Lessons from Ukraine and the Red Sea on Autonomous Systems and the Future of the US Navy

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America's role in the world is increasingly contested. Living in a multipolar world with technologically competitive and strategically aggressive near-peer adversaries forces the United States to confront two uncomfortable truths. First, the American Navy is not the presumptive preferred maritime partner in peacetime or in competition—compelling counteroffers from the People's Republic of China (PRC), the Russian Federation (RF), Iran, and their proxy entities use levers of economic and political warfare to exact gains. Second, new and emergent technologies have democratized warfare and thus challenge the US Navy's ability to cultivate and project power at will. Grey hulls are no longer the currency of the realm.

While the United States has until this point accepted some level of operational parity as inevitable, conflicting security commitments and increasingly diverse adversaries hemorrhage American resources in inexorable mission creep. The simple reality is that our status quo is neither stable nor sustainable. Powerful legitimate actors such as the PRC and the RF continue to erode the deterrent effect of US security commitments, and if allowed to continue apace, the United States will end up overstretched and isolated in an unfriendly global commons. This is not our

preferred future, and we must prepare accordingly. More effectively competing with—and winning a war against—the PRC requires the US Navy to diversify and multiply its abilities to develop, field, and integrate new and emergent technologies including autonomous systems and artificial intelligence into its force design.

In order to accomplish this end, the US Navy must consider the following key tasks. First, the Navy must define and demonstrate the scope, scale, and battlefield relevance of maritime autonomous vessels for kinetic and nonkinetic effects. Second, the Navy will need to propagate maritime mission requirements that reflect trusted autonomy in naval systems across the fleet. For the purposes of this paper, trusted autonomy means that any autonomous systems, processes, or capabilities employed are utilized effectively and reliably at the individual level and are consistently integrated into military planning processes as a proven mode of enabling and projecting naval power. The desired end state is an autonomy-enabled capital fleet, augmented by intelligent autonomous systems, delivered at scale to preserve, protect, and project American maritime interests. This end state is a function of technology, economics, and security commitments.

This paper argues that persistent presence of autonomous systems in naval force structures is representative of a step-change in the very nature of warfare. As nation states and rogue actors multiply their fleets of autonomous systems, they are creating naval power from scratch at relatively low cost. We suggest that this change is significant for two reasons. First, the creation of cheap power forces a change in the risk and decision calculus for large actors, which are more likely to *be disrupted* by autonomous systems than to *do the disrupting*. Coercion is no longer using military power as a tool for inflicting violence as cost (as theorist Thomas Schelling suggests) but is a calculation of exploiting nuanced asymmetries in economics, norms, and the military.[1] Second, maritime conflict is no longer solely the purview of the Navy. This state of affairs is not a brief abnormality, but rather a complex and possibly inevitable consequence of drones democratizing warfare to multiply and diversify battlefield effects for any actor, against any adversary.

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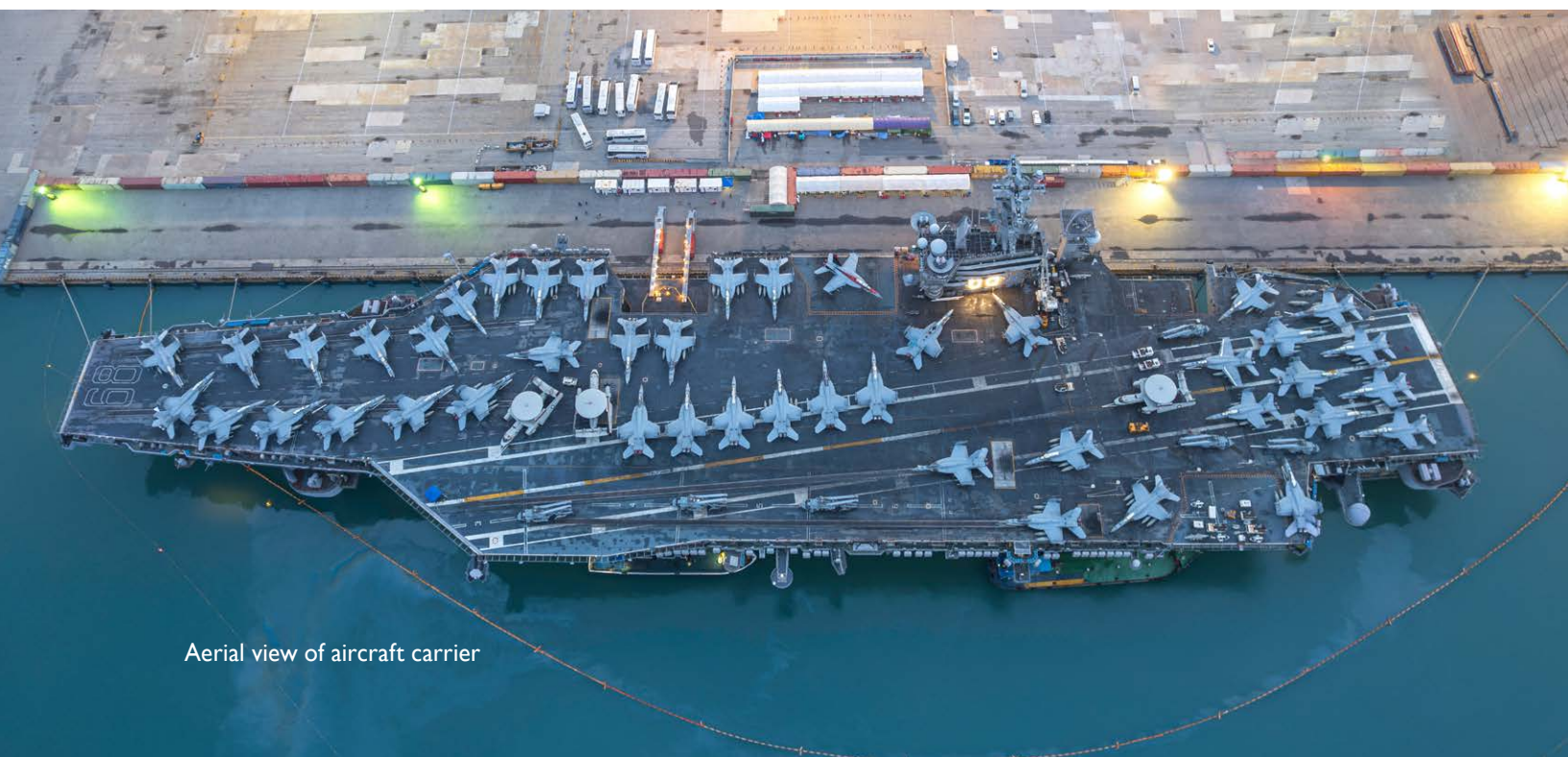
Aerial view of aircraft carrier

There are two ongoing examples of this phenomenon. The 2022 Russian invasion of Ukraine has proven that small, non-naval states can disrupt and decimate supposed great powers using commercial, off-the-shelf (COTS) autonomous technologies combined with irregular warfare tactics. While Russia is not to be underestimated, the Ukrainians have held on much longer—and inflicted more bloody, costly losses—than the world expected. In contrast, Houthi rebels in Yemen have targeted Red Sea shipping channels with hundreds of autonomous systems over the course of the past calendar year.[2] Whereas the Russia-Ukraine example shows the impact of autonomous systems in state-on-state conflict, the Red Sea hostilities demonstrate the multiplicative effects of autonomous systems for relatively inconsequential non-state actors. The next two sections of this paper analyze the extent of use and integration of autonomous systems in multiple domains for each case study and examine the efficacy and efficiency of drones as a battlefield effector. Finally, the last section of the paper synthesizes key lessons learned for the US Navy and its strategic competitors.

Ukraine and Autonomous Systems

The most salient and perhaps most painful reminder of autonomous systems as a battlefield equalizer is the Russo-Ukrainian War. The RF's early invasion in February 2022 was predicated on the supposition of an easy and relatively uncontested victory, with Russian land forces rolling across Ukraine's eastern border and the Russian Black Sea Fleet throttling shipping and supply routes.[3] Ukraine had no Navy; Russian maritime superiority was all but pre-sumed assured. This assumption proved fatal—in the past two years of war, Ukraine has "sunk or disabled a third of all Russian warships in the Black Sea."[4] Early strikes on capital ships and the subsequent brutal dismantlement of the rest of the fleet turned "the once-feared force into something of an afterthought in Europe's largest war in seven decades."[5] This result is not a function of great power war, nor is it even the function of two formidable navies meeting in battle. Ukrainian maritime forces are small, uncrewed, lethal drones that deliver diverse and scalable combat power without risk to force.

For example, the Ukrainians attacked "perhaps the most valuable target for [their] missile crews and drone opera-tors," the Russian Navy frigate *Admiral Makarov,* in October 2022.[6] Reports from multiple entities cite "at least one" unmanned surface vessel (USV) making contact with the *Admiral Makarov,* which served as the flagship of the Black Sea Fleet before it was rendered non-mission capable for nearly a year by Ukrainian USVs.[7] This attack is a strategic narrative and economic victory—the *Admiral*

Makarov is assessed to be a $450 million capability. Its weapons complement was one 100 mm A-190 Arsenal naval gun; eight UKSK Vertical Launching System (VLS) cells for Kalibr, Oniks, or Zircon anti-ship/cruise missiles; twenty-four 3S90M VLS cells for 9M317M surface-to-air-missiles; two AK-630 close-in weapons systems; eight Igla-S or Verba air defense systems; two double 533 mm torpedo tubes; and one RBU-6000 rocket launcher.[8] However, the vessel was seemingly taken out by good tactics, planning, and a USV.

Furthermore, the Russian Black Sea Fleet took a protective stance in its home port of Sevastopol and even removed some assets back to Novorossiysk.[9] This move constituted a strategic impact and critical shaping mechanism for the conflict, forcing a supposed great power to extend its supply lines, accept a critical operational loss, and lift and shift millions of dollars of equipment.[10] As military analyst, former Ukrainian Navy captain, and Black Sea security expert Pavlo Lakiychuk stated in his interview with the *Kyiv Independent,* "It isn't hard to see that the Russian Black Sea Fleet is not currently capable of serving its function in this war, and especially is incapable of supporting Russian ground forces in southern Ukraine."[11] USVs are not just Navy makers, they are Navy breakers.

Even if we were to estimate four Ukrainian USVs were necessary to hobble the *Admiral Makarov,* that economy of warfare is 450 to 1. Undoubtedly, the Ukrainians proved a concept—unmanned systems, autonomy, and COTS items must be used for asymmetric advantages in the new age of warfare. Large exquisite systems no longer hold the advantage on the battlefield, and ruling powers such as the United States must address the new threat en-vironment by building their own capability, constructing resilient and robust defense mechanisms, and leveraging irregular warfare for scalability and flexibility in combat. The battlefield becomes increasingly more complex as autonomy and artificially intelligent systems continue to mature in their capabilities.

The Red Sea and Autonomous Systems

Since the October 2023 attack on Israel by Hamas, multiple rogue actors have seized on regional instability to foment discord, interrupt international shipping, and force major powers to commit grey hulls to eliminating drones. The United States and its regional partners and allies have defended Red Sea shipping and, more recently, conducted strikes on Houthi targets in Yemen. Despite a twenty-country naval task force and incontrovertible mismatch in

The *Admiral Makarov*

power, the Houthis have disrupted shipping in one of the most consequential maritime corridors in the world.

The US Navy has repeatedly shot down Houthi drones from air and sea, one after another, compounding cost. Budgetary analysts and program managers across the US Department of Defense dislike the mismatch—multimillion-dollar missiles are being used to destroy thousand-dollar drones. The reality is that things are about to get much more expensive. The Red Sea crisis is a natural consequence of the democratization of warfare. Smaller entities such as the Houthis and other proxy forces can easily expand operational reach, increase lethality, and augment poorly manned or poorly trained forces with attritable and affordable autonomous systems. When that democratized military capability is applied to a sensitive regional area like the Red Sea or the Gulf of Aden, an outsized trade impact on the 7.1 million barrels of oil and 4.5 billion cubic feet of natural gas that transit the Bab el-Mandeb every day will have ripple effects across the globe.[12] Houthi activities in the Red Sea showcase that Alfred Thayer Mahan's[13] thesis on entanglement of economics and seapower as a means for prosperity and security is not exclusively applicable to nation states, and that land-based bad actors without sea power can still exert sea control.

The Red Sea crisis is a natural consequence of the democratization of warfare.

Advances in weapons systems allow land-based actors to shape maritime behavior, forcing military vessels to strike sovereign territory and thus carry escalation risk. When combined, these factors all pressurize the US defense apparatus and challenge America's ability to maintain its security commitments—ultimately benefitting near-peer adversaries or regional disrupters who wish to see US forces distracted, all the while riding the coattails of the US Navy's policing of the global commons. Iranian sponsorship of the Houthis, Hamas, and Hezbollah has created strategic dilemmas for the United States. Houthi use of unmanned systems in the Red Sea poses a multi-faceted threat by 1) targeting US allies and interests, 2) conducting asymmetric warfare, and 3) complicating peace efforts, thus destabilizing the region and fractioning US military presence.

First, Houthi decisions to target key infrastructure in Saudi Arabia and the United Arab Emirates temporarily disrupted the global oil supply and highlighted vulnerabilities in critical infrastructure. Notable Houthi attacks include strikes on the Saudi Aramco oil facilities in September 2019 and again in March 2022—the political

Ensign Hunter Riportella relays information from the bridge aboard the guided-missile destroyer USS *Mason* (DDG-87) during a vertical replenishment with the aircraft carrier USS *Dwight D. Eisenhower* (CVN-69) in the Red Sea, 8 January 2024.

blowback from repeated attacks pressured the United States to support its allies in bolstering their defenses, diverting attention and resources from other strategic priorities.[14] More recently, the US Navy has rerouted the USS *Theodore Roosevelt* (CVN-71) and its carrier strike group complement from INDOPACOM to the Red Sea to "maintain a presence in the region."[15]

Second, Houthi strikes in the Red Sea have identified and exploited the asymmetric advantage of small attritable systems in a complex operating environment. Similar to the Ukrainian use case, leveraging autonomous systems is a relatively inexpensive way for the Houthis to split strategic attention, force attrition of payloads, and cripple the international economy.[16] By operating on a low-cost, high-density business model, the Houthis can maintain their operations despite limited resources and a capability-constrained environment. These multidomain attacks come in the form of "anti-ship cruise missiles, anti-ship ballistic missiles, explosive surface drones, and aerial drones as well as uncrewed underwater vehicles (UUVs)," all of which require the United States to develop robust multidomain counter-drone technologies and tactics to protect assets, allies, and equipment in the region.[17]

Third, Houthi strikes have broader regional effects. Increased friction in the region complicates multilateral peace efforts to resolve conflict in Yemen and hobbles the flow of goods and services around the world. While the September 2023 peace talks between all parties seemed promising—"Yemenis [were] benefiting from commercial flights; fuel and commercial ships [were] entering via Hudaydah port; and hostility levels [were] significantly lower"—Houthi basing in Yemen and seemingly in-discriminate strikes on commercial and military ships smothered any optimism for a near-term resolution.[18] This diplomatic stagnation has also had economic conse-quences. For example, early reporting from the *New York Times* indicated that "Shipping companies have tripled the prices they charge to take a container from Asia to Europe, partly to cover the extra cost of sailing around Africa. Shipowners that still use the Red Sea, mainly tanker owners, face rising insurance premiums."[19] Once again, the United States is leading a coalition force through Opera-tion Prosperity Guardian to deter or destroy incoming threats to commercial and military vessels regardless of flag.[20]

Notably absent from Operation Prosperity Guardian, the PRC has "avoided criticizing the Houthis and has not participated in military actions against them."[21] The Chi-nese and Iranian relationship has historically been one of opportunity for Beijing, focusing on securing energy flows and managing a consistent, if relatively low-level, security cooperation agreement. China may not be interested in an Iran-US war, but it is certainly interested in maintaining strategic ambiguity in INDOPACOM through ambiva-lence or scope creep.

Beijing routinely hedges its bets on alliances in the Middle East by courting several regional adversaries in an attempt to provide energy resource sustainability and resiliency. Despite US sanctions on Iran, China imported an average of 1.05 million barrels per day (bpd) of Iranian crude oil in 2023, with a peak of 1.45 million bpd in October 2023.[22] This is not to say that the PRC needs Iranian oil exclu-sively; it purchases oil from Saudi Arabia and Russia as well, ultimately importing roughly 72% of its oil supplies.[23] China has options if Iranian politics become too unstable or its other, more profitable allies push Beijing to sever ties. Iran, on the other hand, does not have this luxury. If China were to divorce itself from the Iranian regime, Iran would lose its largest consumer—the PRC imported $5.72 billion in Iranian goods in 2022.[24] China may not be interested in dealing with a war in the Middle East, which would increase costs on its oil imports and complicate its economic development projects in the region. To this end,

China has (at least outwardly) managed its relationship with Iran and has not declared support for the Houthi proxy forces that have destabilized the Red Sea and the Gulf of Aden.

PRC silence on Houthi activity may have broader implications—it is possible that destabilization of shipping and military activity in the Red Sea is not designed to benefit the separatist movement in the long term, but rather to forcibly split US attention between CENTCOM and

Lessons, Consequences, and the Future of Warfare

Despite stark differences in cause and mission, the Ukrainian and Houthi employments of autonomous systems provide the United States with several key lessons on the future of naval warfare. As US Naval officer Mike Knickerbocker notes, "both forces have effectively utilized commercially available or inexpensively developed unmanned systems and anti-ship cruise missiles to great effect,

Yemeni forces during training to confront the Houthis

INDOPACOM. To this end, Chinese supplies of weapons components to Iran allow Tehran to siphon off US attention and resources by, with, and through non-state actors.[25] Given its role as the main security guarantor in the Middle East, the United States is forced to commit assets to protecting maritime freedom of movement and thus cannot focus its efforts towards managing competition in the Pacific.

stressing and challenging technologically and numerically superior adversarial forces in the Black and Red Seas."[26] The simple reality is that autonomous systems are scalable, attritable equalizers of naval power, and the United States needs to be prepared to both engage and employ these vessels with confidence. In doing so, there are three key lessons that the Department of Defense should consider:

The simple reality is that autonomous systems are scalable, attritable equalizers of naval power, and the United States needs to be prepared to both engage and employ these vessels with confidence.

1. First, *naval power is not exclusive to the good guys.* While the Ukrainians have been able to decimate a supposed great power fleet, the Houthis have strangled international shipping and conducted strikes on US and allied assets. New technologies still have old form factors that can be devastatingly effective—converted jet skis, motorized kayaks, and cardboard unmanned systems show us that obsolescence can still kill.

2. Second, *irregular warfare still matters.* Low barriers to access for lethal force allow rogue actors to complicate and complexify the battle space. The ability to understand, leverage, and mitigate new and emerging technologies is most likely the purview of special operations forces (SOF), as they are the only organization able to proactively prepare for hyper-enabled conflict down to the individual unit level. The requirement for being well prepared is having a decentralized command structure and a flexible, articulable force structure. SOF does both of these extremely well, but

UAV operator launching drone
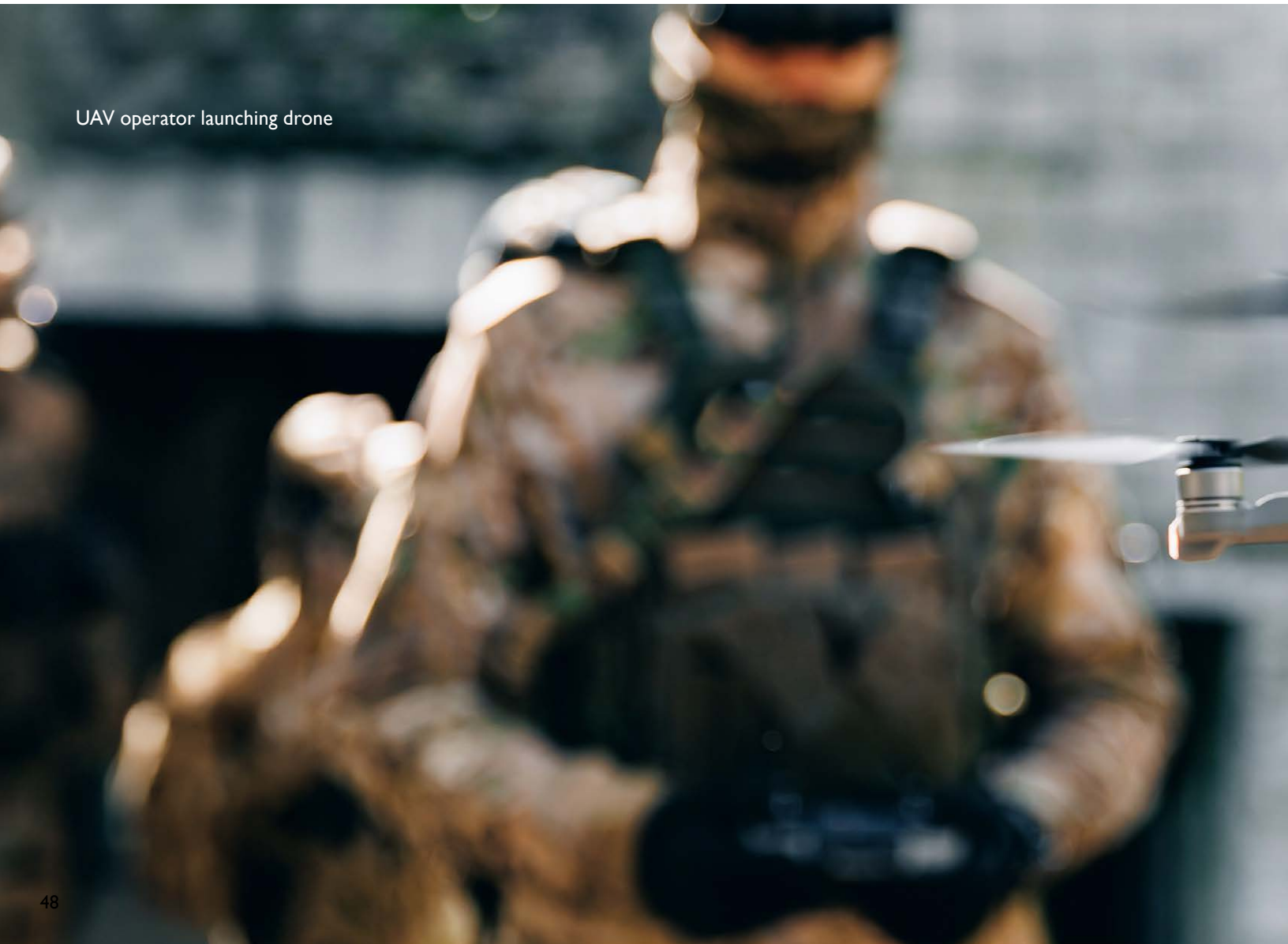
the US Navy has only the first in spades. The second is a more complex relic of WWII force design. The idea of using a historic force structure to restore regional stability—a laughable goal for anyone who has passingly studied the Middle East—is doomed to failure.

3. Third, *China is watching.* Just as the United States is learning from Ukraine and the Red Sea, the PRC is learning as well.[27] Funneling weapons and cash to Iran and thus to the Houthis is demonstrative of the PRC's anti-access/area denial (A2/AD) construct working without their explicit involvement, allowing Beijing to watch and carefully measure US reactions. While Iran is a partner of convenience, China is learning that it can sever the Achilles tendons of the international economy for a wallet-friendly price point.

Most importantly, both the Black Sea and Red Sea engagements demonstrate to the PRC and the world that seapower and sea control are not strictly maritime endeavors. While history might suggest that naval power is unidirectional from sea to land, the Houthis and Ukrainians are unintentionally validating the People's Liberation Army Navy concept that sea power can be land-based, and it does not have to come from a global power to have global effects.

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NOTES

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