Defense Paper Series

Joint Warfighting Concept 2034-2044

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For decades, U.S. warfighters have stated that offensive action is the key to victory. However, recent massive advances in sensors, command and control systems, and precision weapons produced en masse are creating a period of defensive dominance in the land, sea, and air domains. To respond, the Joint Warfighting Concept must change to focus on timely offensive operational maneuver designed to give U.S. forces the advantage of the tactical defensive.

The Guadalcanal Campaign is a good example of this concept. U.S. forces got ashore quickly, dug in, and forced the Japanese to attack against an all-domain defense. Although U.S. naval and air forces had inferior training and equipment at that point in the war, the Japanese forces tasked to eject the Marines had to fight through both air and naval forces before they could even get ashore. The Japanese ground forces took such heavy attrition during transit that they never achieved superiority against the Marines.

The second major change needed in the JWC is accepting that any war with China will be a long war – measured in years. Unfortunately, the Joint Force consistently wargames short conflicts. But since 1750, conventional conflicts between healthy major powers have lasted years to decades. At the time, national leaders assumed each of these wars would be short -- Seven Years War, French Revolutionary/Napoleonic Wars, U.S. Civil War, First and Second World Wars, and Korean War. Unfortunately, they lasted from three to twenty-three years. There have been short conventional wars since 1750 such as the Austro-Prussian War, Franco-Prussian War, Sino-Japanese War, Russo-Japanese War, and Spanish-American War. But each of these shorter wars saw a rising power smashing a collapsing one.

Some analysts have stated that the United States and China can only fight a short war because both sides will run out of ammunition in a matter of weeks. Unfortunately, the historical record does not support this idea. In the U.S. Civil War and the First World War, both sides rapidly expended their peacetime ammunition stocks. Shortages reduced the intensity of fighting for up to a year. But both sides mobilized their industries and replenished ammunition stocks even as they mobilized massive armies. Each war continued for years after the initial ammunition shortages were overcome. The current Russo-Ukrainian War seems to be following this pattern.

These long wars ended in one of two ways. The U.S. Civil War and Second World War were outliers in that they ended with the destruction of the enemy's forces and

occupation of its homeland. In contrast, most ended with the economic exhaustion of one side and a negotiated treaty.

However, nuclear weapons now make occupation of a nuclear armed power a very dangerous concept. While we do not have historical precedents for this scenario, Dr. Andrew Krepinevich notes

> [W]ith the advent of nuclear weapons, wars between great powers can be protracted only if political constraints are imposed on vertical escalation. … Thus belligerents would have a strong incentive to practice mutual restraint. Whether they would be able to do so is problematic. If they succeeded, the victors in such a war would not be able to impose anything like unconditional surrender on their enemies, as occurred in World War II. Regime change would be out of the question.

As Professor Krepinevich notes, the presence of nuclear weapons seems to preclude a strategy of annihilation or massive attacks on either combatant's homeland. Instead, both would have to pursue a strategy of exhaustion. He notes that in this type of conflict, sea control will be critical. Other scholars note that "blind faith" in the deterrent value of nuclear weapons could risk unleashing a massive conventional war. While there is little historical evidence concerning how nuclear weapons will impact a major conventional conflict, notable scholars have suggested they will not prevent a prolonged conflict.

A third fundamental change in the JWC is the clear need to defend the homeland. The U.S. homeland had not been as vulnerable to adversary actions since the Civil War and War of 1812. This threat manifests itself in both kinetic and non-kinetic threats. Russian and Chinese hypersonic maneuvering missiles and extended range cruise missiles able to impact U.S. critical infrastructure and military facilities with conventional weapons. China and Russia, and in fact almost any U.S. state or non-state adversary can use cyber malicious activity to disrupt or damage U.S. national critical infrastructures. Chinese efforts to conduct operational preparation of the battlefield in support of this – known as Volt Typhoon – have already been discovered and attributed to China. Finally, China, Russia and Iran all conduct aggressive cyber-enabled information operations campaigns aimed at weakening the U.S. will to fight.

Understanding the Adversary's Vulnerabilities

Prior to applying these three fundamental changes to the JWC, it is important to understand where strategic dilemmas can be applied to the adversary's decision-making process. China has been consistently identified as the pacing threat and is the only adversary who can reasonably compete with the U.S. in the economic domain so they are the subject of this assessment.

Chinese leadership has expressed two major strategic concerns. The first, and most often cited in the west, is the "Malacca dilemma" or its vulnerability to a distant naval blockade. The second is its fear of internal unrest.

The Malacca dilemma summarized the centrality of seaborne trade to China's economy. In ascending order of importance, four sectors are of critical importance to China – energy, food, industrial inputs, and trade.

Energy

Liquid energy – oil and natural gas – is often cited as China's primary strategic vulnerability. However, oil represented less than 18 percent of China's primary energy consumption in 2022. In June 2023, the Heritage Foundation estimated China had a reserve of between 100-120 days of peacetime petroleum imports.[1] To further reduce its reliance on imports, China has made major efforts to increase both renewable and nuclear energy production. In short, interruptions of imported liquid energy will create major strains on China's economy but will not be decisive.

Food

Food security is a matter of great concern to China's leadership. With only 10 percent of the world's arable land, it must feed 20 percent of the world's population.[2] The net result is that from 2000 and 2020, China's food self-sufficiency ratio decreased from 93.6 percent to 65.8 percent.[3] Chinese leaders are acutely aware that food shortages have historically led to instability within China. Compounding the problem, China is facing severe water shortages with up to 25 percent of river water being unsuitable for

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[1] Lewis Libby, "Will China's Increased Oil Supplies Change Xi's Taiwan Calculus?" Heritage Foundation, June 14, 2023, https://www.hudson.org/energy/will-china-increased-oil-supplies-change-xis-taiwan-calculus-lewis-libby.

[2] Zongyuan Zoe Liu, "China Increasingly Relies on Imported Food. That's a Problem," Council on Foreign Relations, January 25, 2023, https://www.cfr.org/article/china-increasingly-relies-imported-food-thats-problem.
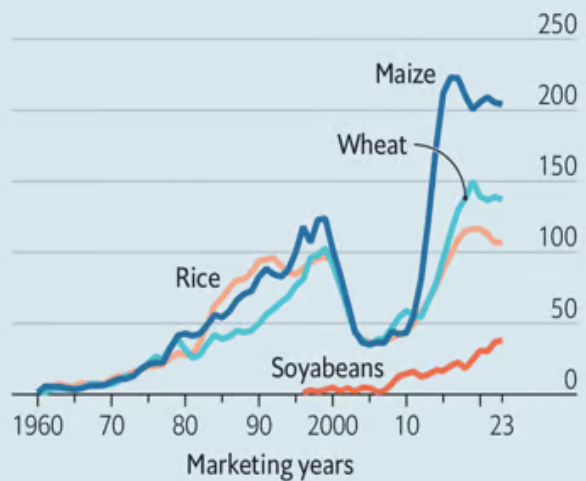
[3] Zongyuan, op cit.

agricultural use.[4] China is building massive water transportation systems to address its water distribution problem, but is unlikely to significantly increase its grain production in a crisis.

Industrial Inputs

During 2022, China imported more than $325,000,000 in non-food raw materials per month.[5] Chinese domestic production of iron ore during the same year was 380 million tons or only 24 percent of its annual needs.[6] While China is the world's third largest producer of copper,[7] it is also the world's largest importer, accounting for 58 percent of the world's copper ore

Granular details
China, commodity stocks, tonnes m

Source: United States Department of Agriculture

The Economist

imports.[8] In short, while China has the world's largest shipbuilding industry producing 48.4 percent of the global shipbuilding total, the industry is heavily dependent on imports.[9] If the allies can maintain control of the sea in a prolonged conflict, China will struggle to obtain the raw material needed to sustain its economy and war production.

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[4] Henry Storey, "Water scarcity challenges China's development model," *The Interpreter,* September 29, 2022, https://www.lowyinstitute.org/the-interpreter/water-scarcity-challenges-china-s-development-model.

[5] "China Imports of Non-food Raw Materials," *Trading Economics*, https://tradingeconomics.com/china/imports-of-non-food-raw-materials.

[6] C. Textor, "Production of iron ore in China from 2010 to 2022," Statista, January 3, 2024, https://www.statista.com/statistics/307473/china-iron-ore-production/.

[7] "Copper production in China and major projects," *Mining Technology,* June 28, 2023 https://www.mining-technology.com/data-insights/copper-in-china/?cf-view.

[8] "Copper ores and concentrates | Imports and Exports | 2022," *Trend Economy,* https://trendeconomy.com/data/commodity_h2/2603#:~:text=Top%20importers%20of%20Copper%20ores%20and%20concentrates%20in%202022&text=China%20%2D%2058%25%20of%20the%20world,%2D%203.4%25%20(%243.26%20billion).

[9] Lai Lin Tomala, "Ship tonnage in orderbook of Chinese shipbuilding industry 2014-2021," Statista, January 3, 2024, https://www.statista.com/statistics/1064122/china-tonnage-in-orderbook-of-shipbuilding-industry/.

Trade

Despite major efforts to shift from an export-based economy to a domestic demand driven one, trade represents 38 percent of China's Gross Domestic Product (GDP).[10] Ninety percent of that trade is seaborne.[11] A RAND study noted that in a long war, China's economy might contract 25-35 percent.[12] This is equivalent to the contraction of the U.S. economy in the Great Depression. Like all previous wartime economies, China's will adjust. However, it will do so at a significantly lower level of production and productivity.

Alternatives to maritime trade

China has invested heavily in railroads as an alternative to maritime shipping but at its peak in 2021, rail accounted for only 0.6 percent of its global seaborne trade. China has proposed additional rail projects to Thailand, Myanmar, but even if these lines triple rail throughput, they will still provide less than 2 percent of China's current seaborne trade. The fact remains that rail simply cannot provide China a significant substitute for seaborne trade.

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[10]"Trade (% of GDP) – China," The World Bank,
https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=CN.
https://trendeconomy.com/data/commodity_h2/2603#:~:text=Top%20importers%20of%20Copper%20o
res,%2D%2014.2%25%20(%2413.7%20billion).
[11] Isaac B. Kardon and Wendy Leutert, "Pier Competitor: China's Power Position in Global Ports," *International Security*, (2022) 46 (4), 10, https://doi.org/10.1162/isec_a_00433.
[12] David C. Gompert, Astrid Stuth Cevallos, Cristina L. Garafola, "War with China: Thinking Through the Unthinkable," RAND, 2016,
https://www.rand.org/content/dam/rand/pubs/research_reports/RR1100/RR1140/RAND_RR1140.pdf.

China Railway Express routes

Source: China Railway Express Construction and Development Plan (2016-20)   SCMP

Internal Instability

"The ultimate irony of the regime presiding over the 'people's republic' is that its greatest fear is that one day it will have to confront the wrath of the Chinese people directly. Worrying about internal challenges is 'what keeps Chinese leaders awake at night.'"[13] The degree of concern is reflected in its internal security budget. By 2017, China's internal security budget was 118 percent of its national defense budget. While China has ceased publishing official documents on their expenditures on internal security, the population's potential reaction to a crashing economy and shortages of food associated with a blockade deeply concerns the CCP leadership.

Adapting the Joint Warfighting Concept (JWC)

Given China is the pacing threat, the prospect of a long war in a period of defensive dominance requires the United States to rethink its warfighting concepts in all domains and include defense of the homeland as a major element. Even as defense is increasingly

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[13] Joel Wuthnow, "System Overload: Can China's Military Be Distracted in a War over Taiwan?" Center for the Study of Chinese Military Affairs, June 2020, 5, https://inss.ndu.edu/Media/News/Article/2232448/system-overload-can-chinas-military-be-distracted-in-a-war-over-taiwan/.

dominant at the tactical level, it remains essential to be on the strategic and operational offensive to dictate the outcome of a conflict and introduce strategic dilemmas into the adversary's decision-making process. How this is achieved depends on the conditions of the conflict. Thus, the JWC must be adapted across the domains and functions.

Maritime Domain

The maritime domain ranges from traditional deep water naval warfare where offensive pulses are vitally important to the new environment where ground-based forces dominate. When out of range of major shore-based systems, naval combat will still be ruled by Captain Wayne Hughes' "salvo equations." To win in these clashes, the Joint Force needs to be able to launch much larger volleys.

However, as naval forces close to the shore, the salvo equations become less viable. A major element of the equation is the fact that successful hits on an enemy combatant (i.e. mission kills) effectively remove any missiles still in its magazines. A hit or two on an Arleigh Burke Flight II destroyer will eliminate any missiles not previously launched from its 96 VLS cells. In contrast, land-based firing batteries can be widely dispersed. While the ship may identify and target one of the launchers, any given hit only eliminates that launcher. The other launchers in the battery remain in action – miles away. The inherent advantages of concealment, dispersion, magazine depth, and hardening mean land-based systems can attack and defeat naval forces to ever increasing distances from shore. Naval forces must learn how to adapt to an environment where even insurgent groups can strike naval targets hundreds of miles at sea.

Fortunately for the United States, sea control has been a major factor in wars between continental and sea powers for over 200 years. According to the U.S. Navy *Naval Warfare Publication 1*, sea control remains its most important mission. However, today sea control will require air, ground, space, cyber, and EW efforts as well as naval forces. In fact, we need to understand that ground-based missiles, drones, rockets, and mines will dominate the sea to increasing ranges. They can already deny use of key straits and narrow waters like the Red Sea and Black Sea.

Sea control will require the Joint Force to both prevent an enemy from using the sea and clear any straits an enemy dominates. These missions do not require high end surface combatants but, to date, the Navy has failed to develop sufficient alternative systems to achieve these missions. Increased urgency on the development of unmanned, or optionally manned, surface and subsurface vessels is necessary. These cheaper, less complex vessels should not be designed and built at the laggardly pace of manned

warships, but instead should have their development cycles measured in months or a year, not decades.

Sea control will be key to success in a long war with China. It is inherently offensive both on the strategic and operational level. It strikes at a key Chinese vulnerability – dependency on shipping for both resources and markets. Yet, controlling and defending key naval chokepoints globally will allow the Joint Force to fight primarily on the tactical defensive.

Air Domain

The rapidly increasing capabilities of relatively inexpensive, long-range precision weapons and mobile ground-based air defense dictate a major rethink of how we will apply airpower to achieve the core functions of air superiority, global strike, and global mobility, ISR, and C2.[14]

Defense. The Russo-Ukraine War has demonstrated both the effectiveness of mobile, ground-based anti-air systems and the ability of cheap drones to attack airfields deep in the enemy's rear areas. The ability of enemies, ranging from nation states to insurgent groups, to strike U.S. air bases globally requires major changes to the way the U.S. operates air assets.

To exploit its massive investment in manned, tactical aircraft, the Joint Force must protect its air bases from attack by the increasingly capable and numerous families of long-range precision munitions appearing on the battlefield.

This fundamental change in the security of fixed locations should drive passive investments in air defense. This includes air base agility – the ability to rapidly move, establish minimum facilities, and conduct combat operations needs to be measured in hours or days not weeks or months. It takes prepositioned assets well in excess of need to introduce uncertainty and political risk into adversary targeting cycles. Additionally, a return to investments in decoys and passive tools is long overdue.

Offense. The increasing range of air-defense weapons and networks also dictates a change in offensive tactics and capabilities in the air domain. Manned penetrating aircraft introduce excessive risk to force and drive airframe costs on an increasingly

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[14] "Air Force Future Operating Concept (AFFOC) Executive Summary," AF.mil, March 6, 2023, https://www.af.mil/Portals/1/documents/2023SAF/Air_Force_Future_Operating_Concept_EXSUM_FINAL.pdf.

attritable asset. This will also require longer range weapons (at reduced costs), increased ability to maneuver and re-target down range, and a more resilient targeting system. The inability to protect bases in proximity to the adversary, and the increasing range at which the enemy can impose its will, will drive extended range aircraft or ground-based missiles and drones, launched from even greater distances.

Electromagnetic Spectrum. While the Department of Defense does not identify the electromagnetic spectrum as a domain, the ability to use the spectrum and deny it to the enemy defines what the Joint Force can and cannot accomplish. Contesting the electromagnetic spectrum will require a great deal more attention and investment than the Joint Force had dedicated to it in the recent past. Electronic warfare capabilities are going to be essential down to the smallest tactical level. In Ukraine, both sides have rapidly developed EW systems from theater-level to man-portable systems that accompany squad-sized elements. The U.S. electronic warfare attack capability necessary to deal with a peer adversary has degraded persistently over the past three decades and is limited to a handful of Navy electronic warfare aircraft.

Recent events in Ukraine have demonstrated that Russia can interfere with GPS signals. Russia has significantly reduced the effectiveness of U.S. GPS-guided weapons. Both Ukraine and Russia are developing GPS-independent, autonomous weapons systems that can operate in the intensive electronic warfare environment that now exists in Ukraine. The United States must adapt its own precision weapons accordingly.

Space Domain

Despite the fact Ukraine is not a space power, earth observation satellites have provided vital intelligence to Ukrainian forces. While the United States, China, and Russia have spent heavily on space assets over time, commercial companies now provide analyzed electro-optical, infrared, hyperspectral, and synthetic aperture radar images within hours of a request. U.S. forces will be observed wherever in the world they are by an increasing array of friendly, enemy, and neutral organizations.

Despite international agreements to the contrary, both Russia and China are working on systems that weaponize space. Both countries are pursuing efforts that place weapons in space with the intent of destroying other satellites and space-based infrastructure, and are pursuing weapons that can be delivered from space, such as fractional orbital bombardment systems. The United States is confronted with a challenge similar to that it faced in 2019 with regard to the Intermediate-Range Nuclear Forces (INF) Treaty, where

the other major signatory, Russia, was clearly violating the terms of the treaty in its weapon development programs and a non-signatory, China, was aggressively developing weapons that the U.S was proscribed from building. In 2019, the United States decided to abandon its previous commitments, suspend its compliance with the INF treaty, and pursue longer range land-based missiles - and this was none too soon. The risk to force is even greater in this issue of weaponizing space, the dependence of the Joint force on space-based systems is immense, and if only the adversary has the ability to impact the domain kinetically, deterrence will be at risk. The Outer Space Treaty is not as prescriptive as the INF Treaty and the U.S. may not need to suspend compliance, but it should aggressively pursue the weaponization of space to ensure the Joint Force is able fight through and from space.

C4ISR. While C4ISR has always been a critical warfighting function, the effective application of artificial intelligence is now essential to make sense of the massive increase in information flow. Only if a commander can make sense of the data, can he/she exploit the capabilities provided by constantly improving precision weapons. Space-based communication systems like Starlink provide high-capacity communications networks to those who can contract with the companies that own the system.

Cyber Domain

In a contingency or conflict, U.S. forces must maintain their ability to detect and track adversaries, communicate among forces, and mobilize and sustain forces. An adversary's opening moves in any crisis or conflict, either to deter U.S. action or to defeat U.S. efforts, will be aimed at limiting or eliminating: the U.S. military's ability to sustain its operations logistically; the U.S. ability to see, track, and locate enemy forces; and the capability of U.S. military leaders to command and control forces.

To avoid this situation, the U.S. military needs to build information resilience, including through redundancies, across every link and node of its operations — from sensors to attack platforms, in information architecture and networks, and across command-and-control systems. In addition to this cyber hardening, the United States will need to acquire large numbers of low-cost and expendable platforms that would support surveillance, communications, logistics, and strike — especially during the opening days of a campaign.

An adversary will also test the cyber resilience of the U.S. military mobility systems. The rail, highway, maritime (especially ports), and aviation networks that move U.S. forces

off of their bases and into the warfighting theater are generally owned and operated by the private sector. A delay or disruption in the movement of supplies, personnel, equipment or munitions could have devastating consequences on the battlefield. It is critical that the federal government work closely with these transportation sectors before a crisis to ensure that the transportation networks are prepared for malicious cyber activity and have proactively rooted out foreign malware. The recent Volt Typhoon intelligence reporting indicates that China has already identified this vulnerability and attempted to install malicious cyber payloads in numerous U.S. critical infrastructures.

This resilience will need to extend into all U.S. national critical infrastructure — the financial sector, electrical power systems, water systems, pipelines, and other sectors that enable the economic productivity that produces military equipment and supplies and supports significant U.S. economic and diplomatic warfighting tools. Building such a resilience is a burdensome process as it relies on a public-private collaboration that has struggled despite 25 years of government efforts. It is estimated that 85 percent of the national critical infrastructure is owned and operated by private sector or state and local utilities, not the federal government. This creates an emerging cyber defense challenge that is much more complex than traditional warfare areas, such as anti-submarine warfare or air defense, where all the assets are owned and operated by the U.S. military. These interdependencies and vulnerabilities will have to be addressed and mitigated.

Despite persistent efforts by the U.S. military services, the U.S. military has been unable to establish an acceptable force generation model for a number of years. The military services are also inconsistent in organization and training methods, and all of this has led to flat or declining readiness levels at a time of increased risk. Additionally, the size of each service's contribution to the Cyber Mission Force has not changed appreciably since the original agreements a decade ago, despite significant changes in the cyber threat. As a result, the United States is not optimized for conflict with a Chinese adversary, which created a single military cyber component in its Cyber Support Force back in 2016. This Chinese effort is improving in capability and already has a significantly larger capacity then similar U.S. forces. The Cyber Mission Force needs to be reorganized so it can effectively produce forces for 21st century warfare, and this may require a dramatic solution, such as an independent Cyber Force, as was recently done with the Space Force.

Ground Domain

Ground operations may face the greatest challenges in adapting to new combat conditions. For over 80 years, heavy mechanized forces have dominated close combat.

However, recent conflicts have demonstrated that even the heaviest armored vehicles are vulnerable to relatively cheap drones and anti-armor weapons.

The explosion of sensors and precision weapons has most dramatically changed the character of ground warfare. Ground forces will have to rebalance their force structures. Rather than one fires brigade supporting three maneuver brigades, they will need to reverse the ratio to three or more fires brigades for each maneuver brigade. Every unit from squad level up will need drones (both ISR and attack) and electronic warfare systems.

In addition, the ground force must deal with a new battlespace: the air littoral which reaches from ground level to several thousand feet. This will require both sensors and weapons that permit the ground force to control and exploit the air littoral.

Protecting force generation and logistics capabilities

One of the Force's biggest challenges will be protecting force generation facilities from the homeland to the frontline and the logistics systems that support it. Containerized missiles on merchant ships can provide an opponent the opportunity to conduct homeland attacks on both critical infrastructure and key military systems like B-2s and tankers. The rapid development of long-range autonomous submarines capable of laying mines means we also must be prepared to conduct mine clearing operations in friendly harbors.

The two missions of air defense of the homeland and maintaining clear channels to harbors both require major new investments.

Implications for the Joint Warfighting Concept

Fuse and Distribute Data Faster than the Adversary

The future battlespace will be under constant surveillance and most of it will be within range of significant numbers of precision weapons. The increasing number of long-range weapons and sea mines being deployed in commercial containers is cause for serious concern for two reasons. First, if done properly, it will be almost impossible to differentiate between containers with weapons and mere cargo containers. Hence, pre-emption becomes extremely difficult. Second, containers are suitable for sea deployment

on any ocean-going vessels. China owns over 5,500 ocean going cargo ships and 3,600 deep sea fishing ships.[15]

At the same time, the volume of every commander's battlespace is increasing exponentially. To understand the fight, tactical commanders must be able to see and understand the battlespace out to over 1,000 miles. Theater commanders must be able to see across their theaters, and for certain items of interest, well into adjacent theaters.

This is an order of magnitude change. Historically, a battalion-level ground commander's battlespace was from the front line to about five kilometers. Today it reaches out tens of kilometers and thousands of feet into the air. Ship commanders used to focus within the range of their sensors. Today, the increasing number of long-range cruise and ballistic missiles means naval commanders must sense and fight out to over 1,000 miles. Air commanders are challenged in a different way. While they can sense much deeper, their ability to attack deep has not progressed as far. In fact, ground assets and surface warfare ships now outrange most U.S. tactical aviation.

Russia and Ukraine are constantly improving their ability to see the battlespace and strike identified targets within minutes. Both China and the United States are working hard to develop command-and-control systems that will allow them to exploit the wide range of sensors providing real time surveillance and attack them with precision weapons.

Effective, AI-assisted C4ISR will be essential to make sense of and exploit the masses of intelligence that will be generated by satellite, balloon, drone, and ground-based sensors. The Russo-Ukrainian war has demonstrated that tying sensors to precision weapons has allowed the successful engagement of targets in minutes. An inherent part of the C4ISR system will be cyber and electronic warfare capabilities and the ability to counter enemy use of these capabilities.

The United States has a mature and growing array of space-based assets, but commercial firms are launching satellites at a much faster pace. According to Jonathan McDowell, an astronomer at the Harvard-Smithsonian Center for Astrophysics, there were 10,036 active satellites in orbit as of July 18, 2024.[16] The United Kingdom Space

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[15] "We have 80 ships, the Chinese have over 5,500," United States Merchant Marine Academy, https://wearetheusmma.com/we-have-80-ships-the-chinese-have-over-5500/ and "China's deep-water fishing fleet is the world's most rapacious," *Economist,* December 8, 2022, https://www.economist.com/international/2022/12/08/chinas-deep-water-fishing-fleet-is-the-worlds-most-rapacious.

[16] Eric Mack, "There Are 10,000 Active Satellites In Orbit. Most Belong To Elon Musk," *Forbes,* July 19, 2024, https://www.forbes.com/sites/ericmack/2024/07/19/theres-now-10000-active-satellites-in-orbit-most-belong-to-elon-musk/.

Agency estimates there may be 60,000 in orbit by 2030.[17] Ukraine, with the assistance of western nations and corporations, is exploiting the availability of commercial space sensors for intelligence purposes. Planet Lab is imaging parts of Ukraine up to ten times a day. It can either provide raw data, as it does for the U.S. National Reconnaissance Office, or it can provide AI-interpreted intelligence directly to the consumer.[18] The Joint Force will have to establish systems for acquiring commercial satellite intelligence. In particular it will have to decide if the process will remain centralized or if individual units can go directly to the company and request direct feed on the battlefield.[19]

Develop and Utilize Emerging Space-Based Capabilities

Space capabilities are central not just to DoD operations but to global commercial operations. In addition to improving and increasing space-based communications and ISR capabilities, the Department of Defense will have to develop and deploy counterspace weapons to protect friendly assets and disable adversary ones. Doing so will require not only technical and operational expertise but has major implications for existing international treaties on the use of space.

Just as important as detecting enemy signatures will be hiding friendly ones -- in all spectrums. This will be accomplished by minimizing U.S. emissions, remoting antennas from their sources, hiding transmission in the background noise, and creating decoys – both physical and electronic.

With key adversaries like Russia and China aggressively preparing for the weaponization of space, the dependence of the Joint Force on space-based systems is immense, and the risk is too great to not take action. If only the adversary has the ability to impact the domain kinetically, deterrence will be at risk and the Joint Force should aggressively pursue the weaponization of space to ensure it is able to fight through and from space.

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[17] "The future space environment," Gov.UK, May 16, 2024, https://www.gov.uk/government/news/the-future-space-environment#:~:text=The%20number%20of%20active%20satellites,60%2C000%20active%20satellites%20in%20space.

[18] Sandra Erwin, "AI transforming satellite imaging industry 'but it's not magic'," *Space News,* June 12, 2024, https://spacenews.com/ai-transforming-satellite-imaging-industry-but-its-not-magic/.

[19] Sandra Erwin, "Amid commercial boom, U.S. military lacks timely access to satellite imagery," *Space News,* April 12, 2023, https://spacenews.com/amid-commercial-boom-u-s-military-lacks-timely-access-to-satellite-imagery/.

Rapidly Fielded Offensive and Defensive Munitions at an Affordable Cost

The rapid global evolution of supersonic and hypersonic missiles means fixed bases and major platforms like carriers will require massive investments simply to defend them. In fact, it may require most of the combat power these platforms can develop simply to defend themselves. Most concerning, long-range cruise and hypersonic missiles are creating ambiguity about where the nuclear/conventional threshold is crossed.

Both Ukraine and Russia are accelerating the development of GPS-independent, autonomous drones, rockets, and missiles to operate in all domains. Thus, we should assume very large numbers of autonomous precision weapons (think tens to hundreds of thousands) will be the norm in the future battlespace. All services must shift their operational and procurement focus from the current exquisite platforms to masses of precision weapons. In short, think "weapons not platforms" in all domains.

These weapons should have the following characteristics:

1. New weapons should be platform-agnostic. Globally, nations are developing containerized missiles and drones. These weapons can be mounted on military or civilian ships or trucks. This massively increases the number of potential launch platforms and makes targeting orders of magnitude more difficult. Ideally, they will not require a major fixed base or large navy platform. Today, Russia, China, Iran, Israel, and the United States have all demonstrated the ability to launch long-range anti-ship cruise missiles from standard shipping containers. These weapons have been fired from a variety of oceangoing platforms to include merchant ships and barges.

2. The launchers should be widely dispersed and require a minimum number of personnel to be near them when they are employed. Ideally, these systems will be emplaced by a very small team and then operated from a distance.

3. They must be relatively low-cost and easy to manufacture using advanced manufacturing techniques. The very high consumption rates of weapons in the Russo-Ukraine War means thousands to potentially millions of weapons will be required. Low-cost is essential. The Ukrainian *Magura V* sea drone costs $273,000 per unit. For the price of one *Constellation*-class frigate, a nation could buy over 5.000 *Maguras.*

4. Extended range is an essential requirement. From the crossbow and pike defeating armored knights to the carrier outranging the battleship, the ability to strike the opponent repeatedly before it can get within range has allowed cheaper systems to defeat the then-dominant system. Range obsolescence

has arrived for many current weapons systems. A legitimate question is whether manned aviation is range-obsolete. Russia, Iran, and China all have drones, ballistic and cruise missiles with ranges exceeding that of the F-35. Unless the F-35s have extensive tanker support, they will be subject to attack at their home bases while the launch locations of the attacking drones and missiles remain out of the F-35's range. While the B-2 and B-21 can operate from U.S. mainland air bases (if they have sufficient tanker support), these bases could well be subject to attack from containerized weapons on merchant ships in the Gulf of Mexico or off the U. S. West Coast. The United States will have to expend major resources to protect these aircraft at their bases. This places America on the wrong side of the cost-imposition curve.

Build Persistent Integration across the Joint Force and with Allies and Partners

Given the extraordinary range of new weapons and the emergence of weapons with the potential for global employment (cyber and space), it is imperative the United States develop an effective global integration cell. This cell must be able to analyze ongoing and potential conflicts and advise the Secretary of Defense on whether to release high-demand, low-density items or capabilities we wish to conceal to a combatant commander. While we have peacetime procedures for this task, the Department lacks the ability to do so quickly enough to affect ongoing operations. In particular, space and cyber capabilities span the globe and can be employed in minutes. The decision to exploit a system for an immediate opportunity or save the capability for a more important target will need to be adjudicated between COCOMs in real time.

All commands from unit to theater level require integrated C2, ISR, Fires, EW, Cyber, Maneuver, and Logistics. Ideally, commands will be tied together in a theater or even global C4ISR network based on CJADC2. Deconfliction of the effects flowing intentionally or unintentionally within and between domains will be a major challenge.

New systems need to integrate AI as it matures to assist commanders in processing the massive flow of all-source inputs and to take over routine aspects of planning, deconfliction, and execution. Keeping in mind that China's Systems Destruction Warfare is specifically designed to disrupt U.S. C2, it is essential that all commands can fight independently in local, low probability of intercept/detection/jam networks.

Invest in Resilient, Rapidly Recoverable Logistics and Cyber Networks for Forward-Deployed Forces and the Homeland

Logistics units and rear areas need integrated protection against both kinetic and non-kinetic attacks. Even more challenging, the United States must be able to protect critical infrastructure against cruise missile and cyber-attacks.

A critical vulnerability of the Joint Force is its inability to clear sea mines. The blatant U.S. weakness in this area is well-known to enemies and provides an exceptionally inexpensive, asymmetric method to restrict the flow of forces and supplies. We need to be able to clear both ports of embarkation and debarkation in a timely manner.

Because commanders now have numerous ground-based weapons that outrange many current air- and sea-based weapons, the Joint Force must rethink its battlespace management scheme. Should a Typhon battery or brigade commander who has targeting quality data on a priority target that is outside the range of available aircraft have to request permission from the JFACC to fire his weapons? Do we require the same level of fire support coordination when sharing airspace with Collaborative Combat Aircraft as we do with manned aircraft? In short, we must rethink how we apply fires.

The emergence of the air littoral will also require rethinking battlespace management. What altitude should separate it from the air domain and to what range from friendly frontlines? Or do we experiment to see if we can operate without boundaries between commanders and domains?

The U.S. military needs to build information and critical infrastructure resilience. For information systems, this will include through redundancies, across every link and node of its operations — from sensors to attack platforms, in information architecture and networks, across command-and-control systems. For cortical infrastructures, particularly the rail, highway, maritime (especially ports) and aviation networks that move U.S. forces off of their bases and into the warfighting theater are generally owned and operated by the private sector and it is critical that the federal government work closely with these transportation sectors before a crisis to ensure that they the transportation networks are sufficiently resilient. This will also include an assessment of the role the military can and should play in protecting these networks in a crisis or wartime.

Allies and Partners – don't leave them behind

There has been great concern in the last few decades that the United States is adopting such sophisticated weapons that we are leaving our allies behind. They simply cannot afford the high-end aircraft, missiles, and communications systems the United States is fielding for the Joint Force. This reduces their ability to fight alongside U.S. forces.

Fortunately, if the United States shifts its focus from few and exquisite weapons systems to the affordable, mass-produced weapons suggested by this paper, then U.S. allies can afford to field similar systems. Many American allies have defense industries sophisticated enough to co-produce these weapons, thus increasing the depth of allied magazines. Japan, Korea, the Philippines, and Australia are already fielding relatively affordable land-based anti-ship cruise missiles. The U.S. Army Multi-Domain Task Force and Marine Littoral Regiment are conducting combined training exercises to integrate U.S. capabilities into these nation's defenses. These allied contributions will significantly complicate any Chinese efforts to achieve dominance in the region. Similarly, commercial space products and communication systems like Starlink are bringing affordable ISR and C2 to allies.

The Joint Force must consider allied ability to field and even co-produce new systems when evaluating which systems to buy. This will assist the Joint Force in reaching the mass needed in the future battlespace.

Summary: The "Commander's Intent" for the Next JWC and Five Enabling Factors

The Commander's Intent: "The United States must develop its ability to conduct timely, offensive operational maneuver designed to seize the initiative and give U.S. forces the advantage of the tactical defensive. Without this, our forces will be subjected to withering cost-imposition capacities from which they cannot recover. Force structure must shift emphasis from platforms to weapons. Replacement of wartime losses and the need for massive numbers of weapons must be a primary factor in the design and fielding of new systems. A primary assumption must be that major wars will be long. Therefore, the Joint Force must be organized, trained, and equipped to place adversary economic vulnerabilities at risk and must be logistically and operationally prepared to fight extended wars, to include an equally agile defense industrial base re-engineered to

support the mass production of smart weapons. The defense of the homeland will require major investments to protect against both kinetic and non-kinetic risks.

Enabling Factors

1. Fuse and Distribute Data Faster than the Adversary
2. Develop and Utilize Emerging Space Based Capabilities
3. Rapidly Fielded Mass-Producible Offensive and Defensive Munitions at an Affordable Cost
4. Build Persistent Integration across the Joint Force and with Allies and Partners
5. Invest in Resilient, Rapidly Recoverable Logistics and Cyber Networks for Forward Deployed Forces and the Homeland

6. Allies and Partners, don't leave them behind.