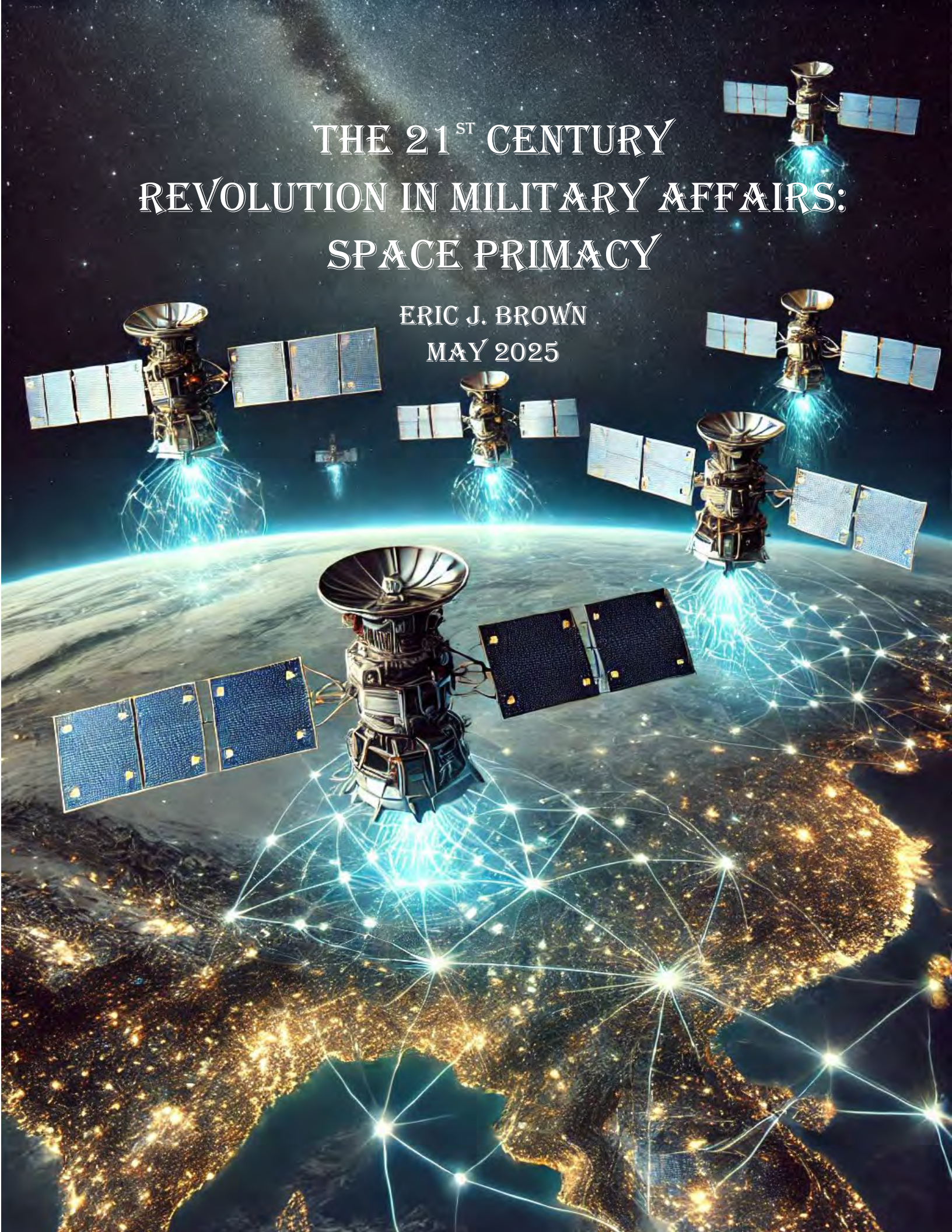

The 21st Century Revolution in Military Affairs: Space Primacy

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Introduction

The term Revolution in Military Affairs (RMA) was first conceived by Soviet military leadership, notably Marshal of the Soviet Union Nikolai Ogarkov, in the 1970s when it was referenced as a Military Technological Revolution. Andrew Marshall, the *de facto* father and decades-long director of the Pentagon's Office of Net Assessment (ONA) normalized the term RMA as he recognized that certain technological and organizational innovations fundamentally changed the rules of warfare ranging from doctrine, to training, to the underlying definition of military dominance. Examples of these fundamental changes included:

- Military implementation of the wheel through employment of war chariots
- Widespread adoption of the Napoleonic General Staff functions which enhanced military decision processes
- Transition of air power from a surveillance and raw bombardment mechanism to a strategic attack capability
- Enablement of combined arms and precision strike through ubiquitous communications and situational awareness (i.e., the advent of the military Information Age).

Much as air power in World War I was a raw set of sensing and collection assets, the space domain has for the course of over six decades been a supporting function in the execution of military effects. Intelligence is consumed, targets are dialed in, and it is the province of other domains to deliver effects. However, airpower evolved and catalyzed – revolted to stick with the RMA parlance – and became the principal means for projecting force. It is my hypothesis that the future of spacepower stands at the threshold of the same revolution, where space not only serves as a crucial enabler for the projection of force in other domains, but in fact, becomes a pillar around which force projection is defined.

An RMA is not a choice that a nation makes. It is not a policy decision that defines a position. It is not the battleground of ethical and moral considerations. It is a fact of life. This paper will not cast value judgements on the employment of space for military purposes, including its weaponization. In unclassified documents, the US Defense Intelligence Agency (DIA) has openly acknowledged that horse is out of the barn.[1] Fundamentally, an RMA is a change of the playing field, a turning over of the gameboard, a redefinition of the norms and conventions of conflict. The alternative is to experience what the French did in 1939 when its army's tried and tested static defense lines were decimated by the German *Blitzkrieg*. The German *Wehrmacht* was enabled by innovations in armored units and communications over the prior two decades.[2] This illustration offers but one proof that an RMA is an inevitable force of change where one may choose to embrace the change or it may perish.

Core Arguments

- We are at the precipice of a revolution in military affairs (RMA) where space will shift from being a support element to having strategic primacy
- Future spacepower will go beyond enabling terrestrial operations and instead will become a pillar for force projection
- There is a continuum of capabilities that will likely emerge: (1) space-defined kill webs, (2) orbital warfare, and (3) multi-domain effects
- The primary constraint on these capabilities is not technical, but national will – game theory suggests some nation will eventually take those steps, leaving all others under threat
- Architectural choices can capitalize on allies' respective strengths vs. attempting to go alone
- RMA is an inevitable force of change – the US and allies must accelerate its adaptation now

[1] Documented since DIA publication in 2022 entitled *Challenges to Security in Space* and openly discussed as far back as 2015 when Gen John Hyten, then the Commander of Air Force Space Command, highlighted the "threat above."

[2] Consistently highlighted among illustrative examples of RMAs due to the convergent impacts of technical innovation, tactical leapfrogs, and organizational overhaul. For example, look to Fitzsimonds, CDR James R. and van Tol, CDR Jan M., "Revolutions in Military Affairs," *Joint Force Quarterly* (Spring 1994).

In this paper, we won't discuss conceptual "rods from god" or efforts like the Strategic Defense Initiative's *Brilliant Pebbles.*[3] Instead, I will explore what a Five Eyes (FVEY)[4] *Plus* Coalition (shorthanded as *FVEY+ Coalition* or just *Coalition*) needs to do in preparation for a peer-level global conflict under a new RMA-effected set of rules. This cannot be the venture of a single nation as no war among global powers since the Russo-Japanese War of 1904-1905 has lacked involvement of coalitions. Space only compounds this as it is inherently a global domain with globally-reaching capabilities.

The FVEY+ Coalition is challenged today by increasingly antagonistic Russian and Chinese powers,[5] and we must assume that our adversaries will employ all available military, political, economic, technological, psychological, criminal, and other means to achieve their geostrategic goals. The last time the Coalition was challenged to this extent, we saw a race for decisive dominance in the air domain and ultimately strategic strike, culminating in the Manhattan Project. As many technical hurdles have been cleared over the past decade, I expect any impending global conflict will be marked by a fundamental change in the way outer space is employed. Space will truly become the "ultimate high ground."

Today's Space: A Domain Defined by All Others

In June 1959, the United States launched the Corona satellite with a single panoramic camera and a single return vessel. This satellite in effect served the purpose of a U-2 without putting the aircraft and its pilot at risk. It imitated the air domain in approach and outcome. I would argue that with the exception of the lineage of missile warning satellites[6] and the Global Positioning System (GPS) satellites, nearly every space-support-to-operations (SSO) satellite program to-date has represented a terrestrial

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[3] However, the recent Executive Order signed by President Trump on January 27 has directed the MDA to revisit the *Brilliant Pebble* concept through the form of space-based interceptors, reinvigorating ethical and technical debates that began decades ago. This *Golden Dome* end-to-end solution is directly in line with the approach this paper will recommend.

[4] *Five Eyes* refers to a coordinated intelligence and security agreements spanning the US, UK, Australia, Canada, and New Zealand.

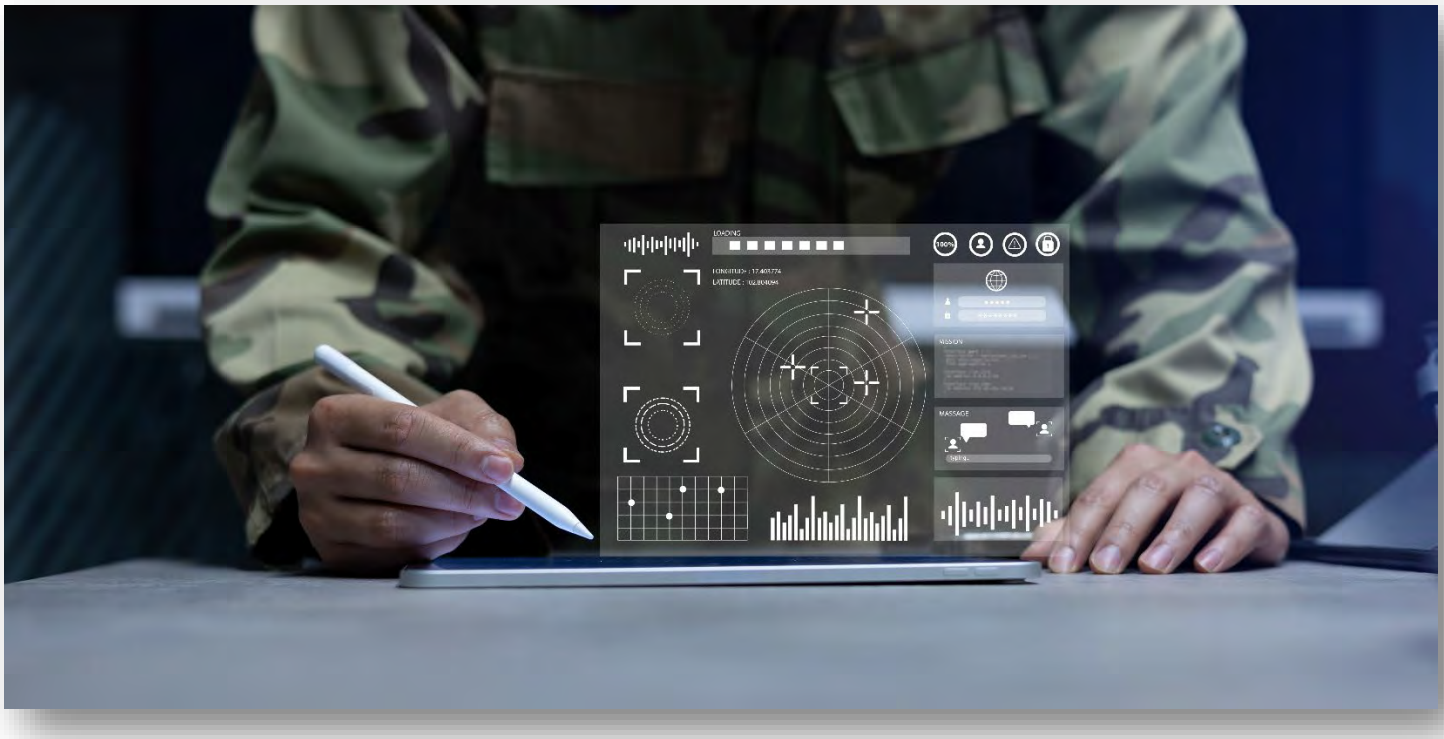
[5] Aided by their own *de facto* coalition of cooperative and client states including North Korea, Iran, Venezuela, etc.

[6] i.e., Defense Support Program (DSP), Space-Based Infrared System (SBIRS), Overhead Persistent Infrared (OPIR)

capability that moved to space for broader coverage, more survivable platforms (due to lack of threats to space), or otherwise obsolescence of the terrestrial platform. SBIRS and GPS were defined and designed to achieve missions that couldn't otherwise be fulfilled in the terrestrial domain. Interestingly, those two systems have now become the object of imitation / replacement both in the space and terrestrial domains.

Generally speaking, space systems have been developed to enable the conventional force structure of the 20th Century. In some respects, nations have not really evolved force projection beyond the paradigm adopted in World War II with the advent of aircraft carriers, strategic air strike, and long-range missiles (e.g., the V-2). The only agreed upon RMA since WW2 was the employment of technologies to enhance the lethality of those solutions through precision strike. GPS itself was only originally developed to allow submarines to launch reasonably accurate ballistic missiles upon surfacing without *a priori* knowledge of the submarine's location. Fundamentally, space's value has been established as an enabler to legacy terrestrial capabilities. Several US Space Force (USSF) general officers have gone on record as saying "Space doesn't exist for space's sake," meaning that at its core, space enables operations in other domains. [7]

To add to this, the US set a standard and understanding of space domain employment that other nations have spent decades now imitating. The Chinese Beidou position, navigation, and timing (PNT) architecture has adopted concepts that were originally conceived in an optimized approach that defined GPS's objective end-state (but was unable to achieve based on budget constraints and inefficiencies in US acquisition processes). The UK and Australia are currently developing satellite communications (SATCOM) systems that combine



[7] The US Space Command (USSPACECOM) February 2024 Strategic Vision document details this mentality, noting that the Command's three overarching responsibilities are to (1) enable Joint Force lethality and effectiveness; (2) protect the Joint Force from space-enabled attack; and (3) avoid the effects of "day without space" across military, economic, and social applications. Also see Gen Chance Saltzman's C-Note #14 dated June 23, 2023 as he details the importance of maintaining supremacy in the space domain for the benefit of those operating in terrestrial domains.

the purposes of systems like the US's Advanced Extremely High Frequency (AEHF) and Wideband Global SATCOM (WGS) systems. Several nations are developing missile warning; intelligence, surveillance, and reconnaissance (ISR); and space domain awareness (SDA) solutions. In every one of these cases, other nations have effectively imitated the way the US employs space and continue to develop space capabilities that reflect that bias.

In the meantime, new force structures / orders of battle have begun to impede the 20th Century mode of combat. Integrated Air and Missile Defense (IAMD) systems have dramatically reduced confidence in Coalition aerial freedom of action. Notably, General Jay Raymond, the first USSF Chief of Space Operations (CSO) highlighted the shift of Ground Moving Target Indication (GMTI) to space, replacing part of the Joint Surveillance Target Attack Radar System (JSTARS) mission to overcome "range limitations" including in "contested environments."[8] Taking space control[9] threats aside (to be discussed later), space solutions are unencumbered by borders, regional limitations, refueling ranges, or anti-access / area-denial (A2/AD) hurdles. Naturally, then, nations have clamored to overcome terrestrial limitations by building out their own space solutions. One needs only to look at the exponential increase in space launches over the last 20 years to confirm such a growing appetite (Note: To those that ascribe the launch cadence to commercial consumption, I would recommend a closer read of companies' revenue statements).

In the last decade, space has also been dubbed as a warfighting domain unto itself. In 2015, the Chinese People's Liberation Army (PLA) established the Strategic Support Force (SSF) to consolidate space, cyberspace, and electronic warfare (EW) capabilities

in anticipation of conflicts in such domains. Subsequently, US Space Command (USSPACECOM) was reestablished in 2019 as a recognition of the need to take a joint forces approach to prosecuting conflict on-orbit. Since then, several other nations have stood up analogous organizations. Thus far, however, the space control mission has primarily been couched in terms of enabling allied or denying adversarial access to space-based support capabilities for terrestrial forces. Most nations perceive space control / space superiority in terms of protection of high-value assets (HVA), on which terrestrial forces depend.

The bottom line is that space to-date is contextualized in terms of the approach to conflict that was conceived over 80 years ago. Precision strike certainly changed the rules of the game beginning in the 1980s, but even it was largely an extrapolation on the fundamental changes to warfare pioneered in the 1930s and '40s. I would posit that outer space – along with cyberspace – has not yet experienced its apex in terms of impact on warfare. Historically, those leaps developed during

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[8] Hitchens, Theresa, "Raymond Unveils Classified Target Tracking Space Radar Effort," *Breaking Defense* (May 12, 2021).

[9] Space control is a general term to characterize weapons systems that either deny an adversary's ability to employ space capabilities or defends against an adversary's attempts to deny one's employment of space. These solutions range from reversible, non-kinetic capabilities (e.g., electronic warfare, cyber) to non-reversible capabilities (e.g., anti-satellite missiles, co-orbital assets, directed energy, and even nuclear / EMP weapons). Space control capabilities may include ground-based systems or space-based systems attacking either space assets or ground components.

interwar periods, but only revealed themselves during significant conflicts: e.g., air dominance in WW2, stealth and precision strike during the first Gulf War and into the Balkan conflicts in the 1990s. It is likely that if we witness a global conflict in the coming decade (an eventuality deemed highly probable by a large number of senior FVEY+ national security leaders), we are likely to see another RMA if for no other reason than the degree to and duration by which global powers have been observing one another without challenging each other directly over the past 40 years.

Space RMA: A Continuum of Capabilities

In 2022, LTG Dan Karbler (at the time Commander of Army Space and Mission Defense Command [SMDC]) heralded a new triad of space, cyber, and special operations. While SMDC didn't go much further publicly in defining what was intended by this new triad, multiple US organizations began building doctrine around this concept. As I noted to media at the time [10], what was unique about this new triad was its effective response to A2/AD constructs that generally couldn't be addressed through other means. The US Army was quick to recognize that its historical mission of ground maneuver across large land campaigns was held at risk by adversaries' increasingly mature standoff capabilities, both with respect to sensing and prosecuting. The US Army had not engaged in a conventional conflict in nearly 20 years, instead focusing on counterinsurgency. During that time Russia bolstered its standoff capabilities, and amphibious or ground engagement in a potential Pacific theater became even more problematic due to Chinese anti-ship weapons with effective ranges measured in the thousands of miles. This new triad, though, inherently ignores borders. Space by design has global reach. Cyber doesn't even acknowledge the concept of a geographic region for the most part. And special operations forces (SOF) were originally conceived to operate well into contested regions. Whether this was the original thinking behind the new triad construct or not, it was a brilliant herald for the RMA that is coming. In short, if restrained to conventional regional conflict, the home team will win or at least protract conflict such that victory by the away team is unpalatable. Instead, if the away team – the expeditionary force – changes the rules of conflict to disregard the effects of geography, it has overturned one of the fundamentals of warfare across the millennia: time and distance favor the defender / local power. What does this flip look like though?

As in so many things, there is not a single right answer. Instead, it is a continuum shaped by policy, politics, national will, global norms, and (of course) capability. In any case, what we are describing here is a fundamental transformation in the way that future wars are fought. The United Kingdom offers a prime example of a nation at a crossroads. I know of no one that would deny that fundamentally, the UK is historically and philosophically an expeditionary military – one that expects to fight on proverbial foreign soil in order to keep the fight off the British Isles. Over the past two decades His

[10] Erwin, Sandra, "Army looking at new ways to use space technology for unconventional warfare," *SpaceNews* (August 11, 2022)

Majesty's Navy has invested heavily in continuing this proud tradition by building out the Queen Elizabeth Class of aircraft carriers. However, such assets have questionable efficacy in likely European scenarios, and Chinese standoff capabilities far exceed the force projection range for carrier-based aircraft without reliable refueling assets (which would themselves be primary targets for Chinese long-distance, anti-air weapons). So what would a space-oriented rather than current space-enabled force projection look like?

As an intellectual exercise, let's assume that rather than building another £4B carrier, the UK were to build four £1B guided missile cruisers armed with weapons with enough range to limit time of the cruiser in the adversary's weapon engagement zone (WEZ) while also permitting the ship to disregard small concerns (speaking ironically) like having pilots return safely after a strike mission. In this scenario, the naval vessels likely remain out of range (or can minimize exposure) from terrestrial sensors, including longer-range over-the-horizon radars. Therefore, the vessel is primarily concerned with space-based surveillance, which allied space control assets could neutralize. In terms of the strike itself, advanced IAMD architectures create immense obstacles to delivering long-range munitions on-target effectively. However, it is possible to extend effects from space (e.g. EW) that counter adversary IAMD, opening channels for weapons to reach their targets as intended.

Ships under emission control (EMCON)[11] could remain "quiet" in electromagnetic signal terms, passively receiving target data from space assets. Post-launch, in-flight connectivity among raids of weapons permits weapons to improve hit chances, collect battle-damage assessment (BDA) data, and revector trailing weapons to optimize effects. For all intents and purposes, none of these effects could be achieved solely through terrestrial capabilities. Taking aside the particulars of this case, what we have done here is to flip the calculus of the force

[11] Emissions control (EMCON) references the avoidance of active electromagnetic radiation that could be detected by adversarial signals intelligence (SIGINT) assets – often the first tripwire in a web of sensors, which would queue more targeted / geographically limited sensors employing electro-optical, infrared, radar, etc. phenomenologies.

projection from one where space is merely an adjunct capability consumed by the force projection mode (i.e., the aircraft carrier) to one where the force projection mode is optimized to the space assets. This is of course the most organic and benign approach based on its similarity to the way space is employed today.

The other end of this continuum is the exploitation of space-based systems to deliver effects into the terrestrial domain directly. Physics affords us a variety of ways to do this as has been demonstrated in unclassified and declassified documents. For classification reasons, I won't delve into those details in this document for risk of being interpreted as confirming or promoting the viability of any particular vector. This truly capitalizes on the employment of space as the physical high ground, where one only need look to science fiction like *Star Wars, The Expanse,* or the works of writer Craig Alanson to fathom the implications. In this scenario, force projection originates on-orbit where terrestrial capabilities principally become a cleanup crew and garrison force once the adversary is sufficiently softened. This is a sobering proposition to consider developing as a nation, but an even more frightening one to be on the receiving end.

These two cases really bookend what such a Space RMA might reflect where international norms and national willingness define the current tradespace more than the art of the technically possible. Were we collectively to find ourselves in a global conflict, who knows what road might be taken? *Optimistic* thinkers (a term I am reticent to use given the inherent pessimism already assumed in the calculus) today expect to avoid the latter scenario due to fear of escalation. This depends heavily upon a mirroring bias where our adversaries' objectives and risk thresholds align to our own. Ultimately, the US itself disproved this very conclusion on August 6, 1945 over Hiroshima. The question today, then, is "What operational capabilities should we invest in to expand or contract future leaders' option space?" In a quintessential *Prisoners' Dilemma*, the stakes we place today may well inform the Nash equilibrium and outcome of tomorrow's game. [12]

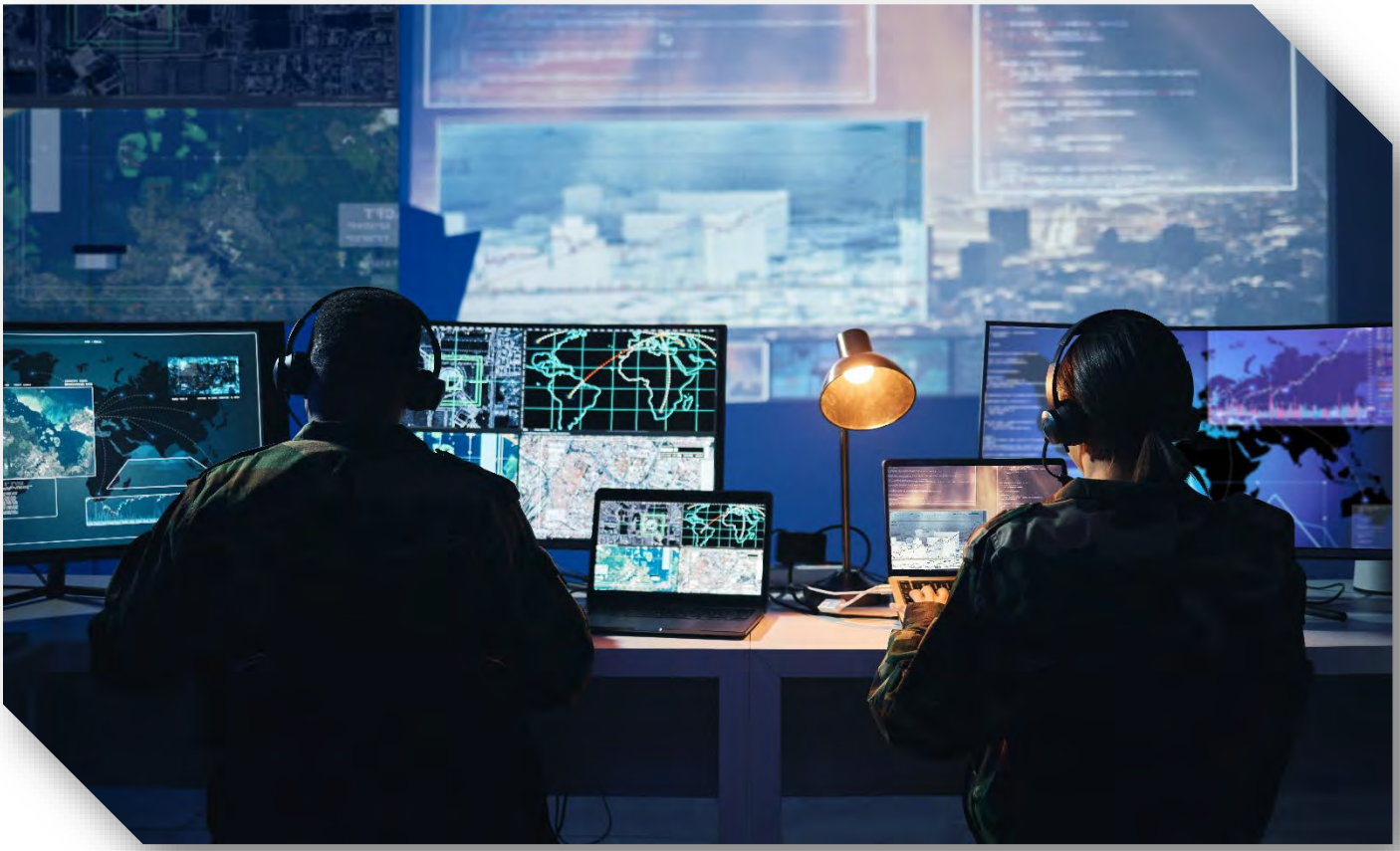
[12] Traditional game theory begins to explain the outcomes of these major strategic movements. If we were to evaluate the decisions of each "player" in isolation, it would appear irrational. Why would one unleash nuclear war upon the world, knowing the horrendous results? However, when one introduces the interactions with other "players'" past moves and potential for future moves, it forces hands to pre-empt or mitigate the others. I argue that while everyone wants in principal to avoid conflict on-orbit due to the incredible economic and societal stakes, traditional game theory forces us to posit that nations will engage in arms races so as not to risk being overcome. For details on application of game theory to political science, I recommend: McCarty, Noland and Meirowitz, Adam, Political Game Theory: An Introduction, Cambridge University Press (2007).

Today's Moves: How to Maximize Option Space

As noted previously, handwringing over whether space should be "militarized" or "weaponized" is already the foolish behavior of the proverbial ostrich. The simple fact of the matter is that for all the beneficial and constructive purposes that space has served and can serve, space has been a military domain since the advent of the First Space Age [13], and only effective enforcement of norms based on the US's *de facto* hegemony in the domain and a Cold War paradigm of "mutually-assured destruction" derived from the nuclear weapons arena have prevented more drastic exploitation for military purposes. As that hegemony and paradigm have eroded over the past twenty years, space has transitioned from a domain in which the military could operate (in support of other domains) to a "warfighting domain" subject to campaigns no different in principle from a ground forces or naval campaign. It is, however, very different in some ways in the substance of the campaign's prosecution.

Space-Defined Kill Webs

The most conservative approach to managing this military revolution is the employment of space-based assets as the primary command, control, communications, computer, cyber, intelligence, surveillance, and reconnaissance (C5ISR) layer across all layers of military operations. It would also



[13] A term coined by LtGen John Shaw to characterize the first 4 decades of space missions where space was almost the exclusive purview of militaries and governments, focused primarily on promoting the interests of great power competition. This is distinguished from the Second Space Age, during which space became a critical backbone of global communications through employment of satellite backhaul for terrestrial communications, television broadcasting, direct-to-home entertainment, and of course GPS. He characterized the Third Space Age as the one we experience today with the exponential democratization of space, where only the limits of creativity preclude the development and employment of space capabilities (as even economic hurdles have been dramatically lowered).

add importance to the denial of analogous adversarial solutions. In some ways, the most prominent military powers around the world have begun this move already. Similar to the JSTARS example, nations are accelerating the fielding of space-based sensing and targeting platforms at the expense of comparable terrestrial solutions. Due to the inherently global nature of space capabilities, these solutions enable theoretically ubiquitous tracking of adversary's capabilities. One only need to peruse various imagery from Google Earth, BlackSky, or similar companies to understand how little is concealed from view in today's environment. At this point, the real magic in which governments would need to invest is the processing capacity and AI engine to automate target identification / tracking and the means to feed that data into weapons systems in a timely manner. Practically, this would point to on-orbit processing; precision positioning / timing; and reliable command, control, and communications (C3) solutions.

From a force structure standpoint, what does this model look like? Certainly, a combined military force would steer funding away from localized sensing platforms in favor of a more robust space-based architecture. As noted earlier, it would permit a move away from crewed terrestrial systems like manned bombers and fighters and towards unmanned systems / delivery platforms with greater standoff ranges. This could permit militaries to drawdown military personnel (MILPERS) budgets, reduce lower-rate production materiel (e.g., fighters, tanks, and low-rate space vehicles), while increasing production of higher production-rate assets that benefit from economies of scale (e.g., missiles).

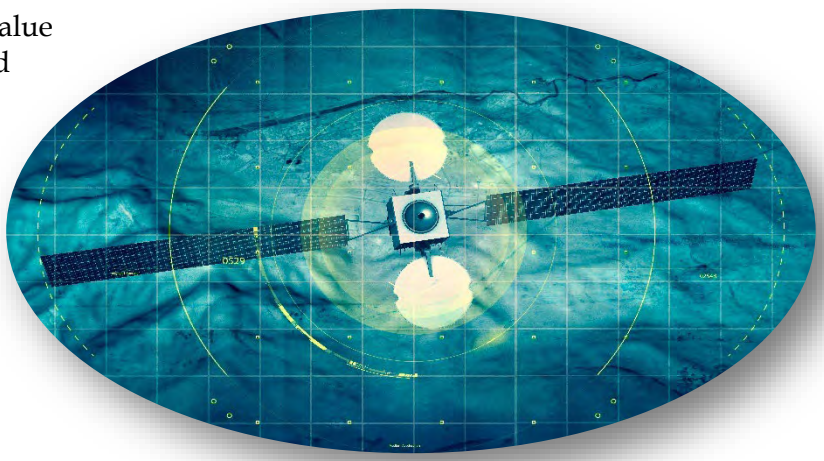
On the other side of the force structure perspective, recognizing this eventuality demands a significant focus on space control solutions. If one's adversary is able to capitalize on high-rate production effectors, it makes defense increasingly challenging. Therefore, an adversary is likely to place a greater emphasis on eliminating one's space capabilities as the cornerstone of such a redefined force structure. This necessitates a multi-layered space control defense-in-depth approach. In every other domain, militaries around the world have recognized for centuries that a single line of defense almost guarantees loss. If we look at a typical carrier strike group (CSG), it must be prepared to defend against

an array of threat vectors from submarines to cruise missiles, where all those effectors are targeting the crown jewel: the carrier itself. Therefore, the CSG employs EW to confuse targeting. It uses picket ships to sense and target threats before they can get into a weapons employment zone (WEZ). The carrier scrambles fighters to function as a combat air patrol (CAP), offering an agile leg of defense. Finally, if all else fails, the carrier and its close escorts have close-range defensive weapons (e.g., torpedoes, helicopters, depth charges, cannons, interceptors) to address leakers. The mix of these layers is determined by the various threat vectors that may be encountered, and the CSG ensures that it can address all probable threat vectors in some way – else one can easily predict to which it will fall victim. This analogy applies exceptionally well to the space domain due to the diversity of threat vectors, the diversity of defensive measures and architectures that can be employed, and the role of relative distance in establishing a defensible architecture. The obvious criticism that may be levied is that the carrier is analogous to high-value assets (HVA) in space that nations have started to forego in favor of proliferating lower-value assets. However, even something as small as a littoral combat ship (LCS) or individual air assets employ a degree of layered defense-in-depth, though it may be scaled or targeted more narrowly at specific threat vectors.

Orbital warfare

While it is my firm belief that any nation preparing for the future of warfare will need some level of defensive space control, the degree to which they prepare for more generalized orbital warfare may vary. Just as the notional adversary in the last section recognizes that attacking the F2T2 portions of the kill chain based in space may be more productive than focusing on the terminal phase effectors (i.e., traditional missile defense). This would lead a nation to shifting investment toward more offensive space control solutions, and indeed, in many cases, they may be similar to the capabilities used defensively, permitting dual-use procurement strategies.

It is my firm belief that in the next peer conflict, the first true "shots fired" will involve a combination of actions taken in cyberspace and outer space. P.W. Singer and August Cole conceived in their 2015 predictive not-too-distant future fiction, *Ghost Fleet*, that a determined coalition of adversarial powers led by China and Russia would capture the proverbial high ground by eliminating US space assets and exploiting cyber weaknesses as the opening actions of a major offensive. By doing this, the antagonists easily secured US forward assets and deprived the nation of any freedom of action at sea or in the air. Back in the real world, China has rapidly escalated its deployment of space assets after seeing the disproportionate advantage afforded to the US in the 1990s Balkans and in the campaigns in Iraq, Afghanistan, and Libya in the 21st century. While they have been careful not to become overly reliant on a space layer, it does offer a tempting series of targets in a future conflict.



Indeed, China and Russia have already begun a "gray war" in space with constant jamming, cyber attacks, etc. China has even begun provocative maneuvers with its Shijian "servicing" satellites and the Shenlong space plane. [14] They have demonstrated an ability and willingness to exercise rendezvous and proximity maneuvers and have begun maneuvers over the western hemisphere where there are no peaceful reasons to do so. Russia took even more provocative steps in November 2021 when it openly destroyed one of its own satellites with a direct-ascent anti-satellite weapon (DA-ASAT). Two weeks later, Russia threatened to destroy the GPS constellation if the US crossed "red lines" relating to Ukraine. Three months later, Russia began its full-scale invasion of Ukraine. China and Russia have both now projected their playbooks that any future conflict would begin with a space war.

The question, then, is what approach a FVEY+ coalition would take to orbital warfare. This turns out to be as much a question of policy and national will as it is one of technical capability. The sentiment that the US does not want to appear provocative in space has historically stemmed what it is willing to openly address in terms of orbital warfare. As noted in several places now, the question of weaponization of space is a horse that has long since left the barn. Therefore, at this stage, the US has to determine what its orbital warfare posture will be. This factors heavily into deterrence approaches as well. While the US and its allies may obscure development of such capabilities in highly-classified environments, it is difficult to deter an adversary if they don't believe you have a credible deterrent. This consideration of "conceal / reveal" policy strategy will play prominently into deliberations about a FVEY+ orbital warfare approach.

Multi-Domain Effects

The most controversial prospect for a nation's positioning in this RMA-informed world is the employment of weapons from space to have effects into terrestrial domains. One of my favorite sci-fi

[14] Numerous citations in open press, particularly highlighting open source data generated by Space Domain Awareness company *Exoanalytics*. See Hadley, Greg, "China's Orbital Maneuvers Have Space Force Leaders Seeking Better Options," *Air & Space Forces Magazine* (December 11, 2024).

works is the *Expeditionary Force* series by Craig Alanson. In the first book of that series – *Columbus Day* – advanced alien militaries bombard targets from orbit using rail gun darts – having all the kinetic effect of a nuclear weapon without the messy fallout. In the sci-fi television series *The Expanse*, rebels living on outer rim asteroids steer meteorites to Earth using gravity well effects, having much of the same effect.

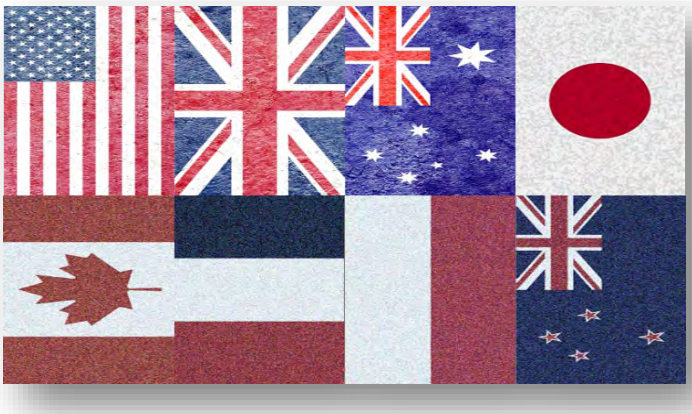
While these sci-fi scenarios are far-fetched on a number of levels (e.g., technically, politically), they do illustrate the creative potential for employing space as a legitimate strategic high ground. It is both physically possible and technically feasible to deliver both non-destructive and destructive effects from space, though the details of such pose some pretty big challenges, especially around things like targeting and delivering effects with sufficient precision. It's a difficult enough feat to deliver munitions on target from 30,000 feet – imagine the mathematical and engineering challenges of doing so from over three million feet while speeding along at 17,000 miles / hour. With that said, the true hurdle – as noted before – is one of political will. The visceral response that leaders had to the atomic bombs of 1945 have informed the use of strategic weapons since, and space weapons fall into that category.

With that said, much as it is increasingly difficult to employ C5ISR assets from terrestrial domains, it will become increasingly difficult to deliver effects on target in an A2/AD environment even with space-defined kill webs. This includes legitimate military targets such as battlespace management command and control (BMC2) centers and enemy weapons systems. Often, strategic weapons systems only reveal themselves for a limited time, yielding a window of minutes to engage the target before it launches its ordnance. Conventional, terrestrial systems simply cannot engage such targets, but the physics of space would theoretically make that possible. The best time to defend against a missile is when it's still on the ground. It's worth noting as well that both non-kinetic and kinetic effects are within the realm of possibility for delivery from space. Much as the US Air Force began to acknowledge the difficulty of using the JSTARS aircraft in a Pacific theater fight, so too, I expect even the new EA-37B Compass Call EW aircraft will face challenges, and we may face a similar choice of moving such capabilities to orbit or risk losing them from the quiver.

Coalition arms in space

If one agrees with the premise that we are entering a space warfare RMA right now, there would be an imperative to revisit acquisition plans promptly. However, even if we assume that we can harvest heavily from other domains, this is a very large bill for any one nation to pick up. This would especially be true during transitional phases, as ceasing / slowing production of terrestrial assets is not a switch that could be flipped overnight.

To that end, I see a tremendous opportunity to reshape the face of global conflict through better employment of allied capabilities. Currently, militaries around the world – while preparing to interoperate with allies – are established to be stand-alone, self-sufficient forces. While it is highly unlikely that the US, UK, Australia, etc. would ever enter a peer-level conflict alone in today's age, they nonetheless have invested to have standalone, and therefore duplicative, forces. With the establishment of organizations like the US Space Force's Space Warfighting Analysis Center (SWAC) and the mirroring of such in other FVEY+ nations, there is the opportunity to develop coalition arms architectures that lean on specialization by each constituent nation. This would depend upon truly existential trust, but I believe it is feasible to consider such approaches both due to today's confidence among allies and in the face of a level of geostrategic desperation that we haven't seen in decades. One



simplistic example may be in the distribution of PNT solutions across orbital regimes, where the US may continue providing capabilities at Medium Earth Orbit (MEO), with allied nations supplying capabilities in complementary orbital regimes. Doing so would translate into contributions to specialized capabilities like search-and-rescue or navigation warfare.

Conclusion

As I started out this thesis, my aim was not to recommend a new procurement approach or offer options from which a nation may choose to develop its space architecture. [15] Rather, it is to highlight an inevitability for which every major industrialized military power must plan. While I laid out three postures that nations may take in the short-run, I do believe that near-future warfare will incorporate aspects of all three. Eventually, it's probable that we'll even see the strategic and economic value derived from space to be so great as to create a fourth posture where space warfare extends beyond orbital regimes that are looking back to the terrestrial domains.

It is possible that we can avoid further escalation in space through productive negotiation, norms of behavior, etc. However, in the same way as we seek to avoid a future peer war, we prepare for its eventuality. To fail to do so could be at the incredibly grave detriment of the nation that turns a blind eye. A coordinated FVEY+ strategy to a new approach to warfare is critical at this moment. We must overcome centuries of parochial interests at the national and military service levels. Policy and security boundaries that have isolated us from one another must be reconsidered. Nations must reconfigure industrial landscapes that have placed fairness, litigation-free procurement, and a mentality of apportioning a sufficient pie to state-subsidized contractors ahead of capability development.

Now is the time to consider what the optimization function would look like if we genuinely brought the best solution to bear across FVEY+ or even NATO. To do so would permit our coalition to lead the way into this revolutionary period. To fail to embrace the RMA would see us face the same fate as Sadaam Hussein's impressive industrial-age military in the face of the Powell Doctrine's shock-and-awe and its use of precision strike or that of the armies of Europe facing France's Grande Armée imbued with the deliberate efficiency of the Napoleonic staff structure. Unlike these historical RMA's that were felt regionally before flowing globally, today's RMA will be something that nations around the world will have to prepare for from day 1.

[15] In the right security environments I am prepared to discuss material opportunities to prepare for both near-term conflicts and for a longer-term state-of-play. These considerations include architectural decisions, procurement priorities and approaches, policy dynamics, and organizational / force structure implications.

The Author

Eric Brown is a seasoned executive in the defense and space industry with over twenty years supporting the US and its allies across their national security missions. He has specialized in mission strategy, supporting the development of critical capabilities across the space domain, special operations forces, and intelligence community. As a former vice president at Lockheed Martin, Eric was responsible for collaborating with senior government and military leaders to define future architectures, capabilities, and systems across missions as diverse as communications; space security; missile warning and tracking; position, navigation, and timing; space domain awareness; exploration; weather; and deep space science. In this capacity, he worked closely with the leadership of the US Space Force, US Space Command, UK Space Command, US Congress, the White House, Australian Defence Force, Japan Air Self-Defense Force, and other allies.

Previously, Eric worked on an embedded basis in the standup of multiple special operations and intelligence elements across the community. He also brings extensive experience in commercial consulting, with a strong track record in growth strategies, mergers and acquisitions, competitive positioning, and organizational efficiency across companies in aerospace and defense, automotive, oil and gas, technology, commercial airlines, test and measurement, third-party logistics, and other industrial sectors.

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