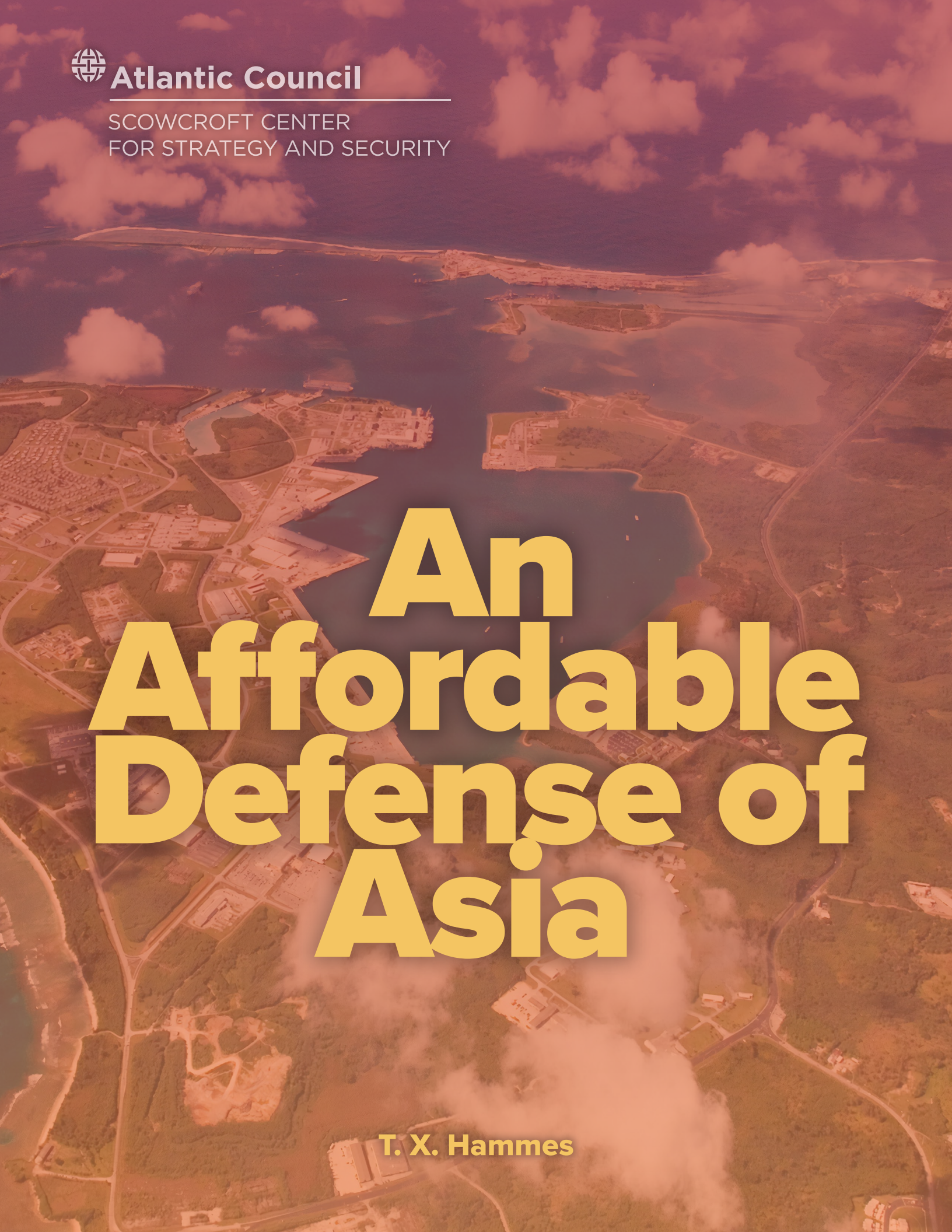
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FOR STRATEGY AND SECURITY
An Affordable Defense of Asia
T. X. Hammes

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Cover photo: An aerial view of U.S. Naval Base Guam, which supports the U.S. Pacific Fleet. Source: U.S. Navy photo https://www.navy.mil/view_image.asp?id=90221. This image was modified with a red filter.

June 2020

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Executive Summary

US military advantages over China are steadily eroding. For the last two decades, China has studied the US military, identified its key weaknesses, and developed the tactics and forces best suited to exploit those vulnerabilities. In particular, China has developed a "counter-intervention" or anti-access/area denial (A2/AD) network designed to target sophisticated US capabilities with long-range precision weapons, thereby forcing the United States to operate from much greater and less effective distances. Chinese military thinkers also appreciate the value of integrating forces across warfighting domains, and have taken significant steps in creating a joint force similar to that of the United States. Lastly, the Chinese have adopted "System Destruction Warfare," which seeks to destroy the critical nodes underpinning the US joint-warfighting concept, potentially precipitating more widespread damage than the destruction of individual units or the dominance of a single domain.

These challenges are compounded by the fact that today's US joint force is deficient in significant areas across all domains of conflict—sea, air, land, space, electronic warfare, and cyber. Proposed budgets cannot overcome those deficiencies using legacy systems. This means that the current US military strategy—a conventional defense of the first island chain from Japan to the Philippines, built on current air and sea platforms supported by major air and sea bases—is increasingly problematic, if not already obsolete.

However, the United States and its allies have two major advantages they can exploit to reverse this trend—geography and emerging technologies. Thus, this paper focuses on the *how* of US-China conflict, rather than the *why*. By developing novel operational concepts that take advantage of emerging technologies, while integrating these concepts into a broader Offshore Control Strategy, the United States can improve its warfighting posture and bolster conventional deterrence. This paper advances the following arguments and recommendations.

First, the geography of the Pacific provides significant strategic, operational, and tactical advantages to a defender. Most analysts believe that this geography is disadvantageous for US forces—which, upon transiting great distances, would be vulnerable to China's A2/AD network in the Indo-Pacific. However, this paper argues that the United States and its allies can create a dense A2/AD network of their own. This defensive approach would exploit China's strategic dependence on several geographic chokepoints. Indeed, the South China Sea and East China Sea are essential to nations, like China, with no other outlet for seaborne trade. The first and second island chains that surround these seas present physical barriers that, if exploited properly, can cripple both China's naval and commercial activities. This paper argues that the United States and its allies should implement an Offshore Control Strategy, which seeks to control a very limited number of passages in the first island chain in order to effectively blockade China.

Second, new operational concepts that employ emerging, relatively inexpensive technologies—including multimodal missiles, long-range air drones, smart sea mines, and unmanned naval vessels—can support an affordable defense of Asia. Due to their lower costs, these emerging technological systems can be fielded by the United States and its allies in large numbers, despite decreasing defense budgets, thereby producing the mass and mobility necessary to circumvent and neutralize China's substantial investment in long-range missiles. Leveraging these new technologies, the Offshore Control Strategy should focus on defending the first island chain, denying China use of the waters inside the chain, and controlling the seas outside the chain. This strategy will necessitate the following three elements.

- **Inside Force:** Within the first island chain, US and allied inside forces should leverage cruise missiles, drones, smart sea mines, and unmanned surface and underwater vessels to survive inside the Chinese weapons-engagement zones and cause considerable damage to Chinese forces. A US ground force stationed on the first island chain could form a tough, resilient, multi-domain force to create A2/AD zones around allied nations and close the passages out of the South and East China Seas. Any force attempting to penetrate would have to deal with capabilities (especially containerized cruise missiles and drones) that can mass in surface, subsurface, and air spaces. These ground forces should also be supplemented by unmanned missile boats and submarines that are difficult to detect, as well as vertical-launch drones, which do not require vulnerable airfields and are therefore nearly impossible to preempt.

- **Outside Force:** Beyond the first island chain, the US joint force should deploy a widely dispersed mix of legacy weapons, like current large warships and manned aircraft, to control the seas, while also using emerging technology to bolster mass and firepower. Specifically, merchant ships should be armed with the containerized missiles and drones developed for the land-based forces, thereby adding a great deal of firepower relatively cheaply. The

lower cost of these technologies allows them to be deployed *en masse*, while also serving as small aircraft carriers for vertical-launch drones.

- **Homeland Force:** The United States must identify and train a homeland-defense force to neutralize cruise-missile threats. Legacy air-defense forces, including current short-legged fighters, can serve this mission if they develop the capabilities necessary for air- and sea-domain awareness. Additionally, further resources must be dedicated to cruise-missile defenses and mine-clearance capability and capacity.

Third, this paper proposes that these new technologies should be manufactured and fielded by US allies and friends in the region. Currently, South Korea and Japan spend a significant amount of money buying sophisticated platforms like the F-35, despite the fact that their airfields are within range of Chinese missile systems. If the United States shifts its investment from its few, exquisite platforms to containerized missiles, smart mines, and drones, it can invite Japan, Taiwan, and South Korea to co-produce these systems. These weapons can also be inexpensive and simple enough to offer to the Philippines, Indonesia, Vietnam, and other nations, while providing them with capabilities that could better challenge the Chinese. Therefore, by partnering with regional allies in the production of these systems, the United States can strengthen both its relationships with its allies and its allies' ability to defend themselves.

Fourth, this paper argues that autonomous weapons will be essential to an affordable defense of Asia. The current arguments against them are morally flawed and need to be abandoned. To ensure autonomous weapons act in accordance with both ethics and the law of war, the United States should focus on developing appropriate hardware, software, rules of engagement, standard operational procedures, and training.

Overall, the United States should pursue an Offshore Control Strategy, as outlined above. By purchasing a mix of aerial drones, unmanned vessels, armed merchant ships, cruise missiles, and smart mines, while developing the maneuver-warfare concepts necessary to employ them effectively, the United States can create a flexible, affordable, tough defense in depth, based on the first island chain. This strategy will reassure and involve US allies while neutralizing much of China's extensive investment in its counter-intervention strategy.

Military theorists refer to two island "chains" along China's maritime perimeter. The first island chain includes Taiwan and the Ryuku Islands, while the second island chain extends from Japan to Guam. Source: Office of the Secretary of Defense https://archive.defense.gov/pubs/pdfs/2011_CMPR_Final.pdf

An Affordable Defense of Asia

"War between the United States and China could be so ruinous for both countries, for East Asia, and for the rest of the world that it might seem unthinkable. Yet it is not: China and the United States are at loggerheads over several regional disputes that could lead to military confrontation or even violence between them. Both countries have large concentrations of military forces operating in close proximity. If an incident occurred or a crisis overheated, both have an incentive to strike enemy forces before being struck by them. And if hostilities erupted, both have ample forces, technology, industrial might, and personnel to fight across vast expanses of land, sea, air, space, and cyberspace. Thus Sino-US war, perhaps a large and costly one, is not just thinkable; it needs more thought."[1]

While such a conflict remains highly unlikely, the possibility clearly exists, and US planners need to think about it. With that in mind, this paper will focus on exploring the *how* of a conflict with China rather than the *why*. It will first assess the geographic setting, before shifting to the United States' current strategy and operational concepts for such a conflict. Then it will examine why that strategy needs to be updated, what steps are being taken today to update it, and how new technologies emerging from the Fourth Industrial Revolution can provide the United States with affordable systems to execute that strategy.

The unfortunate reality is that the United States' ability to fight China is steadily degrading. However, by developing operational concepts that take advantage of emerging technologies, the United States cannot only reverse this trend, but also do so for less cost in blood and treasure. And, while the paper will focus on how to fight China, it is essential to remember that a key element of deterrence is demonstrating the capability to successfully defeat aggression. Deterring China in peacetime necessitates capabilities and concepts that can prevail over China in wartime.

Geography is Key

At the risk of stating the obvious, geography is the key element in any conflict between the United States and China. Most analysts believe that geography places the United States at a disadvantage against China. It is true that most US forces will have to transit great distances to engage with Chinese forces. The closer they get to China, the more deeply enmeshed they become in China's "counter-intervention" or anti-access/area denial (A2/AD) network. While true, this view overlooks the fact that A2/AD works both ways. If the United States works with friends and allies in the first island chain, they can create a dense A2/AD network of their own. And, the limited number of passages through the first island chain would allow the allies to cut China's sea lines of communication.

The South China Sea (SCS) and East China Sea (ECS) are frequently identified as among the most important trade routes in the world. In fact, they are essential to those nations with no other outlet for seaborne trade—China, Vietnam, Cambodia, and Laos. In 2018, China imported 71 percent of its oil needs. Seventy-eight percent of its oil imports and 16 percent of its natural gas passed through the Straits of Malacca.[2] China has worked hard to build up its strategic oil reserve to minimize its vulnerability to energy supply interruption. However, international trade still makes up 38 percent of China's economy, and 64 percent of that passes through the SCS.[3] A blockade would reduce China's economy by more than 20 percent—almost as much as the reduction of the US economy in the Great Depression—and China has no alternative sea routes.

Those nations with ports outside the SCS have options. Even if they have to ship all the way around Australia, the additional cost of shipping is only 1 percent of the value of their trade. Thus, only those nations contained inside the SCS would be cut off from seaborne trade by a closure of the sea to trade. Closure of the SCS would have much less impact on the United States, since trade outside North America represents only 10 percent of the US economy and only 1.4 percent of US gross domestic product (GDP) transits the SCS.[4]

1 David C. Gompert, Astrid Stuth Cevallos, and Christina L. Garafola, *War with China: Thinking Through the Unthinkable, RAND*, 2016, iii, https://www.rand.org/pubs/research_reports/RR1140.html.

2 "Chinese Thirst For Crude Oil Growing; Nearly Equals The Total Production Of Saudi Arabia," *Hellenic Shipping News,* July 8, 2019, https://www.hellenicshippingnews.com/chinese-thirst-for-crude-oil-growing-nearly-equals-the-total-production-of-saudi-arabia/.

3 "Trade as a % of GDP – China," World Bank, https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=CN; "How Much Trade Transits the South China Sea?" China Power Team, Center for Strategic and International Studies, October 10, 2019, https://chinapower.csis.org/much-trade-transits-south-china-sea/?utm_content=buffer2dfa4&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer.

4 Ibid.

China's dependence on the SCS is clearly one of its great vulnerabilities. This dependence poses an obvious question: is it possible to cut China off from its seaborne trade? In fact, a very limited number of channels connect the East and South China Seas to the open ocean. All but the Bashi Channel between Taiwan and the Philippines are narrow and shallow. When viewed from China, the first island chain looks like a barrier between China and the Pacific Ocean.

Even if China can force passage through the first island chain, allies can fall back to the Malacca, Lombok, and Sunda Straits, as well as passages north and south of Australia. Thus, by controlling a very limited number of passages—some at extreme distances from China—US and allied forces can establish an effective blockade against China. Most of China's energy and raw-material imports can be intercepted even farther away from China at the Strait of Hormuz, Gulf of Aden, and Cape of Good Hope.

Since geography is the key to East Asia, allies are the key to accessing the first island chain. In any strategy for conflict with China, it is essential to reassure US allies by providing credible deterrence in peace and an assurance of success in war.

Current Strategy

The current National Defense Strategy envisions that US forces consist of four layers globally—contact, blunt, surge, and homeland. The contact forces are small US contingents working with host-nation forces to build relationships, represent US dedication to those allies, and set conditions for potential conflict. Blunt forces are those US forces permanently stationed in or near the crisis areas to delay, degrade, or deny any offensive operations in the theater. Their purpose is to blunt enemy action in order to provide time for reinforcements to surge from the United States into theater. This allows surge forces time to deploy forward to either win or manage the conflict. The homeland layer protects US territory.[5] The concept seeks to overcome the opponents' anti-access sensor and weapons networks by having sufficient forces forward to prevent opponents from executing a *fait accompli* attack, and provide time for the surge forces to restore the situation.

Given the geographic constraints of the theater, there is growing consensus that the US military strategy in the Pacific should be based on the concept of denying China use of the seas inside the first island chain, defending the first island chain, and dominating the seas outside the first island chain. This approach does not seek the destruction of China, or even the removal of the Chinese Communist Party (CCP). It seeks to defeat China's efforts to dominate the region by convincing China it cannot sustain the long war necessary to defeat the United States. Of particular importance, it seeks to do so while minimizing the risk of nuclear escalation. It must reassure Asian nations that the United States has both the capability and capacity to defeat China. And, it must be affordable under looming budget constraints.[6]

In long wars, economic strength has often been the deciding power. Any major conflict between the United States and China will result in massive damage to the global economy—but, if blockaded, China will suffer much more. A 2016 RAND study estimated that China's GDP would be reduced by 25–35 percent and that of the United States by 5–10 percent by the end of the first year of conflict.[7] However, much like the Allies in the First World War, control of the seas will allow the US alliance to rebuild its trade networks while denying China that opportunity.[8]

The Problem

China understands its vulnerability to blockade, and has been developing the capability to drive US forces off the first island chain. Over the last decade, the People's Liberation Army (PLA) has made major improvements to its organization, training, and equipment. Perhaps the most important is the ongoing effort to create truly joint forces by placing operational forces under joint theater commands. In 2016, China also created the People's Liberation Army Rocket Force (PLARF) to provide a separate service to fully develop its increasingly powerful missile and rocket forces. In addition, China created the Strategic Support Force (SSF) to consolidate its cyber, space, electronic, and information warfare capabilities. While it will take time to create a truly joint force, the reorganization has resulted in better, more realistic joint training with significant efforts to integrate SSF elements into major exercises.

5 Jim Mattis, "Summary of the 2018 National Defense Strategy of The United States of America: Sharpening the American Military's Competitive Edge," US Department of Defense, 7, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

6 To follow the seven years of discussion concerning this approach see: T. X. Hammes, "Offshore Control: A Proposed Strategy for an Unlikely Conflict," National Defense University, June 2012, https://ndupress.ndu.edu/Portals/68/Documents/stratforum/SF-278.pdf; and Thomas G. Mahnken, et al., *Tightening the Chain: Implementing a Strategy of Maritime Pressure in the Western Pacific, Center for Strategy and Budgetary Assessment*, 2019, https://csbaonline.org/research/publications/implementing-a-strategy-of-maritime-pressure-in-the-western-pacific/publication/1.

7 Gompert, Cevallos, and Garafola, "War with China."

8 Esteban Ortiz-Ospina, Diana Beltckian, and Max Roser, "Trade and Globalization," University of Oxford, revised October 2018, https://ourworldindata.org/trade-and-globalization.

These improvements in Chinese capabilities, and the emergence of new technologies over the last decade, have dramatically changed the tactical and operational conditions in the Indo-Pacific theater. Further, Chinese military writing now sees warfare as a contest between operating systems. Chinese writers theorize that by attacking key nodes, "System Destruction Warfare" can defeat the United States faster and more effectively than the destruction of individual units or dominance of a domain.[9] This shifts the focus to critical nodes in the US joint-warfighting concept. Combined with cyber, and perhaps space strikes, it is designed to cripple the US reconnaissance-strike complex that the Chinese feel is at the heart of past US successes. This approach nullifies the US advantage in fourth- and fifth-generation fighter aircraft and, thus, its assurance of air superiority over the battlespace. As noted in the 2017 paper "First Strike: China's Missile Threat to US Bases in Asia," US forces based in Japan are subject to immediate and intensive attack by forces based on the Chinese mainland.[10]

Thus, to execute its current operational concept, the United States will either have to significantly increase the size of its forces or change their posture, structure, and concepts of operations to reduce their vulnerability to systems disruption. This will require a significant shift in the way the joint force fights, but it is essential. The US Navy and Air Force are simply too small, and have the wrong mix of equipment to effectively execute the current US operational concept. Compounding the problem, the US Army and Marine Corps are poorly organized and ill equipped for this fight. Finally, China's consolidation of cyber, space, electronic warfare, and information capabilities under its Strategic Support Force may provide better support to its air and sea forces from these relatively new, but critical, domains.

In addition to the vulnerability of its networks, US forces are also deficient in each domain of war.

Sea-Domain Deficiencies

In 2019, the US fleet consisted of 286 battle-force ships. This count includes auxiliary and support ships. The People's Liberation Army Navy (PLAN) fleet consists of 335 battle-force ships, not counting auxiliary and support ships.[11] While US ships are superior in most classes, Chinese ships are closing the gap. More importantly, the US Navy has global commitments, while China's navy is concentrated in the Far East. On a day-to-day basis, the PLAN battle force outnumbers the US Seventh Fleet battle force by about ten to one. Until the US Navy can develop and field new generations of anti-ship cruise missiles, it will suffer from a range disadvantages in missile exchanges with Chinese ships

Further, while operating near the first island chain, the Chinese fleet can receive extensive support from the People's Liberation Army Air Force (PLAAF) and PLARF. These forces field an increasingly capable and numerous inventory of drones, cruise, ballistic, and, perhaps soon, hypervelocity missiles. The DF-21 "carrier killer" and DF-26 "Guam killer" missiles are specifically designed to attack ships that approach China. And, while its actual performance is still unclear, China revealed the DF-100 missile in its October 1, 2019, parade. It is either a cruise or ballistic missile, but some observers believe it may be a hypersonic cruise missile with a range of 1,200 to 1,800 miles and is "mainly designed for big targets at sea."[12]

The result is that most US surface ships, including carriers, have to sail through hundreds of miles of contested water before they are in range to fire back. While the US Navy may be able to conduct raid-type operations by penetrating far enough that the fleet's weapons can engage China's surface fleet, it cannot operate continuously in the denied area.

Air-Domain Deficiencies

Since the Second World War, the United States has been able to count on airpower to reinforce its naval and land forces. But, just as the rapidly improving PLARF and PLAAF challenge US naval forces, so too are they driving US airpower to operate from much greater distances. The US Air Force has superior numbers of fourth- and fifth-generation fighters, but these aircraft have relatively limited ranges. This is a critical issue, since current airbases in Japan and the Philippines are within DF-21 missile range of mainland China. With China's fielding of the DF-26 missile, US bases in Guam are also within range of Chinese missile forces.[13] The Federation of American

9 Jeffrey Engstrom, *Systems Confrontation and Systems Destruction Warfare, RAND*, 2018, ix-xi, https://www.rand.org/pubs/research_reports/RR1708.html.

10 Thomas Shugart and Javier Gonzalez, *First Strike: China's Missile Threat to U.S. Bases in Asia, Center for a New American Security*, June 2017, https://s3.amazonaws.com/files.cnas.org/documents/CNASReport-FirstStrike-Final.pdf.

11 Ronald O'Rourke, "China Naval Modernization: Implications for US Navy Capabilities—Background and Issues for Congress," Congressional Research Service, August 30, 2019, 18, https://fas.org/sgp/crs/row/RL33153.pdf.

12 James Holmes, "Is China's DF-100 Missile a Threat to the US Navy?" *National Interest,* November 4, 2019, https://nationalinterest.org/blog/buzz/chinas-df-100-missile-threat-us-navy-93166.

13 "China Military Power," US Defense Intelligence Agency, 2019, 93, https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.

DOD Estimates For China's Rocket Forces

China's Rocket Force 2018

System	Launchers	Missiles	Estimated Range
ICBM	50-75	75-100	5,400-13,000+ km
IRBM	16-30	16-30	3,000+ km
MRBM	100-125	200-300	1,500+ km
SRBM	250-300	1,000-I,200	300-1,000 km
GLCM	40-55	200-300	1,500+ km

China's Rocket Force 2019

System	Launchers	Missiles	Estimated Range
ICBM	90	90	>5,500 km
IRBM	80	80-160	3,000-5,500 km
MRBM	150	150-450	1,000-3,000 km
SRBM	250	750-1500	300-1,000 km
GLCM	90	270-540	>1,500 km

Source: Department of Defense annual reports to Congress on military and security developments involving the People's Republic of China, 2018 and 2019 https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF; https://media.defense.gov/2019/May/02/2002127082/-1/-1/1/2019_CHINA_MILITARY_POWER_REPORT.pdf

Annotations: Hans Kristensen, *Federation of American Scientists* https://fas.org/blogs/security/2019/10/china-military-parade/

Scientists estimates that China had deployed sixty to eighty DF-26 launchers by October 2019.[14] As the table above shows, China is rapidly increasing its inventory of both ballistic and cruise missiles.

Further, the PLA continues to develop cruise missiles to augment its ballistic-missile fires against US bases throughout Asia. It is also rapidly developing long-range drones to complicate US efforts to defend fixed facilities.

Obviously, range is the key problem for US airpower. The US Air Force (USAF) states the F-35A has a range of 1,350 miles (1,200 nautical miles)—which would translate to an operational radius of 675 miles.[15] Unfortunately, this range

14 Hans M. Kristensen, "Military Might Takes Center Stage at Chinese 70-Year Anniversary Parade," Federation of American Scientists, October 1, 2019,. https://fas.org/blogs/security/2019/10/china-military-parade/.

15 "F-35A Lightning II," US Air Force, April 11, 2014, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/478441/f-35a-lightning-ii/.

assumes a peacetime flight profile, and does not make allowance for wartime flight profiles, which consume more fuel. The geography of Asia ensures that, unless they operate from the first island chain, F-35s, F-15s, and F-16s will require extensive tanker support just to reach the fight.

Even with the addition of long-range, air-launched missiles, fighters will require extensive tanker support to project power if forced off the first island chain. Unfortunately, the tankers and Airborne Warning and Control System (AWACS) aircraft critical to the USAF's concept of employing fighter/bomber aircraft are not stealthy. And, the Chinese have developed long-range, air-launched, anti-air missiles specifically to attack these aircraft.[16] US planners are acutely aware of the problem, and are struggling with the logistics of how to employ and sustain these short-legged fighter assets. Long-range air-to-air and air-to-surface missiles provide a partial solution, but cannot solve the problem of persistent presence. In short, US forces in the first island chain must be prepared to fight with limited air support.

Heavy bombers—B-52s, B-1s, and B-2s—provide a partial response because they can strike from long range. Unfortunately, they have three major vulnerabilities. First, they generate extremely low sortie rates. Since China can already strike Guam with the DF-26 ballistic missile and H-6K bombers using land-attack cruise missiles, US bombers will have to operate from bases east of Guam.[17] Second, even if they operate from the continental United States, the Chinese can strike their easily identified and vulnerable bases. Although the Chinese will hesitate to engage US stateside bomber bases with ballistic missiles—for fear the attack might be misinterpreted as an escalation to nuclear weapons—new cruise missiles and drones packaged in standard shipping containers launched from merchant ships off the coasts of the United States or Mexico offer a feasible and less risky approach. While the launch of ballistic missiles can easily be mistaken for the start of a nuclear attack, cruise missiles will not be. Further, cruise missiles are precision weapons that can be targeted at purely military targets like aircraft on the ground, and accompanied by an information campaign to ensure the US public knows that China is only striking US-based forces in response to those forces attacking China. If the US military is using heavy bombers based in the United States to conduct strikes into Chinese territory, the CCP will need to respond. While escalatory, cruise missiles may well be seen as an appropriate response to US attacks on Chinese territory.

China has developed the YJ-18C, based on the Russian Kalibr-class missile. The Kalibr is reported to have a range of about three hundred and thirty miles in the anti-ship mode.[18] The land-attack versions have ranges from 900–1,500 miles, with an upgraded version under development that will reach 2,700 miles.[19] Russia has been offering this version for sale in containers. As early as 2016, China was displaying cruise missiles mounted in standard shipping containers at trade shows.[20] Therefore, it is prudent to assume China has, or will soon develop, an operational capability. Once containerized, these missiles could be carried on any oceangoing vessel that can carry a forty-foot container. And, of course, these armed merchants can range US bases throughout the western Pacific

Many bomber and tanker bases in the continental United States (CONUS) will also be within range of armed merchants. The cost of defending against such attacks will be very high. Thus, any cost computation for new bombers should include the very high cost of providing effective, layered air defense against drones and missiles. Finally, even if the United States can protect its air bases, bombers will require extensive tanker support to operate in the vast spaces of the Pacific. Thus, the tankers will need protection at their home stations, and potentially en route from containerized anti-air missiles on merchant ships.

Ground-Force Deficiencies

US ground forces are also poorly structured for a fight against China. They were built primarily to fight other ground forces in a force-on-force confrontation. While well trained and equipped to do so, the vast majority of the forces useful in a ground fight are essentially useless

16 Marc Champion, "Chinese Missiles Are Transforming Balance of Power in the Skies," Bloomberg, May 7, 2018, https://www.bloomberg.com/news/articles/2018-05-07/chinese-missiles-are-transforming-balance-of-power-in-the-skies.

17 "China Military Power," Defense Intelligence Agency, 33, 93.

18 Michael Pilger, "China's New YJ-18 Antiship Cruise Missile: Capabilities and Implications for US Forces in the Western Pacific," US-China Economic Security Review Commission, October 28, 2015, https://www.uscc.gov/sites/default/files/Research/China%E2%80%99s%20New%20YJ-18%20Antiship%20Cruise%20Missile.pdf.

19 Mark Episkopos, "Russia's Dangerous 'Kalibr' Cruise Missile Could See Range Doubled: Report," *National Interest,* January 12, 2019, https://nationalinterest.org/blog/buzz/russias-dangerous-%E2%80%9Ckalibr%E2%80%9D-cruise-missile-could-see-range-doubled-report-41427.

20 Jeffrey Lin and P.W. Singer, "Come Look at China's Coolest New Missiles," *Popular Science,* November 8, 2016, https://www.popsci.com/chinas-new-missiles-zhuhai/.

Kalibr Range Chart

In a war with China, military bases on the US homeland would likely be targets. New cruise missiles and drones, such as the Chinese YJ-18C cruise missile based on the Russian Kalibr-class missile, can be packaged in standard shipping containers and launched from merchant ships off the coasts of the United States or Mexico. Source: Author developed.

in a maritime and air fight. Even the long-range rocket Multiple-Launch Rocket System (MLRS) and air-defense units (Patriot and Terminal High-Altitude Area Defense (THAAD)), which can contribute to this fight, are highly vulnerable to preemption by long-range Chinese systems. As currently configured, these units create large and distinct visual, thermal, radar, and electronic signatures. In addition, they generate heavy logistics demands for specialized parts and maintenance, as well as large quantities of fuel.

Space-Force Deficiencies

A major vulnerability of US forces is their dependence on space assets for long-haul communications, targeting, and strike. The US strike complex relies on space for situational awareness, as well as position-navigation-timing (PNT) services. Thus, it is highly vulnerable to attacks in space. In contrast, China, fighting close to home, has an alternative for long-haul communications. It can use a range of communication paths from high-frequency (HF) radio to domestic fiber-optic networks.

Today, China has strong space surveillance systems across the spectrum. It can also make use of the rapidly improving commercial surveillance systems. The commercial capability was clearly demonstrated when photos of the damage caused by the January 2020 Iranian missile attack were published less than twenty-four hours after the attack. Thus, US forces will not be able to hide any major bases or ships from China's surveillance.

US Space Command and the Defense Advanced Research Projects Agency (DARPA) are working hard to both increase the resilience of assets in space and provide rapid launch capabilities to restore US space assets if China attacks them. They are making progress, but the fact is in 2019, China conducted thirty-two successful launches, while the United States had nineteen.[21] Thus, China may be able to restore space capabilities more quickly than the United States.

21 "Space Environment: Total Launches by Country," Aerospace Security, Center for Strategic and International Studies, last visited January 2, 2020, https://aerospace.csis.org/data/space-environment-total-launches-by-country/.

This commercial satellite picture of the damage caused in the Iranian January 2020 attack on bases in Iraq appeared in the news less than twenty-four hours after the attack. It shows both the responsiveness of commercial space and the accuracy of the Iranian missiles. *Source: Planet Labs, Inc.*. https://commons.wikimedia.org/wiki/File:Ain_al-Assad_air_base,_8_jan_2020.png

Some analysts state that if the United States attacks first in space, it will gain a huge advantage. However, this concept does not seem to consider the impact that a major attack in space and subsequent counterattacks will have on both the global economy and US warfighting capabilities. While the Pentagon is working to be able to quickly replace US military space assets, who will replace the PNT services essential to the operation of civilian infrastructure? Given the US military's heavy reliance on contractors for sustainment, losing PNT will have an immediate, negative effect on US logistics support. Further, the economic damage will have long-term effects on the ability of the United States to sustain the conflict.

Cyber-Force Deficiencies

Both the United States and China are investing heavily in developing cyber capabilities. China has consolidated its cyber with its space, electronic warfare (EW), and information commands to improve integration of these capabilities. It is too early to tell if this has been effective, but the intent is clearly to destroy the US system by eliminating its eyes, ears, and communications. The good news is that, if the US move to jointness is any indication, it may take China decades to complete its integration. The Pentagon is making similar efforts in standing up integrated multi-domain organizations in an attempt to bring all its capabilities together.

Budget Will Not Meet Needs on Current Path

Nor should planners think an increasing defense budget will provide the resources needed to match China using current operational concepts. While the 2018 and 2019 defense budgets reflected major increases in spending, the 2020 budget represents level funding, and the 2021 budget declines after inflation is factored in. Even with two years of major increases, the budget remains insufficient to fulfill current plans. The Congressional Budget Office (CBO) estimated the Navy's 2020 shipbuilding plan "would require shipbuilding appropriations that are more than 50 percent larger than the Navy's average funding for shipbuilding over the last five years."[22]

Rapidly increasing interest payments on the US national debt, combined with growing mandated social spending

22 "An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan," Congressional Budget Office, October 2019, https://www.cbo.gov/publication/55685.

and the increasing need for infrastructure investment, make it highly unlikely that defense will see a significant increase it its budget. In 2018, the CBO's long-term spending projections indicated that, by 2041, spending on Social Security, healthcare, and interest will exceed all revenue.[23] The major increases in debt over the last three budget years will likely accelerate that timeline. According to the CBO, interest payments on the national debt ($548 billion) will exceed the base defense budget ($536 billion) in FY 2021.[24] By 2023, interest payments ($702 billion) will exceed the entire defense budget ($679 billion).[25]

Of course, this was all before COVID-19 triggered massive federal spending and severely reduced tax receipts. While it is too soon to see the longer-term impact, a prudent planner must assume the major increases in debt servicing costs will reduce funds available for defense.

Even as available funds steadily decrease over time, DoD personnel costs—pay, retirement, medical care, housing, education—continue to increase. In 2018, the Pentagon personnel costs were $107,106 per service member. However, this number did not include the TRICARE medical costs, retirement costs, or Veterans Administration costs, which are all part of long-term personnel costs.[26] Thus, adding personnel to the force is not an affordable option. And, while each service is striving to buy new systems, the cost of those systems is also dramatically higher than those of the previous generation.

What to Do

China's growing arsenal of long-range precision weapons means a conventional defense of the first island chain, built on current exquisite air and sea platforms supported by major air and sea bases, is increasingly problematic, if not already obsolete. Fortunately, new Fourth Industrial Revolution technologies can dramatically change the tactical and operational situation along the first island chain. They can provide effective defenses that can survive inside the Chinese threat envelope. The new systems can be deployed in ways that generate almost no signatures. If they are dispersed widely and use increasingly capable passive sensors, they will remain hidden until they fire. This will neutralize much of China's investment in long-range strike, which is an essential part of its counter-intervention concept.

Because they can be relatively inexpensive, these systems can be fielded by the United States and its allies in large numbers, despite decreasing defense budgets. Rather than being forced off the first island chain, these systems will allow the US and allied forces to establish an effective A2/AD system to defend the island chain and control the entrances to the South and East China Seas. Given US budget issues and the fact that the key element of US strategy in Asia is to defend the first island chain, these are major advantages to the United States and its allies. However, these advantages can only be leveraged if the United States leads the way in adopting new concepts and technologies.

Key Emerging Technologies

The emerging joint multi-domain battle concept—combined with the contact, blunt, surge, and homeland construct—can maximize the potential of emerging technologies. However, a key to adopting new technologies is to think in terms of weapons, not platforms. Advances in information technology, autonomous navigation, miniaturization, task-specific artificial intelligence, and advanced manufacturing mean it is possible to create large numbers of relatively inexpensive, but highly capable, autonomous weapons systems. The September 2019 attack on Saudi oil facilities saw seventeen of nineteen drones and cruise missiles hit targets hundreds of miles from their launch points. In its January 2020 attack on Iraqi bases, Iran fired sixteen short-range missiles and twelve hit their targets. These systems are mobile and relatively cheap.

These successes provide a small example of both how and why the United States must shift away from expensive, vulnerable platforms to relatively cheap, autonomous systems. Rather than focusing on building ever more exquisite major ships, aircrafts, and ground vehicles, the DoD should work to optimize the production of smart, long-range, but relatively cheap weapons. Of particular importance in rethinking how the United States can deter China are multimodal cruise missiles, long-range air drones, smart sea mines, and unmanned naval vessels. The geography of East Asia will maximize the value of these smart weapons tied to inexpensive delivery platforms like small surface combatants, missile merchants, vertical takeoff and landing (VTOL) drones, and even commercial vessels.

23 "CBO's 2018 Long-Term Budget Outlook," Committee for a Responsible Federal Budget, June 26, 2018, https://www.crfb.org/papers/cbos-2018-long-term-budget-outlook.

24 Kimberly Amadeo, "Interest on the National Debt and How It Affects You," *Balance,* October 15, 2019, https://www.thebalance.com/interest-on-the-national-debt-4119024; "Long-Term Implications of the 2020 Future Years Defense Program," Congressional Budget Office, August 2019, 2, https://www.cbo.gov/system/files/2019-08/55500-CBO-2020-FYDP_0.pdf.

25 "The Budget and Economic Outlook: 2018 to 2028," Congressional Budget Office, April 2018, 44, https://www.cbo.gov/publication/53651.

26 Katherine Blakeley, "Military Personnel," Center for Strategic and Budgetary Assessments, August 15, 2017, https://csbaonline.org/reports/military-personnel.

In 2018, the crew of the Los Angeles-class fast attack submarine USS Annapolis launch a Tomahawk Land Attack Missile (TLAM) off the coast of Southern California as part of a Tomahawk Flight Test (TFT). US Tomahawks are an example of cruise missile technology, which is an increasingly valuable asset in the Asia-Pacific. If containerized, cruise missiles can have significant military effects both inside and outside the first island chain. *Source: Navy photo by Mass Communication Specialist 1st Class Ronald Gutridge, Official U.S. Navy flickr Page.* https://www.flickr.com/photos/usnavy/42434187524/in/photolist-27DLiyQ-2bcqsAi-2j1YAfS-259cDS1-259cDVY-J6shAq-GzbVAg-2iJdXBY-2hyPrQW-9rAVac-2hRfuEt-9rDT9L-p5ovzN-pjQLEu-9rAUXZ-9rAUHX-duTUWs-9krMcF-Smu2Bf-24ShvDz-2g4ZGDS-duNkp2-9rMo1v-duTVFW-9oA48w-9rEhwY-9rFxwQ-pmSQqt-bq51Yq-9rNE7o-d1nhVN-9rNzjy-buD1f6-bq521h-buD1qM-bq524U-9D6Qbw-9rQmbq-9rMnVi-9rQmfJ-9rMnRM-9kuPtA-9kuQbG-9vRVq7-p5nC1X-p5nTSN-pmRgNU-9rMnXM-9oA3Bs-9rMo3T

Multi-modal missiles are designed to be fired from standard shipping containers, and minimize required logistics support. Russia, China, and Israel have already produced containerized cruise missiles, which can provide a wide variety of platforms with long-range precision weapons. Further, a variety of these missiles—Kalibr, Naval Surface Strike Missile, Tomahawk—have been successfully fired from standard containers that can be mounted on either military or commercial trucks or ships. It is inevitable that air-defense missiles will be packaged in standard shipping containers too. Further reducing the logistics burden, the containers can be handled by a variety of widely available civilian cargo equipment. The United States could assign the containerized missiles to ground units, and those personnel would accompany the launchers. Rather than bringing their own military trucks, they could buy or lease commercial assets in country. Once loaded on civilian trucks, the units would subsist off the local economy of the first island chain by purchasing fuel, food, parts, and even replacement vehicles using credit cards, cash, or gold coins. The relatively small fuel, food, and commercial parts demands should not overwhelm the economy of the Philippines (population 104 million) or Japan (population 126 million). The only logistics requirements that would need to be shipped are replacement weapons and parts for military communications equipment.

As noted above, new cruise missiles have ranges from about three hundred and thirty nautical miles for anti-ship cruise missiles and out to 1,500 miles for land-attack cruise missiles. Thus, they can have a major impact both inside and outside the first island chain.

Commercial aerial drones are also improving exponentially. Unlike the expensive and manpower-intensive Predator drone, commercial drones are designed to be inexpensive, airfield independent, and minimally attended. One such drone, the Flexrotor, is VTOL-capable, autonomous,

Commercial aerial drones like this Flexrotor drone are often designed to be VTOL-capable, autonomous, and long-endurance. If combined with a warhead, they are almost ideal weapons. *Source: Wikimedia Commons https://commons.wikimedia.org/wiki/File:Flexrotor.jpg*

long-endurance (over thirty hours), and capable of carrying visual and infrared systems.[27] New synthetic-aperture radars (SAR) are light enough to be mounted even on small drones.[28] They are already being used for maritime-domain awareness, and could be easily adapted for intelligence, surveillance, and reconnaissance (ISR) missions. The relatively low cost ($200,000) means even battalion-sized units could be equipped with them.

Today, many companies are competing to develop drones for home delivery. These drones will require Global Positioning System (GPS) independent navigation (to operate in urban and rural canyons), electronically hardened circuits (to operate near airfields), vertical takeoff and landing, one-meter accuracy, and cheap production costs to allow for attrition. In short, it is an almost ideal weapon if equipped with a warhead.

At the same time that commercial drones are becoming highly capable, the military is experimenting with autonomous drones with extraordinary capabilities. The US Air Force is testing the XQ-58A *Valkyrie* drone. It has a top speed of six hundred and fifty miles per hour, can deliver six hundred pounds of ordnance (two small-diameter bombs or air-to-air missiles) out to 1,500 nautical miles, and, because it is VTOL-capable, does not require an airfield.[29] Kratos

27 "Flexrotor Unmanned Aerial System," Flexrotor, https://aerovel.com/flexrotor/.

28 Mike Ball, "High-Resolutions SAR Imagery Captured with Small UAS," *Unmanned Systems News,* February 25, 2019, https://www.unmannedsystemstechnology.com/2019/02/high-resolution-sar-imagery-captured-with-small-uas/.

29 "XQ-58A Valkyrie," Kratos Unmanned Aerial Systems, https://www.kratosdefense.com/-/media/k/pdf/usd/xq-58a-valkyrie.pdf.

The US military is experimenting with autonomous drones like this XQ-58A Valkyrie. The major advantage of these drones is vastly reduced lifetime costs, both in operation and maintenance (O&M) costs and personnel costs. *Source: Air Force photo by Senior Airman Joshua Hoskins, Wright-Patterson AFB* https://www.wpafb.af.mil/News/Article-Display/Article/1777743/xq-58a-valkyrie-demonstrator-completes-inaugural-flight/

offered the aircraft at $2 million a copy if the United States buys them in lots of one hundred.

Even with the F-35A's recently reduced price of $88 million, the Air Force could field forty-four XQ-58As for the cost of each F-35A. But, the real cost advantage is in lifetime costs. Vice Admiral Mathias "Mat" Winter, the F-35 program manager, believes the program can reduce F-35 hourly operating costs to $36,000 per hour.[30] If the program can reach that cost and the aircraft fly the eight thousand hours planned, then each aircraft has lifetime operating costs of $288 million—or the price of 144 additional XQ-58As.[31] Even more savings will be accrued due to reduced personnel costs. The *Valkyrie* does not require a pilot, and thus requires no lengthy and expensive pipeline to train one. It requires much less maintenance, so fewer maintainers. It does not require an airfield, so no personnel are required to maintain, operate, and protect one. Since personnel costs are one of the fastest-rising defense costs, these savings will be significant. They also reduce the US Air Force's critical pilot shortage. In short, the choice is between one F-35 and its lifetime costs or more than three hundred XQ-58As.

At sea, numerous companies have developed and are selling long-endurance unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs). The US Navy is developing a family of them. Its USVs range from long-range surveillance/anti-submarine platforms to small missile ships. Its UUVs range from torpedo-sized autonomous sensors to the Xtra-Large UUV Boeing is developing.[32] ORCA, the navy's undersea attack drone, will be able to fire torpedoes and lay mines.[33]

A new version of a very old weapon, the sea mine can have a major impact. Sea mines are best employed in restricted waters like the exits to the South and East China Seas. Modern smart sea mines can remain passive until they detect a specific class of ship by evaluating its magnetic, electrical, acoustic, pressure, and seismic influences.

30 Valerie Insinna, "One of the F-35's Cost Goals May Be Unattainable," *Defense News,* May 2, 2019, https://www.defensenews.com/air/2019/05/02/one-of-the-f-35s-cost-goals-may-be-unattainable/.

31 Garrett Reim, "F-35 Stress Tests Raise Possibility of Longer Service Life," *Flight Global,* September 17, 2018, https://www.flightglobal.com/fixed-wing/f-35-stress-tests-raise-possibility-of-longer-service-life/129550.article.

32 John Keller, "Navy Asks Boeing to Find New Missions, Payloads, and Capabilities for Long-Endurance Extra-Large UUV," *Military & Aerospace Electronics,* September 18, 2019, https://www.militaryaerospace.com/unmanned/article/14040163/extralarge-uuv-longendurance.

33 Kris Osborn, "Navy Accelerates New Ship Radar to Support Emerging 'Sea-Attack' Strategy," *Warrior Maven,* January 14, 2020, https://defensemaven.io/warriormaven/sea/navy-accelerates-new-ship-radar-to-support-emerging-sea-attack-strategy-Bfhq4DhooUSU0t6JI9HuCw.

The mine is then activated. Advance mines release an active torpedo warhead. Less expensive but more numerous mines simply detonate. In fact, MK-80 series bombs can all be made into shallow-water sea mines with the addition of a smart fuze. By applying a joint direct-attack munition (JDAM) kit, the mine can also be air-dropped with precision. Since these mines can be effective in up to two hundred meters of water, they can be used in all the exits except the Bashi Channel. And, mines can be pre-positioned to be employed quickly in a crisis. In addition, small USVs and UUVs can be used as delivery systems, particularly in the narrow waters leading from the South and East China Seas into the Pacific Ocean.

The shift from few and exquisite weapons like the F-35 and carriers could also be used to strengthen US relationships with allies and friends in the region. South Korea and Japan are spending a great deal of money buying the F-35, despite the fact that their airfields are within range of Chinese and North Korean missile systems. Many will be destroyed on the ground in a conflict.

If the United States shifts its investment from its few, exquisite platforms to containerized missiles, smart mines, and drones, it can invite Japan, Taiwan, and South Korea to co-produce these systems. Since these systems are less expensive and involve these nations' domestic arms industries, it should be an achievable goal.

These weapons can also be inexpensive and simple enough to offer to the Philippines, Indonesia, Vietnam, and other nations. Further, it would provide these less powerful nations with weapons that could actually challenge the Chinese. Currently, these nations have minimal capability to do so, and too much of that limited capability is dependent on fixed facilities, and, thus, subject to preemptive strikes. By combining containerized missiles, aerial drones, smart sea mines, and surface and subsurface unmanned vessels, even small states can create effective, affordable defensive systems. These systems are ideally suited to their strategic goal of keeping China at bay.

If US contact and blunt forces are armed with the same weapons as host nations, they can train together more effectively. In addition, host nations should be more willing to let the United States pre-position weapons in their countries, since they can be used to augment their own forces in a major crisis.

Drone Swarms

The combination of advanced manufacturing and simple but long-range drones has made the possibility of massive drone swarms real. In 2014, a University of Virginia aeronautical engineering professor three-dimensional (3D) printed a drone in twenty-eight hours. He added an inexpensive electric motor, two small batteries, and a cell phone (for navigation) to create an autonomous drone with a range of thirty miles that cost only $800.[34] Since then, 3D polymer printing speeds have increased more than one hundred times, so a 3D plant of one hundred printers could print ten thousand of these autonomous drones per day.

Nor is 3D printing limited to small drones. In early 2019, Oak Ridge National Lab 3D printed a thirty-foot submersible hull in one month.[35] In October 2019, the University of Maine 3D printed a five-thousand-pound patrol boat in seventy-two hours.[36] Thus, swarms of both surface and subsurface craft are becoming possible. They can be integrated into a defense of the first island chain and based in any of thousands of small harbors, inlets, or streams in the region.

Massed Missile Attacks

At more than $1 million per round, cruise missiles are currently expensive, but advanced manufacturing can reduce the cost and speed of their production. Commercial firms are already printing large numbers of aircraft, spacecraft, and rocket parts. General Electric has successfully redesigned a turboprop engine for a small commercial aircraft. They reduced it from more than eight hundred parts to only twelve 3D-printed parts.[37] Relativity Space is in the process of 3D printing an entire rocket even as Rocket Lab is conducting launches of rockets with major 3D printed components every two months.[38] The rapid mastery of techniques to print rockets and jet turbines indicates the industry is ready to apply advanced manufacturing to cruise-missile production. The major reduction in total number of parts

34 David Sheffler, "The Razor: UVA's 3D Printed Drone," University of Virginia, YouTube video, August 29, 2014, https://www.youtube.com/watch?v=FwRD7UBGecg.

35 Task and Purpose, "The Navy Can Now 3D-Print Submarines on the Fly for SEALs," *National Interest,* May 3, 2019, https://nationalinterest.org/blog/buzz/navy-can-now-3d-print-submarines-fly-seals-55617.

36 Ed Morin, "UMaine Unveils World's Largest 3D Printer—and the Patrol Boat It Printed," Maine Public, October 11, 2019, https://www.mainepublic.org/post/video-umaine-unveils-worlds-largest-3d-printer-and-patrol-boat-it-printed/.

37 Bryce Salmi, "The World's Largest 3D Metal Printer is Churning Out Rockets," IEEE Spectrum, October 23, 2019, https://spectrum.ieee.org/aerospace/space-flight/the-worlds-largest-3d-metal-printer-is-churning-out-rockets.

38 "Rocket Lab Celebrates 100th Rutherford Engine Build," Rocket Lab, July 8, 2019, https://www.rocketlabusa.com/news/update/rocket-lab-celecbrates-100th-rutherford-engine-build/.

and speed of producing those parts will mean much larger numbers of cruise missiles on a future battlefield.

A Proposed Modification to Current US Strategy

The combination of challenges presented by Chinese investments and the potential benefit of adopting a new generation of smart and cheap weapons lead to the conclusion that the United States must modify its strategy for conflict in the Pacific. The balance of the paper will outline just such a strategy. It is based on the Offshore Control Strategy the author wrote in 2012, but updated to account for the extensive improvements in both Chinese capabilities and modern technology.[39] Since a strategy should consist of assumptions, ends-ways-means, priorities, sequencing, and a theory of success, the paper will deal with each in turn.

If the United States can adopt maneuver warfare as a concept, then units can operate with mission-type orders and eliminate the current requirement for almost constant communications. This removes one of the key system vulnerabilities that the Chinese have worked so hard to attack. Further, a move to smaller platforms that do not require bases largely neutralizes China's massive investment in long-range ballistic and cruise missiles designed to destroy those bases. In short, it provides an affordable response to China's System Destruction Warfare concept.

Assumptions

- China initiates the war. This is the most difficult situation for the allies, so it should be the base planning assumption.
- US war goals will not include removal or surrender of China's Communist Party.
- The objective will be to stop Chinese aggression against US interests.
- The duration of such a war cannot be known, but historical examples of great-power conflict indicate the United States should be prepared for extended hostilities. Over the last two hundred and seventy years, wars between healthy great powers have been long—ranging from years to decades. While preferred weapons stocks will be quickly expended and replacement of major platforms will take months to years, the same pattern held true in recent major wars. There was intensive fighting as both sides sought a quick victory, followed by a pause as both sides mobilized, then the long grind until one side was exhausted. Today, China seeks a short war under "informationized" or "intelligentized" conditions. The United States planning for a long war should add to the deterrence value of the US position.
- The precision and effectiveness of new weapons systems will mean high levels of attrition of personnel and platforms.
- The integrated nature of the global economy means a US-China war will cause massive damage to the global economy, no matter how it is fought.
- The United States will declare a maritime exclusion zone inside the first island chain.
- The United States does not clearly understand China's nuclear-release decision process or red lines. Therefore, national decision-makers will be cautious about attacking the Chinse mainland.
- US bases both in theater and in CONUS will be subject to major attacks. While some will argue that China will not take this escalatory step, failing to plan for it is planning for defeat. The fact that the United States continues to field a force that requires sanctuary bases to operate effectively extends a critical vulnerability that China is already positioned to attack.

Ends-ways-means

As stated earlier, the end is conflict termination without the destruction of China or the CCP. The way is to exhaust China by denying it use of the waters inside the first island chain, defending the first island chain, and dominating the waters outside the first island chain to cut China off from seaborne trade, while minimizing the risk of nuclear escalation.

Means will be driven by geography, which dictates that a conflict with China will be about defeating Chinese naval, air, space, and cyber forces. But, as noted, bases on the first and even second island chains cannot be maintained without massive investment in air defense, and maybe not even then. Ships at sea near the first island chain will be vulnerable to missile and air attack. Fortunately, with the advent of long-range VTOL drones, as well as mobile cruise- and ballistic-missile systems, ground forces can create a mobile, effective A2/AD network that will protect the first island chain.

Until US forces can reequip with systems better suited to this conflict, its airbases and major sea platforms will have to operate well outside the first island chain. Obviously, it will take a long time to reequip sea and air forces. Fortunately, emerging autonomous systems can provide

39 Hammes, "Offshore Control: A Proposed Strategy for an Unlikely Conflict."

ground forces with weapon systems that are survivable on the first island chain and, with the proper investment, can be rapidly fielded.

The contact and blunt layers will, by definition, be inside forces. They will fight within the arc of Chinese land-based weapons. The surge layer will start beyond that range, and will have to fight its way in. Thus, it will start as an outside force. Finally, the homeland force will remain focused on defending the continental United States.

Inside Force

The forces of the nations on the first island chain are inherently inside forces. US contact and blunt layers will also be inside forces. It is essential that both US and allied inside forces be equipped with a variety of cruise missiles, drones, smart sea mines, and unmanned surface and underwater vessels. These systems can survive inside the Chinese weapons-engagement zones and can cause considerable damage to Chinese forces. Each of these systems already exists or could be modified from existing operating civilian designs. Using these systems, a ground force stationed on the first island chain could form a tough, resilient, multi-domain force to create A2/AD zones around allied nations and close the passages out of the South and East China Seas. Any force attempting to penetrate would have to deal with forces that can mass in surface, subsurface, and air spaces. Ground forces have the major advantage of being able to disperse and blend into the complex littoral and urban terrain of the first island chain while deploying weapons systems in each of these domains.

Both the US Army and the Marine Corps are experimenting with organizations that will fill the role of stand-in forces on the first island chain. Combining long-range fires, sensors, air-defense, and electronic- and cyber-warfare assets, the units would fight alongside allies and friends in the first island chain to preserve those nations' sovereignty. While each service is moving ahead to field the long-range systems needed for this mission, each is also reorganizing current fires, intelligence, information, electronic warfare, and space assets to understand how the new concept will work.

The US Navy's unmanned missile boats could provide a naval element to the inside force.[40] They can be reinforced by its ORCA unmanned submarines. These autonomous systems have a range of 6,500 nautical miles, so could self-deploy into the South and East China Seas and the waters throughout the first island chain.[41] Extremely difficult to detect, these systems could either attack surface vessels directly with torpedoes or lay smart sea mines in the approaches to Chinese ports.

The Air Force is experimenting with the XQ-58A vertical-launch drone to provide air support on the first island chain. Because it does not need an airfield and can be transported on a truck, it is almost impossible for China to preempt its operations. In addition, its long range means it can strike from almost anywhere within the first island chain. These VTOL systems are small enough to be transported in commercial containers and, thus, can survive on the island chain by remaining hidden until prepped for launch. Further, they can recover at locations other than their launch points.

Outside Force

The joint force could deploy a widely dispersed mix of legacy weapons like current US large warships and manned aircraft as part of the outside force. The good news is the US Navy's "Distributed Lethality" concept ("If it floats, it fights") seeks to upgrade the current surface fleet's combat power by improving existing missile systems and potentially adding them to amphibious and logistics-support ships.[42] They can be reinforced by unmanned surface ships as well as manned, armed merchant ships. At the January 2020 Surface Navy Association conference, Admiral Mike Gilday, chief of naval operations, noted the navy is exploring the concept of missile-armed merchant ships.[43]

Merchant ships can be armed with the containerized missiles and drones similar to those developed for the land-based forces. Container ships could be converted to warships by the addition of containerized weapons and a simple command-and-control system. Most importantly, they can add a great deal of firepower relatively cheaply.

In late 2018, new merchant ships were available for less than $50 million. Even if it cost $75 million to convert and add fifty missile tubes, the $125 million total is a fraction of the $400 million purchase price of a littoral combat ship

40 David B. Larter, "Here's 5 Things You Should Know About the US Navy's Plans for Big Autonomous Missile Boats," *Defense News,* January 13, 2020, https://www.defensenews.com/digital-show-dailies/surface-navy-association/2020/01/13/heres-5-things-you-should-konw-about-the-us-navys-plans-for-big-autonomous-missile-boats/.

41 Ben Werner, "Navy Awards Boeing $43 Million to Build Four Orca XLUUVs," *USNI News*, April 17, 2019, https://news.usni.org/2019/02/13/41119.

42 Thomas Rowden, "Surface Warfare Strategy: Return to Sea Control," *USNI News,* January 9, 2017, https://news.usni.org/2017/01/09/document-u-s-navy-surface-force-strategy.

43 H. Robinson Harris et al., "Converting Merchant Ships to Missile Ships for the Win," Naval Institute Proceedings, January 2019, https://www.usni.org/magazines/proceedings/2019/january/converting-merchant-ships-missile-ships-win.

(LCS) hull.[44] A missile-equipped container ship would need a crew of only about thirty, in contrast to the one hundred needed to crew the LCS. The ship would be expendable, with the crew abandoning ship if it takes a serious hit—much like the LCS. But, unlike the LCS, container ships are very strongly built, due to the requirement to resist hogging and sagging of their long hulls in heavy seas.[45] Many even have double hulls and—since the missiles, maintenance, operations, and living spaces will require fewer than fifty containers—there will be room for more than three thousand additional containers. These containers could be filled with energy-absorbing foam, or even sand, to create a form of armor for the container ships.

Most importantly, this much more survivable and cheaper class of ship could add a vast number of missiles to the fleet. For the price of one DDG-51 *Arleigh Burke*-class destroyer, the United States could purchase sixteen missile merchants.[46] This would put up to eight hundred missile tubes at sea, compared to the ninety-six on current DDGs.

In addition to increasingly capable cruise missiles, VTOL drones like the *Valkyrie* mean almost any seagoing vessel can be a small aircraft carrier. Highly capable drones will provide the US Navy with great advantages, not least of which is a 1,500-nautical-mile strike range, which expands to three thousand nautical miles if the drones are sent on a one-way trip, compared to the six-hundred-nautical-mile range of the F-35C.

Missile merchants would also provide assets that could be rapidly mobilized in time of war. While it will take years to build new combatants, the economic slowdown inevitable in a US-China conflict means that hundreds of container ships will be idled and available. They can be converted to missile merchants in weeks or months. Further, they could be crewed by Navy Reserve personnel. The missile-control centers will be in standard containers. These containers could be placed at Naval Reserve centers around the nation. During monthly training, these systems could provide simulators to run the weapons system reservists through exactly the same steps they would need to launch weapons during war. To sail the ships, officers could be drawn from Merchant Marine officers—many of whom already hold reserve commissions. Reserve crews could also be trained to man the ships themselves. During summer training periods, the weapons crews and ships crews could deploy together on a ship for training.

To test the concept, the US Navy should purchase and equip several of these ships and place them in service as quickly as possible. Under international law, these ships could be classified as auxiliary cruisers if commanded by a naval officer and, as such, have the normal port and transit privileges.[47] Their appearance will have minimal effect on the US-flagged container fleet, since today it consists of only sixty-five ships.[48] Once the systems are developed and the employment concepts established, provisions can be made to quickly purchase and equip additional ships during mobilization.

Finally, blockade operations at distant straits can be carried out by Marines and soldiers operating from either amphibious ships or commercial shipping. Supported by helicopters, they could free Navy forces for the critical mission of defeating the PLAN.

Homeland Force

The emergence of a serious cruise-missile-force threat to the homeland, as well as the potential for using smart mines to close US harbors, means the homeland-defense force must be identified and trained. Developing and maintaining maritime and airspace awareness around the borders of the United States will be a major challenge and will require large resources. Fortunately, this is a mission well suited to legacy air-defense forces, to include current US short-legged fighters, if they can develop the capabilities necessary for domain awareness.

Unfortunately, current US mine-clearance capabilities leave much to be desired, and the challenge is extraordinary. If a ship hits a mine in US harbors, shipping-insurance rates will climb immediately.

The Pentagon must dedicate more resources to the defense of US territory, with particular emphasis on increased air- and sea-domain awareness, cruise missile defenses, and mine-clearance capability and capacity.

44 Ronald O'Rourke, "Navy Littoral Combat Ship (LCS)/Frigate Program: Background and Issues for Congress," Congressional Research Service, June 14, 2016, https://fas.org/sgp/crs/weapons/RL33741.pdf.

45 "Longitudinal Strength of Ships—Hogging and Sagging Moment," Maritime Industry Affairs, March 12, 2019, https://www.worldmaritimeaffairs.com/longitudinal-strength-of-ships-hogging-and-sagging-moment/.

46 "Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress," Congressional Research Service, December 17, 2019, https://fas.org/sgp/crs/weapons/RL32109.pdf.

47 Chris Rawley, "Distributed Lethality, Non-Traditional Fleets, and the Law of War," Center for International Maritime Security, February 24, 2016, http://cimsec.org/distributed-lethality-non-traditional-fleets-law-war/22287.

48 I. Wagner, "US-Flag Oceangoing Privately Owned Merchant Fleet as of January 2019, by Ship Type," Statista, July 26, 2019, https://www.statista.com/statistics/652122/us-flag-oceangoing-privately-owned-fleet-by-type/.

Priority and Sequencing

The top priority will be defending the homeland. Fortunately, homeland-defense forces will operate from within the United States, so they can be mobilized quickly if the Pentagon prepares a plan to do so. As noted, the most serious current weaknesses are domain awareness, mine clearance, and cruise-missile defense.

At the same time, the United States will be defending the first island chain with contact and blunt forces. This is essential to honor its alliances with Japan, Australia, and the Philippines. Of particular importance, Japan provides a well-equipped and well-trained navy and air force that can hold the passages through Japan's islands. Japan's Ground Self Defense Force already has five regiments equipped with anti-ship cruise missiles. Australia can provide essential bases for controlling the Malacca, Lombok, and Sunda Straits, as well as forces that can control passages north and south of Australia.

The Philippines provides key terrain for the mobile ground task forces that can dominate the passages through the Philippine Islands. In February 2020, Philippine President Rodrigo Duterte ordered his administration to issue a notice of termination of the Visiting Forces Agreement between the United States and the Philippines. If the agreement is terminated, US forces will most likely no longer train in the Philippines. And, while the Philippines has not withdrawn from the US-Philippines Mutual Defense Treaty, it is reported to be reconsidering the treaty. Philippine refusal to allow US forces to operate from the Philippines in time of war would make the execution of this strategy more difficult, but not impossible.

And, while the United States does not have a formal treaty with Taiwan and cannot send forces to train there, Taiwan can use the same package of equipment and concept of defense to provide a much harder target if China chooses to attack it.

If the United States declares maritime exclusion zones, then ground forces can immediately assist in the enforcement of the blockade, as well as attriting those Chinese forces attempting to move beyond the first island chain.

The second priority will be to establish dominance outside the first island chain. This will eliminate any PLAN forces outside the first island chain and establish control of the Malacca, Sunda, and Lombok Straits.

Finally, the United States will work to deny Chinese shipping use of the South and East China Seas. This is desirable, but not essential; if allied forces hold the exits to the seas, they will be of minimal economic value to the Chinese.

Theory of Success (Not of Victory)

Offshore Control does not seek decisive victory in the traditional military sense. It recognizes the fact that the very concept of decisive victory against a nation with a major nuclear arsenal is fraught with risks, if not entirely obsolete. Rather, it defines success as the termination of the conflict on US terms through China's economic exhaustion. By sustaining the distant blockade, the United States and its allies isolate China from the sea, which will reduce its economy drastically, even as demands for wartime production increase sharply.

By employing the identified emerging technologies, allies can sustain the A2/AD buffer much more cheaply than China can penetrate it. To defeat the blockade, China would have to gain control of the seas from its mainland all the way to the Middle East (for energy) and to Europe and the coast of Africa (for trade and raw materials.) The farther the PLAN gets from the protection of the PLAAF and PLARF, the more vulnerable it is to US naval power.

Offshore Control seeks to demonstrate to CCP leadership that China cannot break the blockade. But, it also allows the Chinese Communist Party to end the conflict when it sees that sustaining the effort is not worth the gain. A sea blockade is also a flexible instrument that can be adjusted to increase or decrease the pressure on CCP leadership. The United States should avoid escalating the conflict with strikes against mainland economic and infrastructure targets. This gives the CCP an opportunity to terminate the conflict the way it has ended its previous foreign wars. Against India, the United Nations in Korea, the Soviet Union, and Vietnam, China has stopped fighting and declared it "taught the enemy a lesson." This is the conflict termination the United States should seek in a war with a thermonuclear armed power. At the same time, the conflict should destroy a major portion of China's power-projection capability if it tries to seize terrain on the first island chain or break the blockade.

Autonomy: A Requirement

The key to employing swarms of small, smart weapons is autonomy. It will be impossible for human operators to control each of the hundreds, or even thousands, of weapons systems that must be employed in a near-peer fight. This leads us to the ongoing discussion about the level of autonomy the United States can build into its new weapons systems.

Human Rights Watch notes that the level of autonomy granted to weapons systems can vary greatly. Its categorization is worth quoting at length:

"Robotic weapons, which are unmanned, are often divided into three categories based on the amount of human involvement in their actions:

- **Human-*in*-the-Loop Weapons**: Robots that can select targets and deliver force only with a human command;
- **Human-*on*-the-Loop Weapons**: Robots that can select targets and deliver force under the oversight of a human operator who can override the robots' actions; and
- **Human-*out-of*-the-Loop Weapons**: Robots that are capable of selecting targets and delivering force without any human input or interaction."[49]

Human-in-the-loop is the method the United States has used for its drone missions against terrorists and insurgents. A person must physically "pull the trigger" before the weapon can fire. This is clearly the preferred method when there is time. Unfortunately, the fact is that in high-intensity engagements such as a naval fight with multiple sub- and super-sonic missiles, drones, aircraft, and surface targets, humans cannot analyze and understand the information fast enough to successfully defend their units. The US Navy developed the autonomous mode for the Aegis Combat System and the Phalanx close-in weapons systems as the only way to defend against these types of attacks. The rapidly improving capabilities of both drones and missiles means many, if not most, engagements in a near-peer fight will be conducted at machine speed.

The second approach, human-on-the-loop, attempts to compensate for human limitations by limiting the human to monitoring the weapon and intervening only if it is making a mistake. This concept allows the system to operate at machine speed, but also accepts that humans will be too slow to analyze all of the system's actions in a high-tempo engagement. Thus, the human will either not intervene in time to prevent a mistake, or will intervene and fatally slow the system.[50]

Human-out-of-the-loop is not yet technically feasible. This would assume artificial intelligence designed, built, programmed, positioned, and employed the weapon. Even a simple land mine requires human input to determine what triggers it, where it is placed, and when it is activated. Despite Human Rights Watch's inaccurate definition, all existing weapons require human input, even if a human is not actively monitoring the weapon at the time of employment.

The third category is really "human-starts-the-loop" and not "human-out-of-the-loop." No currently existing autonomous systems can execute a mission "without any human input or interaction." All weapons systems still require humans to design them, position them, and determine the algorithms the system will use when activated—by a human. Thus, until Skynet becomes sentient, even fully "autonomous" systems such as the Aegis require a great deal of human input. However, this approach has an enormous advantage over the others. Since human input takes place before the fight starts, humans have sufficient time to think through the actions necessary to make the weapons most likely to perform in accordance with legal and ethical considerations. "Human-starts-the-loop" has been in use since the armed forces fielded heat-seeking air-to-air missiles, Captor smart sea mines, Patriot Missile System, Aegis Combat System in its auto-special or autonomous mode, Harpy drones, close-in weapons systems, and advanced torpedoes. These systems fully comply with current DoD policy that states, "autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operations to exercise appropriate levels of human judgment over the use of force."[51] In fact, the United States and several other nations have operated weapons using the "human-starts-the loop" concept for decades.

It is particularly disturbing that limiting the discussion to human-in-the-loop and human-on-the-loop avoids the ethical and moral responsibility to both the United States and its potential opponents. Neither system will work in time-critical engagements; in essence, this is a discussion about which failed system to assign to killing humans. Further, the discussion does not include the moral and ethical responsibility to protect US and allied service personnel in a near-peer fight.

Rather than trying to overcome the fundamental shortcomings of the first two approaches, the United States must accept the reality that a system based on the human-starts-the-loop concept is the only approach that allows US forces to defend themselves in time-critical engagements. It is the best approach to minimize human limitations, while maximizing the probability that autonomous weapons meet legal and ethical standards. It will not be perfect, but that is not the proper measure. The proper measure is whether it

49 "Losing Humanity: The Case Against Killer Robots," Human Rights Watch, November 19, 2012, https://www.hrw.org/report/2012/11/19/losing-humanity/case-against-killer-robots.

50 For a detailed discussions of the problem with having a human in the loop, see: Richard Danzig, *Technology Roulette: Managing Loss of Control as Militaries Pursue Technological Superiority, Center for a New American Security*, May 30, 2018, 13–17, https://www.cnas.org/publications/reports/technology-roulette.

51 Department of Defense Directive Number 3000.09, November 21, 2012, 2, https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/300009p.pdf.

is better than a human at executing the task in accordance with ethics, law, and the moral imperative to take care of one's own people while minimizing collateral damage.

Obviously, the key factor is getting the parameters right, from design through to weapons launch. For passive weapons, parameters range from setting an anti-tank mine to only destroy heavy vehicles to building sophisticated algorithms that enable a smart sea mine to match the magnetic, acoustic, and pressure signatures unique to a certain type of target. Even for these passive systems, artificial intelligence can already make finer distinctions and use a higher number of variables for confirmation of the target than a human can.

The same logic extends to offensive systems, which are rapidly becoming more capable. Designers understand they will have to operate in a communications-denied environment, and are striving to dramatically increase the onboard capability to properly identify a target and engage a target without human intervention after launch. In fact, the increasing range and capability of many new weapons virtually eliminate the distinction between offensive and defensive weapons. For instance, new anti-air or anti-ship missiles can kill a target hundreds of miles away. Why would this be considered defensive while a smart, autonomous weapon that kills the same target sitting at an airfield or port at a lesser range would not be?

As always, each conflict will have its own training requirements, rules of engagement (ROE), political factors, and strategic objectives. Clearly, a conflict with China presents a much different threat to the US Navy than conflict in the Persian Gulf. Thus, a ship sailing far out in the Pacific will establish different ROE and engagement triggers than one operating inside the tight waters of the Gulf. Similarly, the guidance for that same ship will change as it closes with China's coastline. As engagement times decrease, autonomous defensive systems, by necessity, must have fewer restrictions.

Just as important as the algorithms built into each system is individual operator and crew training concerning when to activate the autonomous mode. What conditions determine when an operator may shift the system to fully autonomous? Who in the crew makes that decision? Does it change under different conditions? What key indicators show that the changing tactical situation requires a change in the concept of employment?

This is no longer a purely theoretical discussion. Autonomous weapons are being fielded by an increasing number of nations, and even by armed groups around the world. Rather than continuing this increasingly artificial and irrelevant debate on the level of required human supervision after launch, the United States needs to focus on refining the weapons and sensor designs, and the guidance provided to operators and systems prior to launch. Constant experimentation, testing, and training is the only way to provide reasonable confidence that autonomous systems will engage within the desired ethical, legal, operational, strategic, and political parameters. It is time to get on with it.

The Return of Mass and Mobilization

Compounding the Pentagon's problem, mass and mobilization will return to warfare. Since the 1980s, US forces have bet on precision to defeat mass. However, advanced manufacturing has the potential to revive mass (in terms of numbers) as a key combat multiplier. As it becomes the standard method of manufacturing, mobilization may also return. In the same way automobile plants shifted to producing aircraft in the Second World War, advanced manufacturing plants using 3D printing and robotics may be able to shift to producing drones and cruise missiles.

The rapid global diffusion of advanced manufacturing will make large numbers of cheap, long-range drones available to many states, and even some non-state actors. Forces dependent on today's exquisite, but few, air and sea platforms will be severely challenged by swarms of small, smart weapons. While the services are experimenting with a variety of directed-energy and electronic-warfare weapons to deal with these swarms, these defenses must be tested in a realistic environment. The opposition must be free to use creative countermeasures such as autonomy to defeat jamming; obscurants to defeat visual and infrared targeting; and electronic hardening to protect systems from directed-energy weapons.[52] The services must also get serious about how they will create their own mass, and mobilize the personnel necessary to employ it effectively.

Transition

Perhaps the most difficult step in adopting a new concept with new equipment is the transition from old to new. The transition from trench warfare to blitzkrieg and battleship lines to carrier task forces took about two decades. Given the accelerated rate of change, it is prudent to assume the transition from few and exquisite to small, smart, and many will be faster. Fortunately, many historical examples illustrate how the process was previously handled. New technology and new concepts evolved in

52 T. X. Hammes, *Technologies Converge and Power Diffuses: The Evolution of Small, Smart, and Cheap Weapons, Cato Institute*, January 27, 2017, https://www.cato.org/publications/policy-analysis/technologies-converge-power-diffuses-evolution-small-smart-cheap.

parallel as they transitioned from helping the old system, to partnering with it, and to eventually replacing it. For instance, naval aviation started out helping the battleship admirals by locating the enemy fleet. As technology and concepts advanced, it added the ability to adjust fire for the battleships whose guns now ranged over the horizon. By the mid-1930s, operational and technical improvements to naval aviation meant that navies began to build strike groups around carriers as well as battleships. Naval aviation had become a full partner. And, of course, by mid-1942, it was clear that naval aviation had replaced battleships as the center of naval-warfare concepts.

The same transition with unmanned systems is taking place today. Cruise missiles started out as helpers in the Gulf War by suppressing anti-air systems. By Operation Iraqi Freedom, they were full partners, and today are replacing manned aircraft in high-risk missions. Drones have replaced manned aircraft for long-duration surveillance. They have become partners in strike missions in low-threat environments, and new systems are becoming "loyal wingmen" in high threat environments.[53] The process has started; the Pentagon must make major efforts to speed it up.

Conclusion

The Pentagon's current approach of continued heavy investment in few and exquisite legacy systems, combined with defense budgets that are declining in real terms, means the erosion of US comparative advantage is accelerating. China's heavy investment in improving its forces is steadily reducing the capability and capacity of the United States' forces to successfully execute the current strategy. Fortunately, the geography of the Asia-Pacific heavily favors the United States and its allies in a defensive campaign, and this provides the United States with an affordable path to maintain a viable defense.

The Offshore Control Strategy allows the United States to still effectively employ its legacy systems, but under conditions better suited to their capabilities. This is critical since, even if the United States stops purchasing *Ford*-class carriers after the USS *Miller,* it will have seven carriers through 2052 and three until 2072. Similarly, the F-35 fleet could be flying into the 2070s. While it is prudent to stop investing in these systems, it is also important to maximize the return on the massive investment made in them.

By adopting the Offshore Control strategy and shifting its investments to the rapidly improving weapons made possible by the Fourth Industrial Revolution, the Pentagon can take advantage of the fact that these new weapons favor the defense, as well as assure US allies and friends. By purchasing a mix of aerial drones, unmanned vessels, armed merchant ships, cruise missiles, and smart mines while developing the maneuver-warfare concepts necessary to employ them effectively, the United States can create a flexible, affordable, tough defense in depth, based on the first island chain. It can reassure and involve its allies while neutralizing much of China's massive investment in its counter-intervention strategy.

53 Tomas Kellner, "Mad Props: Why GE's New Catalyst Turboprop Engine is Turning Heads," GE Reports, May 27, 2019, https://www.ge.com/reports/mad-props-ges-new-catalyst-turboprop-engine-turning-heads/.

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