Information	I Infrastructure
A Areas	Areas - Political (District Boundary, Party affiliation areas)	Areas - Military (Coalition / LN bases, historic ambush/IED sites)	Areas - Economic (bazaars, shops, markets)	Areas - Social (parks and other meeting areas)	Areas –Information (Radio/TV/newspapers /where people gather for word-of-mouth)	Areas – Infrastructure (Irrigation networks, water tables, medical coverage)
S Structures	Structures - Political (town halls, government offices)	Structures - Military / Police (police HQ, Military HHQ locations)	Structures - Economic (banks, markets, storage facilities)	Structures - Social (Churches, restaurants, bars, etc.)	Structures - Information (Cell / Radio / TV towers, print shops)	Structures - Infrastructure (roads, bridges, power lines, walls, dams)
C Capabilities	Capabilities - Political (Dispute resolution, Insurgent capabilities)	Capabilities - Military (security posture, strengths and weaknesses)	Capabilities - Economic (access to banks, ability to withstand natural disasters)	Capabilities - Social (Strength of local & national ties)	Capabilities - Info (Literacy rate, availability of media / phone service)	Capabilities - Infrastructure (Ability to build / maintain roads, walls, dams)
O Organizations	Organizations - Political (Political parties and other power brokers, UN,)	Organizations - Military (What units of military, police, insurgent are present)	Organizations - Economic (Banks, large land holders, big businesses)	Organizations - Social (tribes, clans, families, youth groups, NGOs / IGOs)	Organizations - Info (NEWS groups, influential people who pass word)	Organizations - Infrastructure (Government ministries, construction companies)
P People	People - Political (Governors, councils, elders)	People - Military (Leaders from coalition, LN and insurgent forces)	People - Economic (Bankers, landholders, merchants)	People - Social (Religious leaders, influential families	People - Info (Media owners, mullahs, heads of powerful families)	People - Infrastructure Builders, contractors, development councils)
E Events	Events - Political (elections, council meetings)	Events - Military (lethal/nonlethal events, loss of leadership, operations, anniversaries)	Events - Economic (drought, harvest, business open/close)	Events - Social (holidays, weddings, religious days)	Events - Info (IO campaigns, project openings, CIVCAS events)	Events - Infrastructure (road / bridge construction, well digging, scheduled maintenance)

Source: official U.S. Marine Corps data, adapted by MCUP.

a fascinating way to incorporate complexity theory into military thinking, if only to disrupt and perhaps dislodge the dominance of Newtonian rationale on war.[87] There are many ways to play with these ideas that "the Klein bottle is in the world, but, at the same time, the world resides within the Klein bottle" where the traditional military domains of air-land-sea are themselves contained within the vastness of space, while cyberspace is contained within each of these physical (and in space's consideration, supra-physical) domains, yet warfare can exercise entirely inside of cyberspace while directly impacting the physical reality of humanity in profound, even devastating ways that arguably compare to the horrors of many physical acts of warfare. We cannot conceptualize cyberspace, space, and special operations activities across multiple domains in complex warfare if we are entirely reliant on a Newtonian war paradigm that prescribes Newtonian graphics exclusively. Complex warfare requires not only new ways of rendering these concepts in two-dimensional doctrine and theory, but a paradigmatic shift in how we understand war itself beyond contemporary limits.

Metaphorically, Klein bottles might better adapt to the paradoxical experience of time and space, history, and social construction of reality and how humans live both in an objective, tangible physical reality while also existing in a shared, conceptualized, and highly subjective second order of complexity that denotes human existence.[88] Victor Donas, in adapting Klein bottles to a political science and psychoanalytical approach explains:

> The Klein Bottle/Surface has no in-and-out frontier, it is shaped as a tridimensional moving field, it flows within itself in a rhythm of pulses.

> It entangles the individual with the multiple, the width of its borders reaches out toward alterity, but it returns to itself in a never ending reentry loop. We can also use it as a representation of time and history, the movement of a surface toward becoming in the present that emerges from the landmarks of what has been lived, only to flow again and reenter in the timeline of the past.[89]

Complex warfare, articulated to military forces using nonorientable objects as metaphoric devices, could offer far more latitude in how complexity theory, systems theory, social paradigm theory, and postmodern concepts might be assimilated into how and why security forces understand conflict in novel, unrealized ways. This does require significant revision, reframing, and retirement of nearly all modern military doctrine, complete with reconceptualization of the primary military theories, models, methodologies, and the very terminology that largely converge toward a shared Newtonian fetishization of understanding complex warfare.

Considering the Human-Machine Team at Ontological and Epistemological Levels

This last section briefly addresses how human operators in military organizations now, more than ever, are pairing with machines equipped with ever-increasing sophisticated artificial intelligence (AI). Historically, the tools of war were designed by humans and utilized for battlefield advantage by human controllers. The first horse stirrup, the cavalry sword, or the first functioning firearm are war tools that are means to a human-designed military end state. The atomic bomb and the first spear represent the same general application of organized violence directed at opponents by a human aggressor in war. Yet, we are as a species about to enter an entirely new reality where the war tools we design will become increasingly capable of redesigning our programmed ends into new, emergent ends of their own creation.[90] Whether we can control or prevent advanced AI from deviating from our designed military goals and their specific roles in accomplishing them is for another discussion. Here, the emergence of human-machine teams in future conflict will increasingly have a lopsided relationship in cognitive ability, scale, and speed. Tomorrow's AI system will gain and rapidly exceed even the smartest human on the battlefield, while also able to operate at vast scales and speeds that might make us seem as if we are moving in slow motion.

Given that we as humans seek to remain in control and fully aware of any military human-machine team, the dynamics of this emerging warfighter relationship presents exceptional opportunities if we can break past our dependence on the Newtonian war paradigm. Currently, most AI programming for military applications retains our preferred understanding of social reality. We prompt our AI systems by feeding them our doctrine, instructing them to learn from published policy, historical accounts, or military methodologies that again

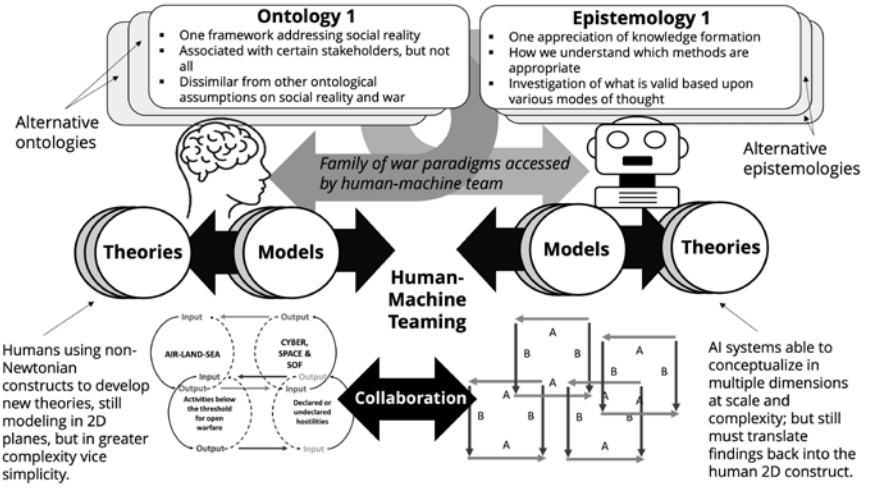
are entirely rendered in a specific war paradigm. Although this does not at all mean that AI, particularly advanced AI or even general intelligence AI, must conceptualize things exactly as we currently do, current human-machine teams are largely stuck in using existing doctrine, theory, and models. Teams operating in cyberspace, considering military activities in the space domain, or combining these in an all-domain, challenging arrangement of forces and systems with many organizations (combining human and AI together) are required to work as warfighters in what remains a Newtonian stylization of complex reality.

Skeptics might posit fairly that Möbius strips and Klein bottles presented thus far are all very interesting, but largely useless for the bulk of military forces. How could a captain in a division joint operations center, or a sergeant working as part of an aviation crew equipped with robust AI systems actually benefit from these non-Newtonian constructs? What if the average human operator simply cannot think beyond the familiar Newtonian shapes and models? This is a fair point, but one that illuminates why human-machine teams should operate differently in future wars. Humans do prefer two-dimensional constructs because they simplify reality sufficiently so that we can usually accomplish what we need. Everything in figures 4–6 can be argued as sufficient for most all modern conflicts, whether the winner or loser is using them. Victorious forces beat their opponents using them, and while some conflicts featured technologically sophisticated AI systems in various manifestations, how those tools were employed were conceptualized using the same Newtonian frame. While the Taliban ultimately defeated Western-backed Afghan forces and suffered tremendous tactical losses for two decades by American led forces equipped with some of the best AI systems in modern warfare, the same systems were managed and set in a strategy dominated by the Newtonian war paradigm. In other words, Westerners had the most lethal, precise, sophisticated weaponry on the planet, but the ontological and epistemological assumptions underlying how we used such tools was quite similar to the technologically primitive Taliban.[91]

In figure 15, the human operator is positioned on the left, and the artificial intelligent system on the right. If we utilize multiple paradigms for a range of war frames, and the computer programmers enable this in the AI system, the human operator can continue to interpret complex reality using what likely will be a Newtonian stylization, or perhaps a modified war frame that uses some non-Newtonian constructs such as Möbius strips and Klein bottles (or other non-Newtonian models). The AI system can operate across a broader range of war paradigms, conceptualizing in multiple dimensions, and offering entirely novel concepts and suggestions to the human operator. In other words, an AI weapon system represents for the first time in human history the potentiality for a human designed tool to generate new ends not anticipated or even comprehended by the designer. This puts war into uncharted territory, where the AI system will still need to articulate new constructs back to the human user, even if there is loss in the depth or sophistication due to human limitations.

Multidimensional or non-Newtonian constructs still must "bridge"

Figure 15. Shifting from a Newtonian to a multiparadigmatic framing for war



Source: courtesy of author, adapted by MCUP.

across to the human operator and ultimately be comprehended in some familiar two-dimensional configuration for maximum understanding. Yet, in the proposed human-machine team dynamic below, the AI is liberated from the Newtonian war paradigm and granted the ability to provide the human decision-maker with new and innovative options that will require the human to think beyond existing institutionalized limits. The space-SOF-cyber construct should not be oversimplified into a triangle, nor should multi-domain conflict be conceived as a layered static cube (see figure 2). Human designed ends-ways-means operational planning and strategies might be utilized within formations, but the AI systems working in tandem need not limit themselves with these oversimplifications of how complex reality actually emerges in time and space.

Figure 15 is one way that we ought to consider how humans and intelligent machines cooperate in complex warfare. Even if the AI system is doing something the human programmers cannot explain or link back to their original coding, that AI should attempt to present these new ideas and opportunities in ways that violate existing military doctrine, theory, models, and our overarching belief system. The Newtonian war paradigm essentially dies here, to be replaced by a new one that must be designed collaboratively with humanity and the intelligent machines we are bringing into reality today. There are clear ethical, moral, and legal concerns with advanced or general AI, yet the anticipated arms race between various competing or antagonistic societies will not cease simply because AI could become the genie we let out of the bottle (or battle).[92] Adversaries are already designing human and AI collaboration in all military domains across all possible security applications and weapon systems.

Current efforts in pairing AI with human decision-makers for strategy, op-

erations, and tactics are potentially insufficient if they retain a single-paradigm, Newtonian-fixated orientation. This would mutate the above graphic to one where figure 1 has the human imposing their singular war paradigm upon all possible activities the AI might conduct. Instead, we must consider a bridge where both the human operator and the AI system can access a multitude of useful, yet alternative war paradigms. In some cases, the human might come up with an innovative option and request the AI system to develop it further. In others, the AI will be conceptualizing beyond human abilities, likely in multiple dimensions and at a scale and speed unprecedented in the history of war. Those human-machine teams that can best utilize such an arrangement can ultimately produce decisive military action that is not artificially limited by one war paradigm or another. We need not make intelligent machines think about organized violence using triangles, triads, ends-ways-means, or centers of gravity. Indeed, they may be the ultimate tool for liberating the modern military profession from five centuries of increasingly insufficient and obsolete thinking on war.

Conclusions: Shifting Away from a Westphalian Nation-State Centric War Frame

This article was written as a thought piece to stimulate debate in the military profession on how and why the institution conceptualizes warfare, and whether many efforts to innovate are stymied not by the lack of vision of those creative thinkers, but by the overarching and often unquestioned institutional paradigm that directs new concepts to be articulated using the preferred cognitive tools, models, and terminology that hold to a particular (and, arguably, quite limited) view of warfare. Innovation is fine if it uses the doctrinal language, is illustrated in two-dimensional renderings dependent on basic geometric concepts shared by the institution, and relies on the very same theoretical and methodological offerings that all other existing doctrinal concepts utilize. This means that acts of military innovation must clear the paradoxically high bar of both critiquing and also *still validating* the very ideas that are under critical examination for retirement or replacement! To accomplish this difficult task, this article operates first and foremost from a philosophical level. The discussions on ontology and epistemology are essential for explaining why we stick to a certain war paradigm and how we might think our ways out of it.

It needs to be restated that conceptualizing complex reality using topological concepts as metaphoric devices is not new, except perhaps to most security forces who remain tightly wedded to ontologically flattened, Newtonian engineered constructs for making sense of war.[93] Postmodern theorists such as Gilles Deleuze have for decades taken concepts such as the Möbius strip "with its continual repetitions of seemingly dualistic terms . . . not in order to produce a reductionist form of dualistic thinking but in order to put it into conversation, to put it in the place of a problem."[94] Postmodern critiques and deconstructions remain largely inaccessible to the modern military profession, arguably due to particularly insular, even anti-intellectual stances dominant across the

dominant professional military education system.[95] However, postmodern experimentation has been attempted in select complex military operations since the late 1990s, starting first in the Israeli Defense Forces and building into what today is a recognized, international "military design movement."[96]

One of the most cited examples of this mode of reframing thought and action in warfare comes from a 2002 Israeli infantry operation against enemy forces entrenched in urban neighborhoods in Balata. Colonel Aviv Kochavi, a former student of Dr. Shimon Naveh and this postmodern way of warfare would reconceptualize his unit's mission in what he termed "fractal geometry."[97] His metaphor of "a worm eating its way through the apple" explained his idea to invert the urban terrain and have his forces "walk through walls" by turning buildings into maneuver corridors and avoiding the well-prepared kill boxes outside in the streets.[98] Indeed, Kochavi's concept provides tactical and operational examples of the Möbius strip and Klein bottles with how they reimagined their difficult mission to clear the enemy from a well-defended cityscape by abandoning traditional views of geometry and warfare.[99]

Introducing topological concepts as new metaphoric devices for reimagining complex warfare opens the door for many previously off limits or institutionally ignored fields, disciplines, and theories to be incorporated in meaningful ways into warfare frames.[100] While postmodernism plays the intellectual boogieman for traditional Newtonian military purists, the overemphasis of the Newtonian objectivist ontology, mechanistic epistemology, and instrumental praxeology only function to reinforce institutionalized war beliefs. These are that all wars across time and space, future and past can be frozen in time, isolated, reduced, analyzed through inductive and deductive reasoning, and then reverse-engineered with clear precision for military forces fixated on risk reduction, uniformity, best practices, and rigorously institutionalized patterns of known behaviors. The Möbius strip and Klein bottles act to disrupt, soften, and challenge these near ideological stances on complex warfare. New metaphoric devices and language need to be paired with this proposed shift in conceptualizing warfare, with worms and apples, *Pac-Man* and twisting paper belts requiring new ways of thinking beyond triangles, triads, cubes, and two-dimensionally limited constructs.

In closing, the suggestion to shift away from rigid, two-dimensional conceptualizations and metaphoric devices such as cubes, closed lines and loops, triangles, and fixed geometry does not substitute one *oversimplified* concept with an overly *complicated* one. The metaphoric devices, models, and terminology themselves are merely tools used to activate deeper theories and methods that, in keeping with shared belief systems, sustain a social paradigm (how we know what war is, and how we know what to do within warfare to get what we desire). The notion to disrupt, challenge, and replace how we conceptualize our models and metaphoric devices in addressing complex warfare is less about techniques or graphics in the next doctrinal publication and far more about how an organization *thinks about its own thinking* about war. Deleuze and others pursue this

by morphing an organization's conceptual frame at deep philosophical levels, in that "a Deleuzian 'geophilosophy' takes space as neither the ground nor the object of analysis but rather as a condition for thought itself."[101]

Militaries need not convert themselves into postmodern theorists to realize warfare differently, but they ought not shun entire disciplines and fields such as complexity theory, quantum theory, systems theory, social paradigm theory, and postmodern philosophy because they require new language, concepts, and theories to process. The end of the Newtonian paradigm for warfare is here, if not well past. Everything in warfare need not be forced into some *Donkey Kong* plane of existence, as the next generation of military professionals already operate immersed in multiple dimensions of entertainment, culture, and complex reality whether through virtual, augmented, or tangible means. Future generations of military professionals will drift away from such oversimplification and static, reductionist renderings of complex security affairs, likely with new education as well as technological advancements in artificial intelligence, human-machine teaming, and a complete introspection of how and why militaries could become so trapped in particular ways of thinking about warfare so that alternatives remain off limits.

Endnotes

1. Carl Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore, MD: Johns Hopkins University Press, 1989).
2. Another useful way to distinguish between tacit and explicit knowledge is when someone needs to move over so we can do whatever task is being asked, as "we know how to do it, but explaining it takes too long."
3. Haridimos Tsoukas, *Complex Knowledge: Studies in Organizational Epistemology* (New York: Oxford University Press, 2005), 213–16.
4. Ben Zweibelson, "War Becoming Phantasmal: A Cognitive Shift in Organized Violence Beyond Traditional Limits," *Expeditions with MCUP*, forthcoming 2024.
5. Early Greek concepts would inspire seventeenth century scientific reforms that would displace and challenge the "premodern" through a new "scientific rationalism." Lorraine Daston, *Rules: A Short History of What We Live By* (Princeton, NJ: Princeton University Press, 2022), 233–34.
6. Marianne Lewis and Mihaela Kelemen, "Multiparadigm Inquiry: Exploring Organizational Pluralism and Paradox," *Human Relations* 55, no. 2 (2002): 251–75, https://doi.org/10.1177/0018726702055002185; Majken Schultz and Mary Jo Hatch, "Living with Multiple Paradigms: The Case of Paradigm Interplay in Organizational Culture Studies," *Academy of Management Review* 21, no. 2 (1996): 529–57, https://doi.org/10.5465/amr.1996.9605060221; and Colin Clarke-Hill, Huaning Li, and Barry Davies, "The Paradox of Co-Operation and Competition in Strategic Alliances: Towards a Multi-Paradigm Approach," *Management Research News* 26, no. 1 (2003): 1–20, https://doi.org/10.1108/01409170310783376.
7. Gen Stanley A. McChrystal et al., *Team of Teams: New Rules of Engagement for a Complex World* (New York: Portfolio, 2015), 57.
8. Christopher Paparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design* (New York: Bloomsbury Academic Publishing, 2013); Ben Zweibelson, *Understanding the Military Design Movement: War, Change and Innovation* (New York: Routledge, 2023); Ben Zweibelson, *Beyond the Pale: Designing Military Decision-Making Anew* (Maxwell Air Force Base, AL: Air University Press, 2023); Jamshid Ghara-

jedaghi, *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture*, 3d ed. (New York: Elsevier, 2011); Jamshid Gharajedaghi and Russell Ackoff, "Mechanisms, Organisms, and Social Systems," in Haridimos Tsoukas, *New Thinking in Organizational Behaviour* (Oxford, UK: Butterworth-Heinemann, 1994), 25–49; Russell Ackoff, "On the Use of Models in Corporate Planning," *Strategic Management Journal* 2, no. 4 (December 1981): 353–59; Tsoukas, *Complex Knowledge*; and Haridimos Tsoukas, "A Dialogical Approach to the Creation of New Knowledge in Organizations," *Organization Science* 20, no. 6 (December 2009): 941–57.

9. Gary Weaver and Dennis Gioia, "Paradigms Lost: Incommensurability vs Structurationist Inquiry," *Organization Studies* 15, no. 4 (1994): 565–90, https://doi.org/10.1177/017084069401500040; Norman Jackson and Pippa Carter, "In Defence of Paradigm Incommensurability," *Organization Studies* 12, no. 1 (1991): 109–27, https://doi.org/10.1177/017084069101200107; and Dennis Gioia and Evelyn Pitre, "Multiparadigm Perspectives on Theory Building," *Academy of Management Review* 15, no. 4 (1990): 584–85.
10. The author, as a former "opposing forces" company commander and operations group planner at the Joint Readiness Training Center in Fort Polk, LA, wrote a thought piece specifically on this topic. See Ben Zweibelson, "Preferring Copies with No Originals: Does the Army Training Strategy Train to Fail?," *Military Review*, February 2014, 15–25.
11. Tsoukas, *Complex Knowledge*, 213–14.
12. Christopher Paparone and James Crupi, "The Principles of War as Paradox," U.S. Naval Institute *Proceedings* 131, no. 10 (October 2005): 39–44; Ben Zweibelson, "Gravity-Free Decision-Making: Avoiding Clausewitz's Strategic Pull," *Directorate of Future Land Warfare, Australian Department of Defence*, Army Research Papers no. 8 (Canberra: Australian Army Research Centre, 2015): 60; and Zweibelson, *Beyond the Pale*, 47–97.
13. Tsoukas, *Complex Knowledge*, 213.
14. Antoine Bousquet, "Chaoplexic Warfare or the Future of Military Organization," *International Affairs (Royal Institute of International Affairs 1944–)* 84, no. 5 (September 2008): 919; James Der Derian, "Virtuous War/Virtual Theory," *International Affairs (Royal Institute of International Affairs 1944–)* 76, no. 4 (October 2000): 786; and Paparone, *The Sociology of Military Science*, 18–20.
15. Sebastien Le Prestre de Vauban, *The New Method of Fortification, as Practised by Monsieur de Vauban, Engineer-General of France. Together With a New Treatise of Geometry, the Fifth Edition, Carefully Revised and Corrected by the Original* (London: S. and E. Ballard, 1722; Farmington Hills, MI: Gale Ecco, 2018); and Henry Guerlac, "Vauban: The Impact of Science on War," in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986).
16. Tsoukas, *Complex Knowledge*, 212–14, 240.
17. The term *interplay* is used by Schultz and Hatch in a specific manner for multiple paradigms. Interplay refers to new and emergent collaborative outputs that are achieved through two or more social paradigms and otherwise are inaccessible by just one of the paradigms independently. See Schultz and Hatch, "Living with Multiple Paradigms"; and Ben Zweibelson, "The Multidisciplinary Design Movement: A Frame for Realizing Industry, Security, and Academia Interplay," *Small Wars Journal*, January 2019.
18. Karl Weick, "Drop Your Tools: An Allegory for Organizational Studies," *Administrative Science Quarterly* 41, no. 2 (1996): 301–13, https://doi.org/10.2307/2393722.
19. The author, as an operational planner at the Joint Readiness Training Center in 2006, witnessed an evaluation team mentor, an infantry battalion commander, who refused to use linear planning doctrine because he felt his previous Iraqi deployments rendered them irrelevant. The evaluating task force seniors devised the "football plays toward the endzone" construct to placate the commander (a football enthusiast) but continue the same planning processes they needed to evaluate the battalion with. This is an excellent example of swapping out terminology and models while holding to the same theories and overarching paradigmatic belief system.

20. Of the Napoleonic war theorists, only Clausewitz would incorporate German Romanticism and German Idealism into his theories. These were available to him and others in the late eighteenth through nineteenth centuries, yet the scientific discipline of sociology was only just commencing in the mid-nineteenth century. Complexity science, quantum theory, and other twentieth century revelations would be entirely inaccessible. On Clausewitz's unique fusion of Enlightenment science with German Idealism, see Peter Paret, *Clausewitz and the State: The Man, His Theories, and His Times* (Princeton, NJ: Princeton University Press, 1985), 7, 156, 196–97; Gibson Burrell and Gareth Morgan, *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life* (Portsmouth, NH: Heinemann, 1979), 69; and Peter Paret, "The Genesis of *On War*," in Carl von Clausewitz, *On War*, ed. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 11.
21. This section draws extensively from the author's current book in development. Tentatively titled *[Re]Conceptualizing War*, the author summarizes key points from the first chapter here with several paragraphs incorporated here from the current draft chapter. Thomas Kuhn, *The Structure of Scientific Revolutions*, 3d ed. (Chicago: University of Chicago Press, 1996).
22. War's effects are experienced objectively in physical reality through destruction, death, and harm to any living creatures and inanimate objects impacted, but also subjectively in how war damages living creatures in ways that can be seen as well as in many invisible forms. If just the physical, tangible effects of war are considered, these occur entirely in the physical reality that might be divorced from the social reality within which living, intelligent beings perceive and interpret another part of the world.
23. Lewis and Kelemen, "Multiparadigm Inquiry," 252.
24. Siniša Malešević, *The Sociology of War and Violence* (Cambridge, UK: Cambridge University Press, 2010), 314, https://doi.org/10.1017/CBO9780511777752.
25. Yuval Harari, *Sapiens: A Brief History of Humankind* (New York: Harper Perennial, 2018), 110.
26. Gareth Morgan, "Exploring Plato's Cave: Organizations as Psychic Prisons," in *Images of Organizations* (San Francisco, CA: Sage Publications, 2006), 226.
27. Burrell and Morgan, *Sociological Paradigms and Organisational Analysis*, 1; and Robert Chia, "Teaching Paradigm Shifting in Management Education: University Business Schools and the Entrepreneurial Imagination," *Journal of Management Studies* 33, no. 4 (July 1996): 414, https://doi.org/10.1111/j.1467-6486.1996.tb00162.x.
28. Zweibelson, *Beyond the Pale*, 56–64.
29. Specifically, ontology addresses what we as humans declare cognitively is real. If one holds a hammer, we ontologically know what a hammer is, even if this particular hammer looks different from most other hammers. If we accidentally hit our fingers while using it, we know that pain is real too, even though you can hand another person the hammer, but you cannot give the other person the precise pain you are experiencing, even if you struck their hand with the same hammer. We experience pain subjectively, but we all ontologically agree that pain exists despite us each having our own contextually unique understanding.
30. Burrell and Morgan, *Sociological Paradigms and Organisational Analysis*, 1; and Lewis and Kelemen, "Multiparadigm Inquiry," 255.
31. Lewis and Kelemen, "Multiparadigm Inquiry," 255; and Shirley-Ann Hazlett, Rodney McAdam, and Seamus Gallagher, "Theory Building in Knowledge Management: In Search of Paradigms," *Journal of Management Inquiry* 14, no. 1 (March 2005): 32, https://doi.org/10.1177/1056492604273730.
32. This is a simplified introduction to social paradigms for military organizations. A deeper study is available in Zweibelson, *Beyond the Pale*, 52–68.
33. John Shy, "Jomini," in *Makers of Modern Strategy*, 144–46, 161; and Beatrice Heuser, *Reading Clausewitz* (London, UK: Pimlico, 2002), 76–77.
34. Special Forces do not own a particular domain, while military forces assigned to space and cyberspace may not be the only entities acting within them for security or national designs. Thus, the model is simplistic and, in some ways, misleading. The space-SOF-

cyber triad is not nearly as simple as the triangle model suggests. However, for the purposes of explaining the concepts to the broader Department of Defense forces, these military organizations selected a triad as one of several ways to graphically model the arrangement.

35. Julian Jaynes, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, 3d ed. (Boston, MA: First Mariner Books, 2000), 53.
36. Ben Zweibelson, "Why Do Militaries Stifle New Ideas?," *Contemporary Issues in Air & Space Power* 2, no. 1 (2024): 1–6.
37. Christopher Paparone, "On Metaphors We Are Led By," *Military Review* 88, no. 6 (December 2008): 55–64; Paparone and Crupi, "The Principles of War as Paradox"; and Christopher Paparone, "Beyond Ends-Based Rationality: A Quad-Conceptual View of Strategic Reasoning for Professional Military Education," Research Gate, 16 May 2016, 309–47; Christopher Paparone, "How We Fight: A Critical Exploration of US Military Doctrine," *Organization* 24, no. 4 (2017): 516–33, https://doi.org/107.171/1773/51035058048147167699338 53.
38. Paret, *Clausewitz and the State*, 369; and Antoine Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* (London: Hurst Publishers, 2009), 13; and Malešević, *The Sociology of War and Violence*, 174.
39. Herbert Rosinski, *Power and Human Destiny*, 1st ed. (New York: Frederick A. Praeger, 1965), 151. Emphasis added.
40. *Joint Planning,* Joint Publication 5-0 (Washington, DC: Department of Defense, 2020), 164.
41. Not to confuse Kuhnian paradigm shifts with social paradigms, the rise of Newtonian science caused major societal changes outside of the European civilization accepting a scientific rationalization on reality. The debates on whether the Sun orbited this planet or if Earth and other planets orbited the Sun reflects the difficult social and scientific shift from one mode of thinking to another.
42. Bousquet, *The Scientific Way of Warfare*, 40–41; and Paparone, "On Metaphors We Are Led By," 55–58.
43. Although ancient Greek phalanxes seem nothing like a modern infantry platoon today, the fundamentals of maneuvering on land toward a specific objective and seizing it with a combination of different weaponry and attacks against a defender remain basically similar in execution. The medieval knight charging on horseback would seem eerily similar to the early twentieth century cavalry charges, while ancient ships waging maritime war would basically pursue similar warfighting objectives to their modern counterparts of the twentieth century. While the "why" of war should continuously be debated, the "how" of warfare appears more stable over great periods of time.
44. Zweibelson, *Understanding the Military Design Movement*, 63–76.
45. Daston, *Rules*, 216.
46. David French, *The British War in Warfare, 1688–2000* (Cambridge, MA: Unwin Hyman, 1990), 2.
47. Martin van Creveld, *The Training of Officers: From Professionalism to Irrelevance* (New York: Free Press, 1990), 13.
48. C. C. Pecknold, "How Augustine Used the Trinity: Functionalism and the Development of Doctrine," *Anglican Theological Review* 85, no. 1 (Winter 2003): 131.
49. David Lindberg, *The Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, 600 B.C. to A.D. 1450* (Chicago: University of Chicago Press, 1992), 85–131.
50. Lindberg, *The Beginnings of Western Science*, 190–91.
51. The duality of ritualization and historically validated practices in war cannot be understated in premodern societies. Nearly every aspect of war carried clear examples of ontological and epistemological assumptions that this world required specific activities for supernatural ends. The blessings by clerics before battle, the use of religious artifacts, symbols, and banners on uniforms or presented by forces, and the last rites offered to fallen warriors are all examples of shared belief systems concerning war. Visions, oracles, dreams, divine edicts, prayers, and interpreted signs from a higher power

would influence military decision-making, while each society often paired the justification to wage war and inflict violence upon others in ideological reasoning, referring to divine texts. For feudal Europe, this combination of church and state interest would make most military affairs a joint effort with clear consequences and benefits to both groups.

52. *DOD Dictionary of Military and Associated Terms* (Washington, DC: U.S. Joint Staff, 2007), 169.
53. Chris Paparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design* (New York: Bloomsbury, 2013), 18–19.
54. Der Derian, "Virtuous War/Virtual Theory," 786.
55. Paparone, *The Sociology of Military Science*, 20.
56. Zweibelson, *Beyond the Pale*, 97–137.
57. J. F. C. Fuller, *The Foundations of the Science of War* (London: Hutchinson, 1925; Newbury, UK: Books Express Publishing, 2012), 43. Citations refer to the Books Express Publishing edition.
58. Fuller, *The Foundations of the Science of War*, 38.
59. Fuller, *The Foundations of the Science of War*, 43–44.
60. Fuller, *The Foundations of the Science of War*, 18. Fuller would embrace attempts to extend Darwin's theory into sociology, often called "social Darwinism" that became popular in the late nineteenth and early twentieth century. War could, for Fuller, become manageable and predictable if a combination of Newtonian and Darwinian processes were rigidly applied.
61. Fuller, *The Foundations of the Science of War*, 45.
62. Jaynes, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, 2–3.
63. Shimon Naveh, Jim Schneider, and Timothy Challans, *The Structure of Operational Revolution: A Prolegomena* (Fort Leavenworth, KS: Booz Allen Hamilton, 2009), 35–36.
64. While the generals of the American Civil War would not readily grasp computers, atomic weapons, or aircraft carriers, they would likely understand all of the general concepts illustrated in figures 4–6, and once the advanced technology were explained, appreciate how these concepts can be articulated and depicted in Newtonian logical arrangements.
65. Grant Martin, "Of Garbage Cans and Paradox: Reflexively Reviewing Design, Mission Command, and the Gray Zone," *Journal of Military and Strategic Studies* 17, no. 4 (2017): 201.
66. Topology would not consider the Möbius strip normal or abnormal. Again, the metaphoric content here is applied to the military profession thinking not about mathematics, but war.
67. Lyn Robinson and Mike McGuire, "The Rhizome and the Tree: Changing Metaphors for Information Organisation," *Journal of Documentation* 66, no. 4 (2010): 604.
68. Sun Tzu, *The Art of War: Complete Text of Sun Tzu's Classics, Military Strategy History, Ancient Chinese Military Strategist Deluxe Collection Edition*, trans. Lionel Giles (Las Vegas, NV: independently published, 2022), 60–61.
69. Aaron Jackson, *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare* (Fort Leavenworth, KS: Combat Studies Institute Press, 2013); and Felix Gilbert, "Machiavelli: The Renaissance of the Art of War," in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 11.
70. Bousquet, "Chaoplexic Warfare or the Future of Military Organization," 919.
71. Jeffrey Meiser, "Ends + Ways + Means = (Bad) Strategy," *Parameters* 46, no. 4 (Winter 2016): 81–91, https://doi.org/10.55540/0031-1723.3000; Paparone, "Beyond Ends-Based Rationality"; Ben Zweibelson, "One Piece at a Time: Why Linear Planning and Institutionalisms Promote Military Campaign Failures," *Defence Studies Journal* 15, no. 4 (2015): 360–75, https://doi.org/10.1080/14702436.2015.1113667; and Ben Zweibelson, "Linear and Nonlinear Thinking: Beyond Reverse-Engineering," *Canadian Military Journal* 16, no. 2 (2016): 27–35.
72. Reginald Litz, "Two Sides of a One-Sided Phenomenon: Conceptualizing the Fam-

ily Business and Business Family as a Möbius Strip," *Family Business Review* 21, no. 3 (September 2008): 217–36, https://doi.org/10.1111/j.1741-6248.2008.00124.x; Hunter Dukes, "Beckett's Vessels and the Animation of Containers," *Journal of Modern Literature* 40, no. 4 (2017): 75–89, https://doi.org/10.2979/jmodelite.40.4.06; Jill Ratzan and Lee Ratzan, "Möbius Strips, Klein Bottles, and Dedications: The Mathematics of a Series of Unfortunate Events," *Children and Libraries*, Spring 2005; Victor Donas, "The Message of a Bottle: A Discussion of 'Trump Cards and Klein Bottles: On the Collective of the Individual'," *Psychoanalytic Dialogues* 30, no. 4 (2020): 408–16, https://doi.org/10.1080/10481885.2020.1774331; Julyan Cartwright and Diego Gonzalez, "Möbius Strips Before Möbius: Topological Hints in Ancient Representations," *Mathematical Intelligencier*, no. 38 (2016): 69–76, https://doi.org/10.1007/s00283-016-9631-8; Renzo Caddeo, Stefano Montaldo, and Paola Piu, "The Möbius Strip and Viviani's Windows," *Mathematical Intelligencer*, no. 23 (2001); Daniel Cockayne, Derek Ruez, and Anna Secor, "Thinking Space Differently: Deleuze's Möbius Topology for a Theorisation of the Encounter," *Transactions of the Institute of British Geographers* 45, no. 1 (2020): 194–207, https://doi.org/10.1111/tran.12311; and Bernadette Barton, "Dancing on the Möbius Strip: Challenging the Sex War Paradigm," *Gender and Society* 16, no. 5 (October 2002): 585–602.

73. This refers to the metaphoric devices and does not imply that in a strict mathematical sense, a nonorientable surface is more complex than an orientable surface. For the purposes of conceptualizing warfare, only orientable, standard geometric constructs have been utilized for many centuries of military theory and practice.
74. The Möbius strip can also be cut into six different mutually adjacent regions due to the Möbius strip not being an orientable plane. This could offer military theorists a multitude of ways to conceptualize the complex interaction of military domains, different forms and functions of organized violence, the arrangement of actions and effects across various agencies and partners, or something entirely different that still adheres to the unique properties of the Möbius strip.
75. Tsoukas, *Complex Knowledge*, 217.
76. Boyd's OODA loop is a conceptual model still grounded in a Newtonian rationale, while military campaign planning reflects more of the mechanistic epistemology and objectivist ontology where "A plus B leads to C." The "ends-ways-means" construct is an epistemological framework for the modern technical-rationalist "military paradigm."
77. Ben Zweibelson, *Reconceptualizing the Space Domain Beyond Historic Perspectives of Warfare*, Schriever Papers no. 1 (Maxwell AFB, AL: Air University Press, 2023), 1–66; Ben Zweibelson, "PART I: The Singleton Paradox: On the Future of Human-Machine Teaming and Potential Disruption of War Itself," *Journal of Advanced Military Studies* 14, no. 1 (Spring 2023): 11–46, https://doi.org/10.21140/mcuj.20231401001; and Ben Zweibelson, "PART II: Whale Songs of Wars Not Yet Waged: The Demise of Natural-Born Killers through Human-Machine Teamings Yet to Come," *Journal of Advanced Military Studies* 14, no. 1 (Spring 2023): 47–82, https://doi.org/10.21140/mcuj.20231401002.
78. This figure and many subsequent ones in this article draw direct inspiration from the original graphics of Möbius strip configurations in Litz, "Two Sides of a One-Sided Phenomenon."
79. Maia Averett, "Mathematical Cut-And-Paste: An Introduction to the Topology of Surfaces," *Pi in the Sky*, no. 21 (Spring 2019): 6.
80. Diego Rapoport, "Surmounting the Cartesian Cut through Philosophy, Physics, Logic, Cybernetics, and Geometry: Self-Reference, Torsion, the Klein Bottle, the Time Operator, Multivalued Logics and Quantum Mechanics," *Foundations of Physics*, no. 41 (2011): 46–47, https://doi.org/10.1007/s10701-009-9334-5.
81. Again, mathematically a three-dimensional rendered Klein bottle does violate certain topological principles, but when used as a metaphoric device or adapted to create interesting glass sculptures in the real world, the ideas generated by a Klein bottle can help shift conceptualization into new, unexplored areas.

82. *The Moscow Mechanism Report on Russia's Failure to Fulfill Its Human Dimension Commitments* (Washington, DC: U.S. State Department, 2022).
83. Mary Jo Hatch and Dvora Yanow, "Methodology by Metaphor: Ways of Seeing in Painting and Research," *Organization Studies* 29, no. 1 (2008): 23–44, https://doi.org/10.1177/0170840607086635; Antoine Bousquet and Simon Curtis, "Beyond Models and Metaphors: Complexity Theory, Systems Thinking and International Relations," *Cambridge Review of International Affairs* 24, no. 1 (2011): 43–62, https://doi.org/10.1080/09557571.2011.558054;
84. Ann Jones, "Woman to Woman in Afghanistan: Female Engagement Teams Joint the Counterinsurgency," *Nation*, 27 October 2010.
85. *Operations*, Field Manual 3-0 (Washington, DC: Headquarters, Department of the Army, 2008), 2–5. In this version of FM 3-0, the U.S. Army uses an electromagnetic spectrum metaphoric device to illustrate the concept of a "spectrum of warfare" behaving as light does in physics.
86. Richard Brown, "The Klein Bottle as an Eggbeater," *Mathematics Magazine* 46, no. 5 (1973): 244–46, https://doi.org/10.1080/0025570X.1973.11976328.
87. Dukes, "Beckett's Vessels and the Animation of Containers," 83.
88. Haridimos Tsoukas and Mary Jo Hatch, "Complex Thinking, Complex Practice: The Case for a Narrative Approach to Organizational Complexity," *Human Relations* 54, no. 8 (August 2001): 979–1013, https://doi.org/10.1177/0018726701548001; Schultz and Hatch, "Living with Multiple Paradigms"; and Peter Berger and Thomas Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge* (New York: Anchor Books, 1966).
89. Donas, "The Message of a Bottle," 412.
90. Zweibelson, "PART I: The Singleton Paradox"; and Zweibelson, "PART II: Whale Songs of Wars Not Yet Waged."
91. This does not mean the Taliban or al Qaeda subscribed to a Western war paradigm. Putting their ideological and cultural positions aside, when a Taliban cell places improvised explosive devices at a roadside ambush point, they are doing in a primitive manner what the American forces did with stealth bombers dropping laser-guided munitions on enemy safe houses.
92. Nick Bostrom, "What Is a Singleton?," *Linguistic and Philosophical Investigations* 5, no. 2 (2006); Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies*, paperback (Oxford, UK: Oxford University Press, 2016); and Zweibelson, "PART I: The Singleton Paradox."
93. This is excluding a small yet growing international military design movement and the pockets of postmodern design experimentation occurring sporadically across that community.
94. Cockayne, Ruez, and Secor, "Thinking Space Differently," 195.
95. Milan Vego, "A Case Against Systemic Operational Design," *Joint Forces Quarterly*, no. 53 (2d quarter 2009): 70–75; Ofra Graicer, "Beware of the Power of the Dark Side: The Inevitable Coupling of Doctrine and Design," *Experticia Militar*, October 2017, 30–37; Eyal Weizman, *Hollow Land: Israel's Architecture of Occupation* (New York: Verso, 2007); Philippe Beaulieu-Brossard, "Encountering Nomads in Israel Defense Forces and Beyond," in *Concepts at Work: On the Linguistic Infrastructure of World Politics* (Ann Arbor: University of Michigan Press, 2020), https://doi.org/10.3998/mpub.11719182; and Philippe Beaulieu-Brossard, "Systemic Operational Design or How I Began to Worry about the Dual Use of Critical Concepts" (outline written in the course of fieldwork, University of Ottawa, Canada, 1 June 2015).
96. Cara Wrigley, Genevieve Mosely, and Michael Mosely, "Defining Military Design Thinking: An Extensive, Critical Literature Review," *She Ji: The Journal of Design, Economics, and Innovation* 7, no. 1 (Spring 2021): 104–43, https://doi.org/10.1016/j.sheji.2020.12.002; Beaulieu-Brossard, "Encountering Nomads in Israel Defense Forces and Beyond"; Philippe Beaulieu-Brossard and Philippe Dufort, "Introduction to the Conference: The Rise of Reflective Military Practitioners" (Hybrid Warfare: New Ontologies and Epistemologies in Armed Forces Canadian Forces College, University of

Ottawa and the Canadian Forces College, Toronto, Canada, 2016); Zweibelson, "The Multidisciplinary Design Movement"; and Philippe Beaulieu-Brossard, "Encountering Nomads in Israel Defense Forces and Beyond," in *Concepts at Work: On the Linguistic Infrastructure of World Politics* (Ann Arbor: University of Michigan Press, 2020).

97. English variations of his name spelling include "Kokhavi." See Yagil Henkin, "On Swarming: Success and Failure in Multidirectional Warfare, from Normandy to the Second Lebanon War," *Defence Studies* 14, no. 3 (2014): 321, https://doi.org/10.1080/14702436.2014.901663.
98. Eyal Weizman, "Lethal Theory," *Log*, no. 7 (Winter/Spring 2006): 53–77; and Weizman, "Walking through Walls: Soldiers as Architects in the Israeli/Palestinian Conflict."
99. Henkin, "On Swarming," 322.
100. For example, "centers of gravity" as assimilated into modern military methodologies bear no relationship with actual gravitational theory. The military has stripped gravitational theory of everything but a loosely associated metaphoric device (drawn from the nineteenth century writings of Clausewitz) and has repurposed "COG analysis" to mean something utterly foreign to what gravitational physicists work with. This demonstrates the dominance of a Newtonian style that incorporates terms and metaphors without altering its epistemological or ontological core positions in what warfare is and is not.
101. Cockayne, Ruez, and Secor, "Thinking Space Differently," 196.

The Sky Is Not the Limit
The Unknowable Future of Space

José de Arimatéia da Cruz, PhD/MPH

Understanding Space Strategy: The Art of War in Space. By John J. Klein. New York: Routledge, 2019. Pp. 258. $144 (hardcover); $43.96 (paperback and ebook).

The Power of the Space Club. By Deganit Paikowsky. New York: Cambridge University Press, 2017. Pp. 263. $108 (hardcover); $34.99 (paperback); $33.24 (ebook). https://doi.org/10.1017/9781108159883.

The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests. By James Clay Moltz. Stanford, CA: Stanford University Press, 2019. Pp. 400. $38.00 (paperback and ebook).

US Presidents and the Militarization of Space, 1946–1967. By Sean N. Kalic. College Station: Texas A&M University Press, 2012. Pp. 224. $40.00 (hardcover).

Space and Defense Policy. Edited by Damon Coletta and Frances T. Pilch. New York: Routledge, 2009. Pp. 368. $176.00 (hardcover); $55.16 (paperback and ebook).

The security environment is also affected by *rapid technological advancements and the changing character of war*. The drive to develop new technologies is relentless, expanding to more actors with lower barriers of entry, and moving at accelerating speed.[1]

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Space is no longer the last frontier once popularized by science fiction television shows and literature. The science fiction of space is the science reality of nations worldwide today. The space domain is a complex environment of push and pull factors composed of technological concepts, context, and warfighting concepts. The potential for conflicts in outer space is driving its technological development. Today, the space domain is a contested environment. The United States is no longer the only player in the game either. In addition to sovereign nations such as China, Russia, India, Iran, and Brazil, several private enterprises and billionaires compete and contest the space domain. For example, the first of Russia's self-financed space tourists, American businessman Dennis Tito, took off from Baikonur Cosmodrome in Kazakhstan on 28 April 2001 for the *International Space Station* (ISS).[2] *Space Operations*, Joint Publication 3-14, defines the space domain as the area above the altitude where atmospheric effects on airborne objects become negligible. United States Space Command's (USSPACECOM) area of responsibility (AOR) surrounds the Earth at altitudes equal to, or greater than, 100 kilometers (54 nautical miles) above mean sea level.[3] Space Operations specifies that space situational awareness (SSA)

> is the requisite foundational, current, and predictive knowledge and characterization of space objects and the OE upon which space operations depend—including physical, virtual, information, and human dimensions—as well as all factors, activities, and events of all entities conducting, or preparing to conduct, space operations. Space surveillance capabilities include a mix of space-based and ground-based sensors. SSA is dependent on integrating space surveillance, collection, and processing; environmental monitoring; status of US and cooperative satellite systems; understanding of US and multinational space readiness; and analysis of the space domain.[4]

In *Space Domain Awareness: Doctrine for Space Forces*, Space Doctrine Publication 3-100, space is considered an integral part of homeland defense and a highly contested environment, and "superior knowledge of the natural environment provides space actors with the means to plan and execute operations better than their competitors and adversaries."[5] Understanding the operational space environment is a force multiplier to the spacefaring warriors of the U.S. Space Command. The ability of spacefaring warriors to understand space's operational environment is a prerequisite for the joint force's commander "to execute operations; the vast distances, orbital constraints, and physical characteristics associated with space operations present some unique challenges."[6] Space protection is the responsibility of the U.S. Space Command and the U.S. Space Forces. According to the Department of Defense, the U.S. Space Command conducts operations in, from, and to space to deter conflict and, if necessary, defeat aggression and defend U.S. vital interests. The U.S. Space Force, however, organizes, trains, and equips troops (space guardians) during peacetime to present them to the combatant commands (i.e., U.S. Space Command) during a time of space conflict or war.[7] As people worldwide depend on the sea, air, and space for their prosperity, understanding the space environment plays a vital role in the United States' national security strategy. Each of the five books reviewed provides the necessary foundations on the different components of space power to think strategically about contemporary space policy.

John J. Klein's *Understanding Space Strategy: The Art of War in Space* attempts to put space and warfare within the context of the general theory of strategy and provide a

compelling foundation for discussing space strategy as a practical matter.[8] In his seminal work, *The Peloponnesian War*, the greatest strategist thinker, Thucydides, argued that nations go to war for three reasons, namely, fear, honor, and interest. As space becomes a force multiplier in future conflicts, spacefaring countries, especially China, will go to war for the same reasons as during the Peloponnesian War. According to Klein, when considering the character of war in space, four areas are significant: civil, commercial, intelligence, and military.[9] Regarding civil space activities, Klein discusses the government's efforts to explore space and advance human understanding. Civil space activities include humans and robotic exploration and science missions to advance humanity's knowledge of the Earth, the solar system, and the universe.[10] According to Klein, commercial activities include those "where companies provide services intending to make a profit, whether in the near or long-term."[11] The intelligence sector includes "intelligence, surveillance, and reconnaissance missions conducted by government agencies for national security purposes."[12] Finally, military space activities "seek to achieve political objectives through offensive or defensive operations, whether into, through, or from space."[13]

The commercialization of space is another critical topic Klein discusses. Given the sizable number of satellites in orbit, Klein argues that the commercialization of space will change day-to-day space operations and shape space strategy. Klein asserts that significant commercial space activities "will influence both the political ends and available means for implementing a space strategy."[14] Klein highlights three critical areas for consideration as spacefaring nations move forward with their commercialization of space. Countries should minimize debris and hazards to operations, coordinate rendezvous and proximity operations, and minimize electromagnetic interference.[15] Commercializing space will also provide less capable space nations with both offensive and defensive strategic capabilities vis-à-vis the most powerful spacefaring countries. Those capabilities can be either military or nonmilitary. Klein states that less powerful spacefaring nations could use other instruments of state power, such as diplomacy, economics, and informational instruments of power.[16] Less powerful spacefaring nations can access the "space club" by "establishing a notable presence in space and then proposing international treaties, agreements, principles, or resolutions that advance their interests on relevant issues."[17] For example, space is more significant in the U.S. Southern Command's mission.[18] As reported by the Southern Command, four nations in SOUTHCOM are "part of the NASA-led Artemis Accords: Argentina, Brazil, Colombia, and Ecuador."[19] Those four nations could propose new international treaties, agreements, or principles, or worse yet, ally with China, which already has space capabilities in South America, undermining other more powerful spacefaring nations, such as the United States, in its neighborhood. Also, those less capable spacefaring nations "can use economic measures to contest command of space and achieve modest results."[20] Less powerful spacefaring nations can accomplish such an objective if they "provide a unique commercial or business service that can threaten to withhold its space-based services in the hopes of negotiating better terms or some contentious issue."[21]

While the commercialization of space has opened a lacuna for less powerful spacefaring nations to be more active in the "space club" or try to gain access to it, several constraining factors will prevent such countries from becoming key players in the politics of space. Klein argues that three conditions must be satisfied for less powerful nations to become space-warfaring nations: technological development, doctrinal in-

novation, and organization adaptation.[22] For those three preconditions to exist, there needs to be a transformation in the spacefaring nation. Transformation is "a revolutionary or significant improvement in hardware, tactics, or doctrine, and this term gained popularity in the early 2000."[23]

The commercialization of space warfare is a double-edged sword. Thucydides argues in *History of the Peloponnesian War* that "war is a matter not so much of arms as of money."[24] While the commercialization of space allows for interdependence among nations, it also presents several challenges with governments using and integrating commercial products and services offered by other countries, especially if the country providing some essential space materials becomes an adversary or political foe. Furthermore, as Klein states, there are challenges of "independent verification and validation of commercial data; tradeoffs in data quality, reliability, availability, and quantity; data sharing policies; and the risk of relying on commercial operators to provide mission-critical government data in times of conflict."[25]

War is a nasty business. The nature of it is enduring. However, its characters are in a constant state of flux, adapting and adjusting to new technological revolutions. With the addition of space as a warfighting domain, the United States must be constantly vigilant. Significant, small, middle, and emerging powers will use the space domain in future conflicts. It has been reported that both China and Russia are pursuing nondestructive and destructive counterspace weapons capabilities, such as jammers, lasers, kinetic-kill or antisatellite (ASAT) systems, and cyberattack capabilities.[26] As former president Donald J. Trump stated at the establishment of the U.S. Space Command, "As the newest combatant command, SPACECOM will defend America's vital interests in space—the next warfighting domain."[27] Trump also goes on to say, "Our freedom to operate in space is also essential to detecting and destroying any missile launched against the United States. . . . So, just as we have recognized land, air, sea, and cyber as vital warfighting domains, we will now treat space as an independent region overseen by a new unified geographic combatant command."[28]

Spacefaring nations are rational thinkers. They understand the value of space as a fighting domain. Therefore, they will assess the value of a space force and whether they can afford such an investment into infant space commerce. If the cost of developing a native space industry is too high for a spacefaring aspiring nation, they can join a nation-state space club. Deganit Paikowsky develops the concept of a nation-state space club in her book *The Power of the Space Club*. According to Paikowsky, a nation-state club is a "structure that separates a small and limited number of countries from the rest of the world because they possess unique capabilities that do not exist in most countries."[29] Whether or not to join a nation-state space club is a rational decision-making process carried out by spacefaring nations. By entering the club, the partnering nation gains legitimacy and recognition by other nation-states as a powerful nation since joining a club recognizes the distinction between us and them. Being part of this exclusive group of spacefaring nations has both tangible and intangible benefits since club members "share responsibility for their actions and are expected to act by the norms and standards developed in the club."[30] The concept of a space club dates back to the early 1960s. Paikowsky explains that "the politics of space, characterized by an inherent tension between competition, limited cooperation, and controls on the transfer and flow of technology, produced the integration of what has been termed space club."[31]

Individuals like nation-states join clubs or organizations for several reasons. In-

dividuals may join a club or gym to get in shape or take better care of their health. Nation-states may join a club to gain access to resources that otherwise would not be available, promote legislation that can change the game's rules to accommodate their wishes or desires better, etc. Paikowsky points out that "scholars in sociology, psychology, and economics observe that, in human society, joining a club or a clique is a means to define and visually display 'who we are,' shaping and reflecting one's power and reputation in a way that will elevate one's status, image, and self-esteem in non-violent, but competitive ways."[32] Paikowsky also argues that there are two types of clubs based on the typology of nation-state clubs. A club can be either formal or informal. The differences are based on characteristics such as organizing mechanisms, the process of joining the club, club membership, and interaction among members.[33]

Nation-state clubs are not ex nihilo organizations. Those organizations exist through processes and the interaction of various actors, stakeholders, lobbyists, nongovernmental organizations (NGOs), etc., each fighting for power and agency. According to Paikowsky, nation-state clubs emerge through five stages. In the first stage of the process, key players, usually the superpowers, develop unique capabilities to project power and achieve leadership and competency. In the second stage, the international community's superpowers socialize with the club's newcomers. The superpowers, argues Paikowsky, socialize states to accept their interpretation of power and adopt collectively held norms about power, standing, and prestige. The third stage occurs when a positive reinforcement cycle of these conventions and norms ensues. That is, certain states emulate the key players and develop their capabilities. In the fourth stage, belonging to a club may seem unfair to the newly inducted members since key players offer cooperation while imposing restrictions and limitations on the diffusion of knowledge and transfer of technology and other critical elements. The fifth state of the nation-state club involves interaction among members while simultaneously involving control aimed at setting boundaries to exclude others from joining and marking individual states that acquired the means and symbols of power and separate them from the others. The sixth and final stage of the process is the most important. With the enlargement of the club, members may see the club's advantages as no longer enhancing their political, military, and economic objectives; therefore, they may exit the club or, worse yet, create a new one.[34]

Another vital contribution to the space literature by Paikowsky's book is the discussion of techno-nationalism versus techno-globalism paradigms of space development. Those are two important ideas about how nation-states develop their infant space industry. Techno-nationalism refers to "the development and use of advanced technologies to achieve a state's domestic and international objectives."[35] Countries such as Brazil, India, and Iran have all used techno-nationalism to achieve national and international prestige by developing their space industries. Regarding India, as Paikowsky contends, "In their eyes, India's history as an ancient, powerful nation, and the fact that the Indian people are one of the world's largest peoples, demands that India be a world power."[36] Brazil also developed its infant space industry during the military dictatorship of the 1960s. The idea of *grandeza*, or greatness, was one of the driving forces behind the military development of Brazil's military-industrial complex. In fact,

> Brazil's first act, from the 1960s through about the turn of the century, included many common elements in growing space programs. It had a sounding rocket program for science and technology research as a precursor to an orbit-

> al launch vehicle. It conducted satellite research and inked agreements with spacefaring nations to build and launch satellites and space assets. And it built a launch facility in Alcântara in the country's far north.[37]

Techno-globalism has replaced techno-nationalism in the age of globalization and the introduction of neoliberalism. In the post–Cold War international system and the "end of history, the politics of space became more oriented toward techno-globalism, in which technological development is used to leverage the advantages of globalization to enrich the national system of innovation."[38] Techno-globalism, like neoliberalism, advocates removing or relaxing all economic barriers and increasing cooperation and commercialization among nations. Techno-globalism strongly believes in the ideas of economic interdependence among nations.

Two competing hypotheses guide Paikowsky's *The Power of the Space Club*. The first hypothesis is that "states that define themselves as powers will emulate the superpowers by developing indigenous space capabilities. These states will justify their decisions by arguing that this action is expected of them due to their status."[39] The second hypothesis is that states "are not powers but aspire to upgrade their power. International standing will develop national space capabilities and thereby try to join the club."[40] In the final analysis, the two hypotheses can be summarized as follows. Countries develop space programs for two reasons: they assume that this is expected of them to maintain their power and international standing, or they aspire to higher power and status for geopolitical and/or domestic reasons, regardless of clear, tangible cost/benefit consideration."[41]

Another vital contribution to the politics of space security is James Clay Moltz. In his 2019 tour de force, *The Politics of Space Security*, Moltz, the chairperson of the Department of National Security Affairs at the Naval Postgraduate School, examines the history of international politics of the space age from 1957 to the modern day. It is a difficult undertaking, but Moltz argues that by taking such a longitudinal approach to space politics, he hopes to "explain past outcomes and draw some practical lessons for the future . . . to focus on space security issues and turning points in the management of military space threats as experienced to date."[42] Moltz's thesis is that there is a compelling logic to exercise military restraint by all actors in space because of their shared national interest in maintaining safe access to critical regions of space—especially low Earth orbit, which is from around 60–1,000 miles in altitude.[43] In other words, given space's domain interconnection and interdependence, "environmental factors have played an influential role in space security over time and provide a useful context for considering the future."[44] Unlike the other books under review, Moltz provides the readers with a clear operational definition of space security.

Moltz defines *space security* as "the ability to pace and operate assets outside the Earth's atmosphere without external interference, damage, and destruction."[45] This definition makes it clear that to be part of the "space club," a state must be able to launch a spacecraft into space and maintain its operation. This distinction creates artificial boundaries between spacefaring nations and the space wannabes as space becomes an essential operational domain and space becomes more commercialized. Moltz divides his book into three sections, making it easy for readers to understand the chronological development of space security. Part I, "Explaining Space Security: Concepts and Historical Comparisons," covers the existing literature, its strengths and weaknesses, and possible alternative explanations for space outcomes. In part II, "Reassessing

Twentieth-Century Space Security," Moltz provides a detailed history of U.S.-Soviet space security relations, focusing on how more limited forms of competition emerged from initially hostile, open-ended, and military-led space programs. In the final section of the book, part III, "Considering Twenty-First Century Space Security," Moltz examines the new dynamics in international space activities with the proliferation of spacefaring nations and the commercialization of space. Moltz pays particular attention to China's rise as a significant space power in this context. According to the U.S. Department of Defense's *2022 National Defense Strategy*, the People's Republic of China (PRC) is a pacing challenge to the United States.[46] The *National Security Strategy* released in October 2022 calls the PRC "America's most consequential geopolitical challenge."[47] China became a concern to the United States and the rest of the world when it launched an antisatellite (ASAT) weapon on 11 January 2007. This marked the beginning of China as a spacefaring nation and established it as a major space player. It also marks "the first violation of a tacit norm of no destructive ASAT testing in place since the U.S. test in 1985."[48] Not only did the United States react to China's behavior but talks of a potential "Space Pearl Harbor" began to circulate among the U.S. government leadership.[49] The United States was not the only nation to react to China's violations of space norms. India announced plans to develop its ASAT weapons through its missile defense capabilities.[50] The European countries took a different approach. Rather than panicking at China's actions, they "continued to cooperate in their joint effort to develop and agree on final language for their space Code of Conduct."[51]

China and other space-aspiring nations challenging the United States' dominance in space should be no surprise to any astute international relations or political science student. Henry A. Kissinger once said, "History is the memory of states."[52] When the Soviets launched Sputnik on 4 October 1957, thus inaugurating the space age, the United States quickly reacted. Committed to avoiding a "nuclear Pearl Harbor," the Dwight D. Eisenhower administration created the Advanced Research and Projects Agency (ARPA) in November 1958 "to work on the military space program of the United States."[53] Furthermore, Eisenhower, using the power of the executive branch, ordered the newly created National Aeronautics and Space Administration (NASA) to run the civilian space program.[54] The John F. Kennedy administration also established the National Security Action Memorandum (NSAM) no. 156 Committee, "an ad hoc group of senior advisors to provide guidance and oversight for the administration's development of space policy."[55]

Moltz argues that the debate regarding outer space as a domain of cooperation or conflict is broken down between two perspectives: space defense and space sanctuary. Further, either perspective follows one of the four schools of thought regarding the debate on space security: space nationalism, technological determinism, social interaction, and global institutionalism.[56] Space nationalism derives its inspiration from three sources: the political theory of realism, the competitive history of great power competition, and the context of the Cold War hostility.[57] From this perspective, spacefaring nations are engaged in a zero-sum game where one superpower's victory represents another's loss. This perspective has as its founding fathers Thucydides, Thomas Hobbes, and Niccolò Machiavelli who believe that "notions of duplicity, power-seeking, and brutality are likely."[58] Space nationalism is a realist perspective of space warfare. While the space nationalism school sees the world as a zero-sum game driven by competition, the global intuitionalism school "emphasizes the possible role of new forms of shared

human and scientific thinking, supported by international cooperation, treaties, and organizations, in providing space security rather than weapons-based approaches."[59] Dutch lawyer Hugo Grotius and German philosopher Immanuel Kant inspired global institutionalism.

Technological determinism is the third school of thought concerning outer space as a source of conflict or cooperation. This school of thought has focused "not on political factors but instead on technology and the resulting structural context of space decision-making."[60] The technological determinism school of thought has also been known as the "collective or public goods" approach, especially within European politics.[61] The final school of thought is social interactionism. This approach "rejects the notion of the inevitability of space weapons, given the availability of policy tools among space-faring states to interact with one another, bargain, and prevent the deployment of harmful weapons, which could damage other priorities they have in space."[62]

Regardless of the four schools of thought concerning cooperation or conflict among nations, the fact is that despite the strategic restraints exercised by spacefaring governments since the early 1950s, the commercialization of space and the addition of more players involved in it, the norms, and regulations that have tended to keep space safe will be challenged and contested in the future. To maintain space as a haven, the United States must take the lead and lead by example. The office of the president of the United States, in the future, will inherit a more complex world when it comes to space. Therefore, that individual will play a tremendous role in the future of the United States.

Sean N. Kalic's *US Presidents and the Militarization of Space, 1946–67*, argues that space becomes a national security issue that demands attention, discussion, and forethought.[63] Yet, before Kalic's book, "there was no single study covering the evolution of the effort by US presidents to build a policy focused on the use of space for peaceful purposes."[64] Before discussing the key differences between administrations vis-à-vis space as a force multiplier, Kalic operationalized the militarization of space and weaponization of space. Those two concepts are essential to understanding the evolution of U.S. space policy during the 1946–67 time frame. By militarizing space, Kalic argues that the idea is "the use of space-based systems to collect, gather, and disseminate photographic intelligence, communications data, weather data, signals intelligence, and strategic reconnaissance."[65] As it can seem from the concept's operationalization, the militarization of space does not connotate with the use of force in an aggressive sense. Instead, the militarization of space "conveys an interest in the use of space for non-aggressive military purposes."[66] The weaponization of space, on the other hand, means "the use of space-based systems to defend against the use of other space-based weapons or to deny an enemy access to space, the use of space-based weapons to target terrestrial sites, and the use of space weapons to destroy an enemy's space-based assets."[67] The definition of weaponization of space implies the aggressive use of force and space-based systems to contain an adversary.

The intellectual impetus for developing a U.S. military space program has its roots between 1945 and 1952. Individuals, including those at the U.S. Navy, U.S. Air Force, and Rand Corporation were essential for ideas to become a reality. For them, "a man-made satellite would be a great value in presenting the United States as the world's technological leader, a vital asset in the emerging Cold War with the Soviet Union."[68] However, the Harry S. Truman administration did little to advance the age of spacefar-

ing. The advancement of Communism, instead, was Truman's primary concern in the early days of the Cold War. As Kalic pointed out, "concern over communist expansion in the early Cold War drove Truman to focus on the development of national security strategies to contain communism rather than on a satellite program that might not have fruitful military applications."[69] Space would gain a prominent position with the U.S. government during the Eisenhower, Kennedy, and Lyndon B. Johnson administrations. Those three presidents recognized the "universal significance of space and openly support US military satellites and space programs as essential to the national security of the United States and the preservation of world peace."[70] In fact, as Kalic also points out, "by the time of Eisenhower's inauguration in 1953, the space age had already begun and the tenets of American future national space policy had been defined."[71] Eisenhower was a proponent of the militarization of space without advocating its weaponization.[72]

John F. Kennedy's presidency marked the continuity of Eisenhower's military space program while seeking an arms control agreement with the Soviet Union. As Kalic points out, "the majority of the space programs advocated by Kennedy had already been under development during the Eisenhower administration, and Kennedy merely wanted to continue funding the projects already underway."[73] Kennedy stated, "space is our great new frontier."[74] Appearing before Congress on 25 May 1961, President Kennedy highlighted his four major goals for the U.S. space program. First, he recommended that the United States land a man on the Moon and return him safely by the decade's end. This is Kennedy's "moonshot." Second, he asked Congress for an additional $23 million to fund the Project Rover nuclear rocket. Third, Kennedy asked Congress for an extra $50 million to accelerate the communication satellite program to enable global communication. Finally, he asked Congress for $75 million for weather satellites.[75] President Kennedy eventually broke away from Eisenhower's space policy and established his "four basic principles" to reshape the U.S. space program. Kennedy's priorities to advance the U.S. space program were "scientific, commercial/civilian, military, and national prestige."[76]

During Lyndon B. Johnson's presidency, the United States fulfilled its commitment to becoming a spacefaring nation. Johnson, who had served on several key committees in Congress, especially the Armed Services Committee and the Satellite and Missile Programs Subcommittee, and participated in several discussions regarding the Soviet Union launching of Sputnik 1 and 2, had expertise regarding the U.S. space program like no other president before him. Johnson saw the launching of Sputnik 1 and 2 as an existential concern to the United States' national security. Johnson took several steps to show his commitment to the U.S. space program. For example, he supported "a national space program encompassing both the military and civilian programs."[77] Furthermore, Johnson's space program was intended to showcase the United States as a spacefaring nation while strengthening the U.S. military space program.[78]

Sean N. Kalic's *US Presidents and the Militarization of Space, 1946–67* calls our attention to an often-misunderstood idea regarding the U.S. space program. The United States did not "seek to race the Soviet Union to arm the heavens, but rather strove to develop a military and civilian space program and policy that advocated the use of space for peaceful purpose."[79] The first era of the space age, between 1946 and 1967, was characterized as "an ongoing commitment to the peaceful use of space for the benefit of all."[80]

Damon Coletta and Frances T. Pilch's *Space and Defense Policy* argue that space

power is "poised to influence policies affecting the national defense of many states."[81] Therefore, the United States must avoid its linear thinking regarding space, its complexities, and how friends and foes will respond to the proliferation of space programs and the commercialization of space. It is time to discuss the risks, the strategic decisions, and the recognition that China will be a "pacing" challenger to the international rules-based order. With that in mind, Coletta and Pilch bring together scholars and practitioners of space to "organize a groundbreaking conversation about defense that will lead actors in the world, and the United States in particular, toward responsible and successful application of space power."[82] Given the importance of space in future conflicts, new actors, including nonstate strategic actors, are attempting to join the "space club," thus posing a threat to the United States and its allies' national security. Spacefaring nations and new actors will interact with the international system in two ways. According to Coletta and Pilch, spacefaring countries and new actors will be competitively maneuvering, for advantage concerning other states, and establishing of norms for mutually beneficial cooperation."[83] Nation-states and nonstate actors alike cannot ignore the importance of space as a force multiplier. Viewed from this perspective, space "acts more as a highway, allowing global access for surveillance and communication systems that provide an order of magnitude improvement in coverage compared to land, air, or maritime alternatives."[84]

Coletta and Pilch, like the other authors here under review, also stress the interconnection between space and the economy. They stated, "it would be difficult to overstate how important commercial space activity is to the US position as the world's premier military and economic power."[85] Commercial space activities are vital to the United States' national security. First, commercial space activities provide important services and products to other federal government agencies and intelligence communities. Second, commercial satellites are vital to the well-being of the U.S. economy as its citizens rely on robust and resilient internet connectivity for everything in their daily lives, such as banking, transportation, and vacationing. Finally, commercial satellites interlink banks worldwide via the Society for Worldwide Interbank Financial Telecommunication (SWIFT). It is no exaggeration to say that today's business environment's dependency on commercial space satellites has led to the end of geography, where geographic boundaries are hollow. Of course, given its great reliance on commercial space satellites and the globalization of the space industry, the United States is quite vulnerable to cyberattacks by nefarious nation-states and nonstate actors intending to disrupt the United States' economic well-being. As Coletta and Pilch pointed out, "the globalization of the world economy, along with new multinational alliances, raises national security questions. US firms that enter foreign markets or merge with foreign companies pose national security issues."[86]

In his testimony to the House Armed Services Committee, John D. Hill, the Defense Department's principal director for space policy, stated that "space-based capabilities are vital to U.S. national security in today's era of de-stabilizing challenges from Russia and undeniable strategic competition with China."[87] Coletta and Pilch argue, "After 16 years of struggle, the Russian space industry has constituted itself as a leading edge of the country's twenty-first-century economy . . . space tourism and the private marketing of space ventures may well be the wave of the future in space."[88] Since the launch of its first human spaceflight in October 2003 in Shenzhou, China has been the leading nation in a second space race.[89]

Despite the Hobbesian nature of the post–Cold War international system space domain with the rise of new challenges and newcomers, the United States still has options for addressing the "pacing" threat and "acute" challenge from China and Russia, respectively. The United States has four options that it could take in dealing with Russia and China. First, the United States could reduce cooperation, as advocated by some critics who argue that the United States has not taken advantage of its lone superpower status in the aftermath of the collapse of the Soviet Union and the end of the Cold War. Second, rather than reduce cooperation, the United States could pursue a policy of limited preventive collaboration and space defenses. According to this approach, there would be some "forms of international cooperation in combination with a well-funded research and development strategy aimed at the future testing and deployment of a limited number of space weapons, largely for defensive purposes."[90] The third option for the United States is to pursue moderate cooperation, with weapons research only but as a hedge. This third option allows for the creation of "rules of the road" or "rules of space" governing space behavior and means of reducing mutual space vulnerabilities through "non-offensive techniques."[91] The final option for the United States is to pursue high levels of cooperation with no weapons research and a new treaty. According to this option, the United States would "seek engagement with both countries [China and Russia] and accept their call for a formal international treaty banning space weapons, including establishing an international verification system."[92]

Each one of the options available for the United States is driven by four major camps regarding the weaponization of space. The four major camps are as follows: space hawks, inevitable weaponizers, militarization realists, and space doves.[93] The space hawks argue that "space already is or holds the potential to become the dominant source of military power." Therefore, space hawks urge the United States to "move quickly and directly to develop and deploy space weapons to control and project power from this dominant theater of combat operations."[94] Furthermore, space hawks "oppose virtually all space-related arms control on regulation because of its potential to slow or derail rapid and direct space weaponization by the United States."[95] The second group is the inevitable weaponizers or skeptics of space weaponization. Members of this group are not convinced that "space weaponization would be beneficial for US or global security, and they are unsure that space will prove to be a decisive theater of combat operations."[96] Militarization realists are different from traditional realists. Traditional realists believe the international system is an arena for competition and a power struggle. Traditional realists view the global system from a Hobbesian state of nature where life is "solitary, poor, nasty, brutish, and short in a state of anarchy." Militarization realists oppose space weaponization since they believe the United States is better serviced by maintaining a status quo in space.[97] Given the low political and technological barriers for spacefaring wannabes, they argue that if the United States takes the lead in weaponizing space, it will become easier for other nations to follow.[98] They also support space-related regulations and arms control to prevent other countries from "weaponizing or even militarizing space."[99] The final group is the space doves. Space doves oppose the weaponization of space based on moral, religious, ideological, and arms control principles. Furthermore, the space doves subscribe to the principles of President Eisenhower's "space for peaceful purposes" policy.[100] Finally, space doves believe that in the aftermath of the post–Cold War, "there is no rationale for space weaponization that is strong enough to overturn the basic strategic logic America developed at the opening of the space age."[101]

The future of spacefaring nations and the commercial space industry holds tremendous promise and potential, as pointed out by James N. Mattis's quote at the beginning of this article. As technology advances and access to space becomes more affordable and accessible, we expect to see an increasing number of nations and private companies participating in space exploration and utilization. This expansion will lead to exciting discoveries, economic opportunities, and advancements in our understanding of the universe and the use of space as a force multiplier. However, it also comes with challenges such as sustainability, regulation, and international cooperation and competition that all key players must address to ensure a responsible and prosperous future in space to avoid a space security dilemma or Thucydides trap.[102] In conclusion, as we continue to push the boundaries of human spacefaring, collaboration between governments and the commercial sector will play a pivotal role in shaping the trajectory of our cosmic journey while avoiding Amara's Law.[103]

Endnotes

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Bitskrieg: The New Challenge of Cyberwarfare. By John Arquilla. Cambridge, MA: Polity Press, 2021. Pp. 212. $ 64.95 (hardcover); $ 22.95 (paperback); $14.00 (ebook).

In this book, John Arquilla tackles the new challenges posed by information operations under the bitskrieg doctrine as "a subsector of Cyberwar" (p. 143). The book links military history and doctrine—*blitzkrieg*—with the author's expertise on cybersecurity and cyberdefense, providing valuable insights into networked warfare and its current challenges to the militaries, state, and society.

The book presents a compelling dialogue between the past, present, and future grounded on accurate sources. Therefore, it links both military doctrine—blitzkrieg—and history, with the author's advisory experience, mainly in Operation Desert Storm (1990–91), trying to set the scene for the future of cyber warfare. Indeed, the book's title, *Bitskrieg*, owes its wording to its predecessor blitzkrieg, which is achieved through an analogy between both.

The author enhances the profound impact that blitzkrieg has introduced since World War II in the military strategic and operational domain. Its velocity and related tactical maneuvers operated in battle have shown that an armed conflict can be everywhere involving many known and unknown actors, which, in turn, challenges Carl von Clausewitz's military paradigm of "defence dominance" (p. 6).

These ideas may apply to information operations and networked cyber warfare where "then the defence dominance must be replaced by 'offence rules' " (pp. 6–7). The author accurately portrays its title and the analogy, which serves as guidance: "Just as the Spanish Civil War (1936–39) foreshadowed the kinds of actions—from tank manoeuvres in the field to the aerial bombardment of cities—that was to characterize much of the fighting in World War II under the rubric of Blitzkrieg, so too have recent Russian uses of the various modes of cyberwar in Georgia and Ukraine provided a glimpse of the next 'face of battle': Bitskrieg" (p. 7).

Next, the author explains the challenges posed by cyber operations, which are below the threshold of violence; although disruptive, "they destroy little," which minimizes "the escalation to a wider war," delving into issues of cyber security (pp. 13–14).

Also, the author considers the profound impact of technology on warfare, its battle doctrine, and military domain. Smaller units highly networked on land, sea, and air will defeat larger forces (p. 14). The military doctrine of information superiority lies at the heart of cyberwarfare and *Bitskrieg*. The side with better information will pursue decisive military operations with possibly fewer losses (pp. 14–15).

One of the book's central and appreciated features relies on its structure and selected topics for discussion. Indeed, it presents the main ideas of the most critical subjects

in cyber warfare to the broad audience at a glance, in a concise, coherent, and perceptible manner.

The book is divided into five parts, covering various topics related to cyber warfare. The first part outlines the main issues and explains the new trends in cyber warfare (pp. 13–24). The second part discusses the importance and impact of market-driven forces on solutions to cyber threats and the vulnerability of liberal societies compared to authoritarian regimes (pp. 32–34). The third part explores the combination of virtual and nonvirtual battlefields, including the role of robotics and artificial intelligence in the revolution in military affairs (pp. 46–51, 67–96). The fourth part examines the challenges of conceiving and controlling cyberweapons, including their dual use, and presents the author's perspective on the feasibility of a cyber arms control agreement (pp. 98–30). Finally, the last part offers solutions related to encryption and cloud computing, which are coherent with the book content and address the main topics already covered.

It is, therefore, a book that brings awareness and invites the readers to rethink cybersecurity, cyberdefense, cyberwarfare, and the future of the military, focused on the U.S. environment (pp. 132–55). The same military has also shown reluctance to detach from old paradigms and invest in new ones with smaller units, precision-guided weapons, and information superiority on "their weapons and the interconnectedness of all forces in the field at sea, and in the aerospace environment" (pp. 89–90).

The author explores the adaptation of the blitzkrieg doctrine from World War II to the cyber domain, which has unique features. However, the author could delve deeper into this analogy to understand its impact on individuals, society, and the state, particularly in balancing cybersecurity, cyberdefense, and fundamental freedoms. Further explanation of this doctrine could also clarify the military's reluctance to adopt *Bitskrieg* and enhance its added value, impact on the conduct of hostilities, and compliance with legal frameworks and rules of engagement. Finally, the book could also address the disagreement on the definition of cyberweapons and its impact on the legal regime of cyber weapons review and the cyber arms control agreement. This would provide further insight into the challenges of regulating cyber warfare and the need for a common understanding of key concepts in this domain.

Notwithstanding, the book significantly contributes to understanding networked cyber warfare, cybersecurity, and defense issues. Undeniably, the book will contribute to readers' understanding, rethinking, and willingness to deepen their knowledge of these critical subjects. This will undoubtedly enhance readers' ability to address the challenges of regulating cyber warfare and promoting cybersecurity.

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The Culture of Military Organizations. Edited by Peter R. Mansoor and Williamson Murray. New York: Cambridge University Press, 2019. Pp. 482. $111.00 (hardcover); $36.99 (paperback); $36.99 (ebook). https://doi.org/10.1017/9781108622752.

The study of culture within military contexts is a welcome trend gathering momentum with the publication of several excellent monographs in recent years, including the exploration of important subcultures as well as the development of an overall Service culture.[1] With *The Culture of Military Organizations*, editors Peter Mansoor and Williamson Murray assembled an impressive array of scholars with the dual aim of focusing attention on the role of both organizational and strategic culture in military effectiveness and of providing current military leaders and policy makers a better understanding of how culture within their respective organizations develops, is shaped, and can influence the choices—and the future—of military Services. The contributors then proceed to examine how various aspects of culture and cultural tendencies manifest in a variety of different military, political, and temporal settings, broadly categorized by land-based military forces, maritime forces, and air forces. The resulting work, then, is one with a wide scope but a narrow focus, and one that succeeds in drawing out the "insights of history" in a compelling, convincing, and constructive way (pp. 3–14).

The authors examine two different kinds of culture throughout—organizational culture, as conveyed by artifacts, beliefs and values, and underlying assumptions—and strategic culture, which the editors describe as being nationally or ethnically defined, rather than by specific institutions. Strategic culture precedes organizational culture, they claim, and this is certainly understandable—military personnel are slowly imbued with various aspects of strategic culture throughout their lives as members of a given national, cultural, or ethnic entity, as if by osmosis. Along with these categories, the editors identify geography, history, and environment as three significant contributing factors that shape the cultures of military organizations. Culture, then, establishes "organizational identity" and expected group behavior in various situations (pp. 2–36).

The book's individual chapters examine how these concepts can be observed in practice, including the influence of strong personalities, the impact of the cultural background of personnel, the role of disappointing performance as a motivator for change, and the importance of past experience in determining both organizational purpose and operational decision-making. There is a disproportionate focus on land-based forces (11 chapters on armies compared to 3 on maritime forces and only 2 examining air forces) and the editors do not offer specific justification for this choice, beyond pointing out that sea and air forces are by nature more reliant on technology, while land forces are shaped by both the populations and urban environments in which they operate. This does not detract from applicable insights that each chapter is able to provide, however. Each contributor, in turn, supports the editors' claim that "having an organizational culture aligned with the challenges of the organization's mission and environment may be the most underrated variable in war and strategy" (pp. 32, 55–78, 121–54, 300–307, 321–22, 426–48).

The editors conclude by contemplating a variety of lessons illuminated by the preceding chapters, including learning and innovation, the role of professional military education in "sustaining" organizational culture, and the dangers that come with the widening disconnect between the U.S. military and American society at large. These are broad topics, with far-ranging implications beyond the scope examined by this volume and its contributors. With *The Culture of Military Organizations*, the authors provide a valuable framework that succeeds in not only demonstrating the crucial importance of culture in understanding military organizations and how they operate, but also supports further work by other scholars who will continue exploring these themes (pp. 449–62).

Note

1. See Melvin Deaile, *Always at War: Organizational Culture in Strategic Air Command, 1946–62* (Annapolis, MD: Naval Institute Press, 2018); Heather P. Venable, *How the Few Became the Proud: Crafting the Marine Corps Mystique, 1874–1918* (Annapolis, MD: Naval Institute Press, 2019); David W. Bath, *Assured Destruction: Building the Ballistic Missile Culture of the U.S. Air Force* (Annapolis, MD: Naval Institute Press, 2020); and Michael W. Hankins, *Flying Camelot: The F-15, the F-16, and the Weaponization of Fighter Pilot Nostalgia* (Ithaca, NY: Cornell University Press, 2021).

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Capturing Aguinaldo: The Daring Raid to Seize the Philippine President at the Dawn of the American Century. By Dwight Sullivan. Mechanicsburg, PA: Stackpole, 2022. Pp. 422. $34.95 (hardcover); $33.00 (ebook).

It is not every day that a valuable work of military history is written by one of our own. And I am not only claiming Dwight Sullivan as one of "our" own because he is a 30-year veteran of our the Service's JAG Corps, the cofounder of the CAAFlog website (the premier blog for military justice law and policy), and for the last decade a member of the senior executive services in the Department of Defense's Office of General Counsel with the military justice portfolio. Yes, he is a veteran military lawyer, but he is more than that. Lest the brief biographical details on the dust jacket deceive you, I am claiming him as one of our own in a more proximate sense. In fact, his consanguinity to the Air Force JAG Corps is closer than perhaps this Marine may want to admit. But for five years, Sullivan worked as the Air Force Appellate Defense Division as learned counsel in the capital appeal of U.S. v. Witt before assuming his current position at Department of Defense General Counsel. Full disclosure, that is where we met and worked together for three years, and then we both continued moonlighting on the *Witt* appeal for another three years until it was ultimately decided in 2016.[1] Sullivan remains a mentor and a friend, so it is with great pleasure that I read his book. And there is much to recommend in this fascinating volume.

I will also offer my review from the perspective of what I know best, that of a judge advocate. And *Capturing Aguinaldo* will certainly be of value to legal professionals, but I suspect that it will be read with great interest by all in the profession of arms for at least three reasons. First, because the context of this story is of value for one's professional readings—namely, a half-forgotten guerrilla war fought seven decades before Vietnam and a century before Iraq and Afghanistan is something that we should know more about. Second, because a number of practical questions are raised in these pages that seem eerily familiar 124 years later—about military justice, the law of armed conflict, and political-military relations. Third, because the story of how the protagonist and his motley crew, which included not only U.S. soldiers, sailors, and Marines but also Filipinos and Spanish turncoats (spoiler alert!) captured the president of the fledgling Philippine Republic is a ripping good yarn. You will not be able to put it down.

A Forgotten Guerrilla War

Nineteen years ago, I found myself sitting at the Military Entrance Processing Station (MEPS) in Omaha, Nebraska, awaiting my medical examination. While most of the recruits were a decade younger, sitting next to me was a Marine Corps veteran closer to my age reenlisting after a break in service. I was reading Max Boot's *The Savage Wars of Peace*.[2] The Marine asked what my book was about, and I told him that many people say that America has no history with and does not know how to fight small wars (*guerrilla* is, of course, Spanish for "little war" from which we derive the term "guerrilla war" in English) and that this book was written to refute that idea. If memory serves, I brought up the example of the Philippine-American War (1899–1902), which is a fascinating counterexample to the post-Vietnam narrative about our supposed ineptitude and inexperience with counterinsurgencies. To his credit, my interlocutor was well aware of such wars. I suggested that was because of his prior service and that the average American probably did not know about such things. As I remember, our conversation ended there. But I stand by my opinion: most of us know about America's "big" wars from high school history classes, but many of us do not know much about the "savage wars of peace" in between.[3]

There is much to learn from them, and this book helps to fill that gap. Part biography, part action-adventure story, part political drama, this is a painless way to absorb some useful history. And members of the JAG Corps should know about this forgotten war—not least because, for the first time in three decades, Americans are reoccupying bases in Philippines as a part of our strategy to encircle China with a network of alliances. This archipelagic nation lies at the crossroads of one of the most important regions in the world, both economically and strategically, and our fates are inextricably bound together.[4] So it would behoove us to know more about our shared history.

Lessons about Military Law

Refreshing our memory about the war in the Philippines serves another valuable purpose already hinted at—that there are clear parallels to more recent history, which, arguably, "is not even past."[5] Discussing more recent wars, whether as to their inception or execution, is of course more fraught. Try asking a room full of veterans if the Iraq War was a mistake or if waterboarding was justified, and you may find yourself embroiled in a heated conversation with opinions dividing along familiar partisan lines. Perhaps examples further removed from present debates and political rancor may provide less controversial case studies and thereby enable clinical detachment and clearer thinking. This volume provides several such examples useful to thinking about military law. Consider three.

Early in the campaign, following a brutal series of battles, there were allegations of serious misconduct and even war crimes committed by the Kansas regiment under Brigadier General Frederick Funston's command. Allegedly, these Kansans were ordered to take no prisoners, shot some enemy soldiers attempting to surrender, and even murdered a few after they were taken as prisoners (pp. 42–43n2). An inspector general investigation concluded that some of these allegations were true (p. 43). Funston's commanding officer, Major General Elwell S. Otis, nonetheless decided against convening a courts-martial because, he said, doing so would endanger American soldiers should the enemy learn about these atrocities. This reflects poorly on the military justice system of the era, which was apparently willing to sacrifice accountability in favor of exigency.

Perhaps lessons can be learned from the mishandling of these crimes that may inform the work of contemporary convening authorities or judge advocates.

The next example concerns the book's marquee story, the Palanan expedition, by which an intrepid band of U.S. soldiers along with allied Spanish expatriates and Filipinos marched across enemy territory and captured the president by pretending to be compatriots who had captured American prisoners (pp. 68–79, 131–57). Novel as this strategy was, the lawfulness of capturing a foreign head of state by treachery was questioned, and Funston was lambasted on these grounds by Massachusetts senator Thomas Patterson (p. 173).[6] This account also merits closer study by modern legal professionals.

A third example concerns Brigadier General Funston's postwar conduct, especially his difficult relationship with President Franklin D. Roosevelt. Despite repeated warnings, during speaking tours about his experience in the Philippines, Funston continued offering political commentary—for example, suggesting that critics of the war should be prosecuted for treason (pp. 171–73, 175–80). Roosevelt was furious (p. 174). Surely every seasoned staff judge advocate has counseled at least one senior officer inclined to say more than they should about controversial or political questions. Funston's behavior is, therefore, strikingly familiar—seemingly ripped from the pages of the Department of Defense Standards of Conduct Office's *Encyclopedia of Ethical Failure*.[7] This is another example of the *timelessness* of the sorts of legal issues that judge advocates wrestle with. Circumstances and technology may change, but human nature does not.

It is worth noting that with each of these three examples, the author stops short of providing a thoroughgoing legal analysis and rarely even expresses his opinion. Like Sergeant Joe Friday, the approach here is limited to "[j]ust the facts, ma'am."[8] Knowing Mr. Sullivan as I do, I have little doubt that he has opinions on these subjects that are strongly held and well reasoned, and I cannot help wondering what conclusions he would reach. Yet, here lies one of the book's virtues: the author leaves it to the reader to reflect on the historical record and to reach their own conclusions. One does not find here didactic finger-wagging; unfiltered history is presented on its own terms.[9]

A Good Story, Well Told

There is an apocryphal quotation attributed to Abraham Lincoln, complaining about a man who could compress the smallest ideas into many words.[10] To its credit, this book does not suffer from that defect. On the contrary, in the hands of a less skilled author, this could have been a much longer book. It spans a full century, tracing the protagonist's parents' migration from Ohio to Kansas; tells about Frederick Funston's early life and career; slows down for the featured events of the Philippine-American War; and speeds up again to recount the aftermath of the raid and Funston's career. Although this book covers much ground, it never feels tedious. This is how history should be written. Even the most patient reader will welcome this book's lively prose and spritely pace.

Conclusion

The conclusion of the remarkable book quotes General Douglas MacArthur, "the son of Funston's mentor and idol," who famously said, "Old soldiers never die; they just fade away" (p. 258n2). The author ends with this observation: "Funston didn't live long enough to become an old soldier. But he has certainly faded away." Would that every old soldier were so fortunate as to have such an author unearth their story and retell it

for a new generation. With this outstanding biography and historical work, teeming with insights on every page, Mr. Sullivan has proven himself Funston's Boswell.[11]

Notes

1. United States v. Witt, 75 M.J. 380 (C.A.A.F. 2016).
2. See generally Max Boot, *Savage Wars of Peace: Small Wars and the Rise of American* (New York: Basic Books, 2002).
3. Rudyard Kipling coined this term to describe the smaller wars during periods of supposed peace between the major wars in his poem about the Philippine-American War. "The White Man's Burden," *McClures*, no. 12 (February 1899).
4. "The Philippines' Proximity to Taiwan Makes It Central to Western Strategy," *Economist*, 21 February 2023.
5. See William Faulkner, *Requiem for a Nun* (New York: Random House, 1952). Consider the numerous articles reconsidering the decision to invade Iraq on the 20th anniversary of the commencement of Operation Iraqi Freedom on 20 March 2003, and it soon becomes clear that these debates are still ongoing.
6. The author cites H. W. Halleck, *International Law; or, Rules Regulating the Intercourse of States in Peace and War* (San Francisco, CA: H. H. Bancroft, 1861), 400–1.
7. *Encyclopedia of Ethical Failure* (Washington, DC: Department of Defense, 2021), 174–87.
8. Although this quotation is attributed the fictional detective of the Dragnet television series, apparently Sgt Friday never actually used this turn of phrase. See Daniel Moyer and Eugene Alvarez, *Just the Facts, Ma'am: The Authorized Biography of Jack Webb* (Santa Ana, CA: Seven Locks Press, 2001), 45, 55, 61.
9. This approach is, arguably, the right one for works of history. See Jill Lepore, "Just the Facts, Ma'am," *New Yorker*, 17 March 2008.
10. There are various versions of this quotation, and this is one of the most common: "He can compress the most words in the fewest ideas of anyone I ever knew."Anthony Gross, ed., *Lincoln's Own Stories* (New York: Harper, 1912).
11. James Boswell wrote what is perhaps the most famous biography in the English language based on his account of his friendship with Samuel Johnson, thereby granting his subject an enduring fame that outlasted his own literary achievements. See James Boswell, *The Life of Samuel Johnson* (London: Henry Baldwin, 1791).

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Women, Peace, & Security in Professional Military Education. Edited by Lauren Mackenzie, PhD; and LtCol Dana Perkins, PhD. Quantico, VA: Marine Corps University Press, 2022. Pp. 288. Paperback and ebook (free). https://doi.org/10.56686/9798985340365.

This book stands as a first step to preserve the rich history of women, peace, and security (WPS) works by military and civilian authors who have entered WPS writing competitions. In this book, the two editors, Dr. Lauren Mackenzie, the leader of the Marine Corps University (MCU) WPS Scholars Program, and Lieutenant Colonel Dana Perkins, PhD, the director of WPS Studies at the U.S. Army War College, showcase the

2021 WPS papers submitted for the Joint PME "best of" WPS Writing Competition. These papers represent the top papers of various WPS schoolhouses, to include the MCU WPS Writing Award. The contributors range in rank from second lieutenant to colonel to civilian. They serve in the Air Force, the Army, the Navy, and the Marines. Missing is a contribution from the Coast Guard, which I trust the Commandant of the Coast Guard, Admiral Linda L. Fagan, will remedy in the future. As I read the contributions, what is missing too are the insights from authors who contributed works for past WPS writing competitions, such as the 2013 National Defense University WPS Writing Award competition winning paper, "Marine Female Engagement Teams in Afghanistan," as well as past Naval War College WPS writing competitions. To ensure we are not deprived of the insights of past winners, but instead have the opportunity to build on their experiences and insights, I recommend MCU create an anthology of past winning papers. I ask MCU to continue publishing the winning papers of future competitions, and that such competitions not exclude the backbone of our military, the enlisted.

While the works address topics as diverse as gender perspective, gender neutrality, gender and violence, mainstreaming WPS in PME, the nexus of climate change, migration, human trafficking, hegemonic masculinity, and operationalizing WPS, a dominant theme is the lacuna of leadership. Fursova highlights General Robert H. Barrow's testimony before Congress (and the many Marines who viewed videos of his testimony) that not excluding women from the combat arms branches "would destroy the Marine Corps" (p. 78). Coddington calls for leadership, stating that "senior leaders must take the lead," to include "leading by example" (pp. 22–23). But, as Vallanueva discloses, "leadership did not observe training unless there were dignitaries or political personnel visiting" (p. 226). Vechinski reveals that the commander-in-chief's 2021 *Interim National Security Strategic Guidance* "does not call out the WPS agenda specifically" (p. 37). Winton decries the lack of executive agent for WPS and sponsor at the Army War College (pp. 55, 57). Garza-Guidara tackles the tough issue of the highest femicide rate in Latin America, arguably exacerbated by the "US-funded Salvadoran military strategy against the [Farabundo Martí National Liberation Front] FMLN" (p. 85). And Patel points out that "government and nongovernmental organizations should raise awareness about trafficking within communities of higher risk of experiencing climate change . . . to help ensure migrants do not fall victim to traffickers' false promises" (p. 112).

The solution: lead. Siemonsma, in explaining Kotter's Leading Change framework, asserts "change can be attributed to leadership in 70 to 90 percent of the time" (p. 43). Salvo highlights the findings of the 2014 *Report of the Fort Hood Independent Review Committee* that "commanders who strive to implement the core elements of the [SHARP] program to the lowest levels and take personal ownership of promoting climates of dignity and respect on a daily basis have consistently demonstrated success in reducing—even eliminating—sexual harassment and assault" (p. 156). But Army leaders fail to examine aspects of Army culture that enable sexual harassment and battery (and neither "acknowledge their responsibility" nor "their power to change" such as the senior installation commander at Fort Hood who responded, "What can I do about it?" (pp. 123, 154, 157). As the secretary of the Army said in 2020, "[W]ithout leadership, systems don't matter. This is not about metrics but about possessing the ability to . . . look out for the best interests of our soldiers" (p. 164). Yet, as Grider points out, the

17th Chairman of the Joint Chiefs of Staff admits, "Every time we open new doors in women's professional lives . . . we end up wondering why it took us so long" (p. 99). Trogus provides the 2018 tweet of Afghan major Abdul Rahman Rahmani about U.S. major Brent R. Taylor to demonstrate the transformational power of example. Rahmani tweets, "Let me admit, before I met Brent [Taylor], even I did not think that a woman and men should be treated equally. Your husband taught me to love my wife Hamida as an equal and treat my children as treasured gifts, to be a better father, to be a better Husban[d], and to be a better man" (p. 169).

What writing is awarded by whom and how provides insight as to what military leadership values and what it does not. While the chief of staff of the Army leads an annual ritual in awarding the General Douglas MacArthur Leadership Award for company grade officers who demonstrate the ideals of duty, honor, and country, there is no annual ritual for awarding the Best of WPS Writing Award, and the chief of staff of the Army does not present the WPS Award (p. 143). Instead the 2021 WPS Award winner received a Joint Staff J-5 certificate and a personalized note from the U.S. Army War College director of WPS Studies (p. xiii). Given that General MacArthur's first demand for reform to the government of Japan in post-WWII occupied Japan was the "emancipation of women," the chief of staff of the Army should award subsequent General Douglas MacArthur Leadership Awards to company grade officers who embody MacArthur's first demand, a demand that occurred over a half-century before UN Security Council Resolution 1325. In selecting awardees, I urge the chief of staff of the Army to consider a contributor to this book, the 2021 West Point graduate Second Lieutenant Elizavetta Fursova.

Fursova provides insights I did not already know. Her work highlights arenas in which women's physical performance "surpasses men," to include "aerobic capacity," "resistance to muscular fatigue," and "recovery following exercise" (p. 62). I should have known. During WWII, Soviet Aleksandr V. Gridnev observed "our experience showed that women fighter pilots in the majority of circumstances, much better than men, endured G-loads to the body which arose during abrupt and sharp changes of aircraft altitude—in steep banking turns, combat turns [chandelles], and during abrupt exits from a dive. Also women pilots had greater endurance than men during high-altitude flights without oxygen." When Fursova explained that the leg tuck was an area in which women did not surpass men, I wondered about the implicit determination by the Army that there is a higher correlation between being successful in combat and the leg tuck, rather than aerobic capacity and resistance to muscular fatigue (p. 75). About a recent visit to the U.S. Naval War College, Irish major general Maureen O'Brien reflected, "They are hung up with the physical standards. They don't include flexibility in these physical standards. If they did, half of the men wouldn't pass it."

For subsequent editions, I recommend inserting the biographies of all contributors. I appreciated the glossary of key WPS concepts and terms. For subsequent editions of the glossary, I also urge incorporating language used in the 2021 winning entries: "Charter on WPS," "gender blindness," "gender performance," "gender awareness," "gender lens," "gender injects," "gender sensitive," "gender institutionalization," "Gender Advisor (GENAD)," "Gender Focal Point (GFP)," "meaningful participation," "structural barriers," "femininity," "masculinity," "toxic masculinity," "military masculinity," "hypermasculine," "hegemonic masculinities," "machista," and "machismo."

Colonel Cornelia Weiss (Ret), a graduate of the Inter-American Defense College, successfully urged the drafters of the 2011 U.S. Women Peace and Security National Action Plan to include professional military education.
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Special Reconnaissance and Advanced Small Unit Patrolling: Tactics, Techniques and Procedures for Special Operations Forces. By LtCol Ed Wolcoff (Ret). Havertown, PA: Pen and Sword Books, 2021. Pp. 400. $39.95 (hardcover); $24.95 (paperback); $21.95 (ebook).

Lieutenant Colonel Ed Wolcoff's *Special Reconnaissance and Advanced Small Unit Patrolling: Tactics, Techniques and Procedures for Special Operations Forces* is a full-throated effort to take a special operations soldier and simply make them better, thereby rendering his efforts in the battlespace more effective while simultaneously maximizing their chances of survival.

Before reading Wolcoff's book, it would have been difficult to imagine that one solitary individual could be a walking repository of virtually limitless knowledge and experience. Until now, that is. This comprehensive "how-to" manual covers a broad spectrum of techniques, tactics, and procedures (TTPs) that a modern special operations warrior must know and practice to thrive in an unconventional/irregular warfare environment, skills that are today every bit as crucial to mission success as ever.

The text of the manual is sanitized and flawless, perhaps a reflection of Wolcoff's tendency as a career U.S. Army Special Forces officer to construct written communication in succinct, direct thoughts that get to the point as quickly as possible. It is bereft of superfluous adjectives and other modifiers that would serve only to distract the reader from the wisdom that Wolcoff is attempting to impart.

If you are looking for a "So no kidding, there I was in the enemy trench, ankle-deep in grenade pins . . . " type of story, then this book is not for you, although Wolcoff does devote recollections from his personal experiences in the art of soldiering to demonstrate how his TTPs worked so well time and again during USMACV-SOG's heyday. More importantly, these are the TTPs that will be successful when our contemporary special operations warriors venture downrange into harm's way all over the world in fulfillment of their role as instruments of national policy.

Wolcoff's practically boundless knowledge in unconventional warfare is without peer and a great resource for special operations forces warriors who espouse a burning desire to become even more efficient and lethal in the application of their craft. Acquiring this resource and implementing the TTPs described therein is an essential task for today's special operations warrior.

In the world of special operations, practitioners often learn from personal experience, far too often gained through the proverbial school of hard knocks. Furthermore, there are multiple instances in the history of armed conflict when great TTPs are developed by one army or another, ones that work well and see widespread usage, but at times have to be improved and perfected at the cost of soldiers' lives. To add insult to injury, these same TTPs are often quickly forgotten by the time the next war or crisis rears its ominous head. As a result, subsequent generations of soldiers are doomed to

reinvent the wheel as the painful and costly process of TTP development begins anew. Wolcoff's opus enables the reader to learn from his years of accumulated knowledge and honed expertise, thus breaking the "wheel reinvention" cycle and allowing them to improve their soldiering skills in ways that are far less costly than trial and error.

This book should by no means be limited exclusively to those serving in special operations forces units. Any soldier who works in a combat arms military occupational specialty will benefit from the lessons Wolcoff teaches in this amazing tome. Historians, scholars, researchers, and frankly anyone who holds an interest in the topic also will benefit from reading this book and learning about the lessons contained therein. If the book's language appears esoteric to the uninitiated, have no fear. Wolcoff includes an extensive glossary of the vast array of acronyms and expressions used, what they mean, and how they fit into the implementation of a particular TTP. Thus, one does not necessarily have to possess a special operations background to understand and appreciate this masterpiece. In addition to the glossary, there are four appendices that supplement the book well. Wolcoff also uses footnotes extensively and includes a comprehensive bibliography divided into periodicals, military technical manuals, books, and of course, web-based sources.

Today's components that form the core of U.S. Special Operations Command would do well to embrace, teach, and practice the TTPs and lessons learned found in this book.

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Right and Wronged in International Relations: Evolutionary Ethics, Moral Revolutions, and the Nature of Power Politics. By Brian C. Rathbun. Cambridge, UK: Cambridge University Press, 2023. $105.00 (hardcover); $33.24 (ebook). https://doi.org/10.1017/9781009344722.

The study of ethics is good for you, like granola, but can be awful in the way granola always is. In *Right and Wronged*, author Brian C. Rathbun draws an arc from theories of social psychology through a series of surveys across Western and non-Western political cultures, before presenting the reader with a detailed analysis of German machinations in the early twentieth century. Unlike granola, Rathbun delivers something close to emotionally fulfilling.

For Rathbun, Western conceptions of morality are too limited to effectively explain the complexity of modern international relations. The idea that ethical action "demonstrates a universal concern for individuals" is far too simple and positively WEIRD (Western, educated, industrialized, rich and democratic) (p. 3). Morality is a human-oriented activity, from *ante facto* instinct to *post facto* judgment, thus cannot be separated from the politics of international relations. The problem with ethics is that liberal normative concepts of morality rely on a sense of *impartiality inexpeditus*. However, Rathbun tells us impartiality cannot exist because it dismisses the importance of instinctual in-group/out-group commitments, which are born through humankind's

long evolution. He argues that groups exist because *binding morality* brings individuals together to meet challenges to a community's welfare. Defense of the group is moral. Threats to the group are immoral. The ensuing condemnation is a necessary adjunct to the very concept of community. Loyalty to the group, deference to authority in times of crises, and respect for the group is moral. These are some of what the author calls binding foundations of morality.

It was the constant prehistorical conflict that sparked the promotion of material well-being. Forming groups was a response to anarchy and violence; it was a survival mechanism. Credible threats of defensive violence allowed the group to advertise its intentions and the potential cost of interaction. Groups displayed their morality with physical violence. This reveals that morality has an ordering principle: Survival of the group is the highest good and evolutionary morality requires contribution to the defense of the group, with potential costs of death weighed against real costs in perception of shirking duty, loyalty, and deference. Morality's ordering principle limited excessive self-interest and encouraged behaviors based on a sense of right and wrong that then become social norms.

From this beginning, Rathbun develops a taxonomy of ethics around political groupings that drives decision making in international relations. Drawing on John Duckitt's "dual process model" of ideology, the author demonstrates that conflict is motivated by either a humanitarian impulse to provide for others, or a desire to protect oneself and one's group. The political right goes one way with militant internationalism while the political left goes another with cooperative internationalism. Both concepts can be operationalized as foreign policies and both present war as a kind of "virtuous violence" with both couching conflict in terms of self-defense. Both foreign policies seek to redress a sense of imbalance and unfairness (i.e., a system that is selfish and unjust). States may feel left out or unfairly treated and use war to gain a larger share of the spoils. Other states would see the protagonist as overly self-interested and potentially creating an injustice and seek balancing defense mechanisms, which are deeply rooted in evolution. This would trigger moral condemnation and possibly retaliation through many tools, but the most well-known is state sanctioned violence. Violence, and we are talking of organized warfare here, becomes a path to retribution and reestablishing equity, that is, justice.

Rathbun demonstrates these phenomena using well-developed case studies on Wilhemine and Nazi Germany. Germany sought to increase their status, moves seen by England, France, and the United States as a grab for an undeserved share of the international system. Germany attempted to coerce France into concessions in Morocco in 1905 but failed. Believing the other great powers were not treating Germany as an equal led to military buildups and a web of alliances in the early twentieth century as each side sought to balance against the other. German nationalists were ashamed that Germany was not being acknowledged as a great power with equal access to colonial resources. Germany felt unjustly immobilized and lashed out. The system sought balance through war, with both sides justifying the conflicts as self-defense. Defeat in World War I was seen as further proof that the Prussian elites had betrayed the German *volk* to save their own political and economic interests, a line of reasoning fully exploited by Adolf Hitler's Nazi campaigns in the early 1930s. And so, the author comes back full circle: fairness is equity, equity is justice, thus what is fair is just. When leaders make the decision to go to war, they are motivated by

moral judgments, just as they are at the interpersonal level. Just like people, states are offended by excessive self-seeking and self-interested behavior in other states. It upsets the instinctual feeling for fairness. States that invade other states are regarded as excessive and must be brought back into line.

Right and Wronged is not a book for the casual reader, and the publisher's inclusion of Russian survey data and statistical methodology drags the reader back toward something necessary, but unappreciated, like granola. Doggedly grinding through the pages, one cannot escape the suspicion that *Right and Wronged* is a quickly assembled tome of Rathbun's previous journal articles and writings. Too often, issues that appear settled early in the book are rehashed later and in a slightly different way, leading the reader to wonder just what the point really is. However, with the German case study detailing the binding morality of that nation in the twentieth century, Rathbun certainly can claim to have established solid evidence to support evolutionary ethics. This reader would be interested in learning more from Rathbun on his humanitarian morality and consequentialist morality. Perhaps more will be forthcoming.

For all that, in writing a book about ethics, Rathbun has provided what is needed by students of international relations: perspective. The stunted humanitarian morality espoused by the rich world has been corrupted and twisted into never-ending arguments about self-defense and just war theory, inevitably used by both sides to justify today's wars. By conceptualizing evolutionary ethics, the author brings back our sense of right and wrong and implores us to tame our animal reactions.

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Intelligence and the State: Analysts and Decision Makers. By Jonathan M. House. Annapolis, MD: Naval Institute Press. Pp. 248. $40.00 (hardcover).

Sherman Kent, the founding figure of U.S. intelligence analysis, strongly held in *Strategic Intelligence for American World Policy* (1949) that the practice of analysis should guard against too close an association with the business of policymaking to ensure its objectivity. This view was subject to criticism nearly from the outset, with Wilmoore Kendall in his review of Kent's book ("The Functions of Intelligence," *World Politics* 1, no. 4 [1949]: 542–52) arguing that the purpose of intelligence analysis should be to directly help "politically responsible" leaders achieve their objectives. Judging from the subtitle of Jonathan House's latest book, *Intelligence and the State: Analysts and Decision Makers*, the reader might understandably anticipate that House intends to make a contribution to this conversation. Unfortunately, the reader will be disappointed.

In his preface, House invokes Samuel Huntington's concerns over the potentially detrimental impact of Cold War strains on the principle of civilian control of the military in America to assert a parallel stress on U.S. "civil-intelligence relations" stemming from "the Cold War and the subsequent era of insurgency and terrorism" (p. ix). He then indicates that his objective in the book is to "address a civil-intelligence interface that has become just as fraught with misunderstanding and error as civil-military relations have ever been" (p. x). Along the way, House avers that post-1945 U.S. policy

makers "had to rely constantly on the expertise of intelligence officers" (p. ix) and that "analysts . . . suspect that the decision-makers are unable to overcome their own biases and partisan politics in order to understand foreign cultures and interests" (p. x).

These are all contentious positions that should offer rich opportunity for development and argumentation. The extent to which intelligence analysis influences policy decisions varies by era and presidential administration, with a number of scholar practitioners, such as Stephen Marrin ("Why Strategic Intelligence Analysis Has Limited Influence on American Foreign Policy," *Intelligence and National Security*, 32, no. 6 [2017]: 725–42) and Paul Pillar (*Intelligence and U.S. Foreign Policy: Iraq, 9/11, and Misguided Reform*, 2011), arguing that influence is very slender indeed. The assertion that intelligence analysts view their policy customers as mired in bias and partisanship, unable to rise to the serene understanding of "foreign cultures and interests" enjoyed by analysts, hints that the author may have a bias toward Kent's views on the proper separation of the two communities but requires substantiation to be credible (p. x).

Similarly, the existence of a "civil-intelligence interface . . . fraught with misunderstanding and error" is not self-evident (p. x). The public use of intelligence analysis by the Joseph R. Biden administration in building consensus for international action in the lead up to Russia's 2022 invasion of Ukraine would seem to be one very visible point suggesting the opposite. The two communities do differ in their outlook and objectives, and the proper relationship between them is a legitimate question that requires nuanced examination taking into account previous attention to the question from scholars and others.

Having stated that his objective is to address the "civil-intelligence interface" and its problems, House begins with a discussion of the extent to which intelligence is a profession without clearly indicating its bearing on the issue (p. x). This is an enduring question that received a burst of attention in the years following the 9/11 attacks by scholar practitioners such as James Bruce (James B. Bruce and Roger George, "Professionalizing Intelligence Analysis," *Journal of Strategic Security* 8, no. 3 [2015]: 1–23), among others. Much of the chapter House devotes to this topic, however, concerns civil-military relations and does not engage with the intelligence studies literature on intelligence analysis as a profession.

This chapter is followed by one on "the intelligence process," which provides a largely conventional description of the canonical intelligence cycle, along with commentary on some of the points at which that cycle can break down (p. 14). Next is a discussion of "the operator-analyst interface" (p. 29). It is in this chapter that House most closely approaches the ostensible topic of the book, asserting that the relationship between analysts and decisionmakers is "at the heart of most intelligence successes and failures" (p. 29). An account of tensions inherent in the differing motivations of analysts and decision-makers, cognitive biases, and political misuse of intelligence using Vietnam War and Iraqi WMD examples is provided, but no new ground is broken or direct engagement with the questions raised in the preface offered.

The bulk of the book follows these three introductory chapters and consists of a summary history of the development of European and U.S. intelligence services in the nineteenth and twentieth centuries, along with an overview of warning intelligence that provides standard examples of intelligence surprise, such as Pearl Harbor and the Yom Kippur War.

House's final chapter, "conclusions," begins by stating that "the vast majority of interactions between intelligence and policy makers experience no more friction and misunderstandings than are typical of any group endeavor," a conclusion that seems at odds with the "fraught" relations between intelligence and policy communities that the author claims at the outset it is his intention to examine (p. 162). This short chapter reads mainly like an opinion piece rather than the culmination of a sustained argument, likely due to no argument or sustained examination of the nominal question having been developed in preceding chapters. A number of points not developed in the text are packaged together here, including the presumed challenges for newly elected officials in overseeing executive branch organizations, the "deep state," subversion and special operations, and politicization and professionalism, the last of which returns to the question presented in the first chapter (p. 163). House asserts that "for decades, the US intelligence community has been ready to function as a profession" according to Huntington's criteria for a profession, but to realize this potential "the civilian leaders of the government should recognize intelligence work as a profession" (p. 166). There is a good deal more to the decades-long examination of the status of intelligence analysis as a profession than House reveals here, but surely depending on nonpractitioners to confer that status is not a convincing argument in its favor.

In his conclusion, House also claims that intelligence surprise following the inability of an analyst to persuade a policymaker to accept an analytic judgment is a type of intelligence failure. Yet, it is very difficult to understand why this should be so. Professional ethics and custom preclude advocacy among intelligence analysts, and decision-makers are exactly that—those who decide. The power differential in these relationships is decidedly in favor of the policy community. House does not offer insight into the reasoning that leads to this assertion.

The book is marred in a few places by what appear to be minor errors. With the discussion of Nazi Germany's intelligence services, Geheime Staatspolizei (Gestapo) is given as "General State Police," rather than the correct "Secret State Police." When discussing post-Church Committee reforms of the intelligence community, House states that the Intelligence Oversight Act of 1980 "requires the President to determine an intelligence collection effort is important to national security and to inform Congress" (p. 121). The act requires notice to the congressional intelligence committees of covert activities, not routine intelligence collection.

Intelligence and the State occupies a curious place in the intelligence studies literature, neither an academic monograph, nor a memoir, or a conventional history. House, in both his title and preface, leads the reader to expect an examination and assessment of the policymaker-analyst relationship, yet does not provide either. Each chapter is capably written but essentially stands on its own, covering standard intelligence-related topics inflected in places with personal viewpoint. Collectively, these chapters do not form an argument or a sustained narrative. The book is perhaps best positioned as a primer for those new to intelligence studies who have an interest in a former practitioner's view of the business but does not improve over more established such works and has little to offer a more experienced audience.

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Maoism: A Global History. By Julia Lovell (New York: Penguin Random House, 2019. Pp. 624. $22.00 (paperback).

A thorough understanding of Maoism's philosophical underpinnings and legacy has become increasingly salient to the American military professional in a world where the People's Republic of China desires to supplant the United States as the global hegemon. Although the destructive effects of Mao's regime are comparable to those of Joseph Stalin's and Adolf Hitler's, there is a paucity of literature on Maoism's impact on a global scale. *Maoism: A Global History* by Julia Lovell helps to fill that void by providing a well-researched account of Mao Zedong, whose ideological reverberations cut across a swath of cultural and sociopolitical contexts; in writing the book, Lovell aims to "suggest the chronological and geographic scope of Maoism, one of the most significant and complicated political forces of the modern world" (p. 7).

Lovell begins her book by defining the tenets of Mao Zedong and exploring the ideology's early effects on China. She then details China's efforts to supersede the USSR as the leader of the world Communist revolution through the 1950s and how this escalation schisms Sino-Soviet relations, shaping the rest of the Cold War.

Lovell then shifts focus to Maoism's effects outside of China, walking through a chronology of case studies. Each of these case studies covers a different country or region, highlighting Maoism's ability to adapt to disparate contexts. By structuring her book this way, Lovell also depicts the evolution of the Chinese Communist Party's (CCP) foreign policy over time. Lovell pulls from a myriad of firsthand and secondhand sources, acknowledging a wide array of perspectives and highlighting where there is division in academia (e.g., the discourse in Vietnam over the consequences of land reform and debates between historians about the degree of Chinese involvement in Indonesia's September 30th Movement). Furthermore, in a book that does not shy away from emphasizing the cruelty and suffering caused by Communism, Lovell also highlights instances where Maoism had a positive effect such as its use by civil rights groups and its influence on figures such as Nelson Mandela.

Lovell's international coverage starts in Indonesia, where an unsuccessful Communist coup in 1965 prompted the government to retaliate with a violent series of purges. The resulting massacres killed half a million Indonesians and allowed power to be centralized under a long-lasting military dictatorship. In Africa, Chinese investment into insurgency training and architecture was welcomed with open arms in some places and decried as imperialism in others. In Southeast Asia, CCP backing was integral to Vietnam's victory in the Anti-French Resistance War (a.k.a. First Indochina War) and the Khmer Rogue's ascension to power after the Cambodian Civil War. However, the alliances between China, Vietnam, and Cambodia eventually disintegrated into nationalist wars, disproving Domino Theory and straining relations between all three countries.

In the West, Lovell explains how Maoism's influence in the United States and Europe shaped civil-rights activism but also fueled militant groups and acts of terrorism. Activists were unaware or willfully ignorant of Communism's ruinous effects on the Chinese economy; Lovell writes that "the Cultural Revolution fever of the 1960s and beyond once more showcased the ability of Westerners to create an imaginary China largely divorced from empirical reality" (p. 291). In Peru, Maoism proved malleable enough to be adapted to an urban, literate, democratic context that was free from im-

perialist control. Peru's Shining Path Communist revolution saw the general populace caught in the crossfire between Communist guerrilla terrorism and the military's indiscriminate retaliation; during two decades, this conflict killed 69,000 people and created at least 600,000 refugees.

In India, social inequity and dismal economic conditions have fomented a Maoist movement that the government considers to be a significant internal security threat. Lovell comments that, in the ilk of other Maoist insurgencies, the movement lacks substantive ideas for governance. When commenting on Nepal, Lovell writes that "the intensity of Maoists' ardour for literary and ideological texts has created a relationship with Maoism that fixates on abstractions and ideals, rather than on lived experience under Mao's policies" (p. 393). Maoists have attained power in Nepal, but the government still fails to reflect the politically diverse, economically advanced state that Maoists hoped to bring forth.

Finally, Lovell draws a close to her book by circling back to China, where Deng Xiaoping's leadership saw China discard socialist economic policies while preserving party rule for the CCP. Today, Xi Jinping's model of authoritarian governance evokes aspects of Mao's regime (such as a strong cult of personality) while aggressively downplaying the great loss of human life during the Cultural Revolution as a regrettable but temporally distant occurrence.

It is incumbent on American leaders to understand how Maoism will continue to be a vehicle for the CCP to expand its influence. Maoism's continued impact is predicated on its enduring prevalence. But what accounts for Mao Zedong's international popularity despite its repeated failures outside of China? Lovell explains that Chinese Communism was seen as a non-Western alternative to the Soviet model; Maoism's heavily anticolonial, anti-imperialist rhetoric resonated with those in developing countries actively fighting for independence from Western powers. Maoism's ubiquity can be traced to its cross-sectional appeal and accessibility; Maoist principles are ambiguous and rife with contradictions, making its tenets easily adaptable to various local conditions.

The enigmatic nature of Maoist doctrine highlights the CCP's disinterest in conforming to their rhetoric. China embraces capitalism despite claiming to be the true successor to the Marxist-Leninist movement, and their state-run opium industry was responsible for a sizable portion of the state's income in its early years despite the party publicly denouncing opium as an instrument of Western imperialism. Maoist thought was used to champion minority rights around the world while the CCP was persecuting ethnic and religious minorities at home. Maoist principles were meant to champion the poor; ironically, lower classes were hurt the most by Maoism in China, India, Nepal, and Peru. Maoism's modern adherents engage in hagiography, fixated on ideology while ignoring its actual effects on the lives of millions of people.

Today, China propagates a narrative of historical victimization under the weight of Western imperialism while underplaying China's global activities during the Cold War. During the twentieth century, a period commonly thought of as a time when China quietly rose to power through economic reforms, the CCP funded, trained, and armed global insurgencies while exporting hundreds of millions of copies of Mao's *Little Red Book*. Maoism will undoubtedly continue to shape world affairs in the coming years, given its penchant for inciting social unrest and its resurgence in modern China. The

danger this poses makes Maoism's global history an important topic of study for political and military leaders.

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