Center for a New American Security

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Arresting the Erosion of America's Military Edge

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The Ongoing Disruption in Military Affairs

America's armed forces are the most highly trained, equipped, and experienced in the world—yet the margin of their battlefield superiority is eroding. Whether our armed forces and international allies and partners are facing the determination of a dictatorship fighting for its continued existence, a rising power determined to flex its military power in pursuit of its maritime interests, or a former great power doggedly refusing to cede influence in its near abroad, beneath those headlines is a consistent trend that powerfully influences the nature of these and other security competitions. That trend is the slow but steady erosion of America's military-technical superiority, something that U.S. policymakers have come to assume and a feature of the international system that our core allies depend on for their security and, in some cases, their survival. Unless that trend is arrested, America's armed forces will find it more difficult to prevail in future conflicts.

Modern American military strategy depends on technological superiority. This was a consistent pillar of strategy during the Cold War, the interwar years to follow, and the wars of the post-9/11 era. American presidents are rightfully loath to send military personnel into the breech without a clear qualitative military edge. What was once an element of deliberate strategy has, over the course of decades, evolved into a presumption of technological superiority.

This presumption stems from nearly thirty years of the United States enjoying an unrivaled military-technical edge in conventional weapons. This edge was deliberately honed by the adroit use of defensed-directed research and development spending in the twilight years of the Cold War. This military-technical strategy—referred to as the "offset strategy"—served to spur first a revolution in military affairs and then a broader societal shift that thrust the world headlong into the information age. That underlying investment portfolio bequeathed advanced computer networking or what became the Internet; the global positioning constellation of satellites; stealth technologies; advanced intelligence, surveillance, and reconnaissance (ISR) platforms; and precision guided munitions or "smart weapons." The resulting monopoly on precision munitions and the efficient means of their delivery is among the reasons the United States stood alone and triumphant at the end of the Cold War, and enjoyed unrivaled military superiority in the decades that followed.

But today's Pentagon leaders are conveying with some urgency the view that this defining military-technical edge is eroding to the point where the United States can no longer rest its defense strategy on the confidence that it enjoys a qualitative military edge against plausible future adversaries. That we can no longer do so portends a seismic disruption in military affairs.

The erosion in American military-technical superiority is occurring because the technologies that underwrote that position are now nearly fully proliferated throughout the international system. The United States must now deal with advanced integrated air defense systems, stealth technologies, and, most problematically, precision guided munitions. The same technologies that U.S. forces enjoyed a monopoly on for decades are now central to the defense strategies of America's competitors. This is *terra incognita* to U.S. defense planners, who are now several generations removed from those who worked under the daily pacing threat of a near-peer competitor with global military reach.

The Velocity of Change and Diffusion of Military Power

The erosion of America's military-technical edge is exacerbated by two overarching trends that are driving the emerging security environment and powerfully shaping U.S. defense strategy and planning: the *velocity of geopolitical change* and the *accelerating diffusion of military power*.

The velocity of geopolitical change could very well be unprecedented in the modern era. Several trends here are worth highlighting. First, the erosion of state power typified by the ongoing collapse of Arab regimes and the implications throughout the Middle East and Europe are unprecedented in their scale and pace. Second, the return of great power politics driven by the rise of China as a global maritime power and the resurgence of Russian determination to maintain continental influence in its near abroad. Third, the rapidly changing geopolitics of energy driven by the shale oil revolution that is positioning North America to be a net energy-exporter by the end of the decade. Any one of these "macro" trends would be sufficient to cause significant disruption in global affairs, but that all three are occurring simultaneously will greatly complicate U.S. statecraft and the formulation of cohesive national security strategy.[1]

These trends are all complicated by the accelerating diffusion of military power.[2] The very forces unleashed, in part, by the Pentagon's Cold War-era research into advanced computer networking (to ensure the survivability of U.S. nuclear forces and hence the credibility of their deterrent power) helped spur a commercial revolution that thrust the world into the information age. This in turn accelerated the diffusion of military power by supercharging globalization and creating the broader knowledge economy, which together served to lower entry barriers that heretofore prevented many state and non-state actors from acquiring advanced military technology.[3] The result of this diffusion of military power has been to expand the employment of advanced technology both horizontally (i.e. more actors are

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[1] There are, of course, other significant global trends. See the National Intelligence Council report *Global Trends 2030: Alternative Worlds*. On the geopolitics of energy, see Elizabeth Rosenberg, *Energy Rush: Shale Production and U.S. National Security* (Washington DC: Washington DC: Center for a New American Security, 2014). On the rise of China see Robert Kaplan, *Asia's Cauldron: The South China Sea and the End of a Stable Pacific* (New York: Random House, 2014).

[2] See Michael Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (New Jersey: Princeton University Press, 2010).

[3] One of the first to talk about the "democratization of violence" was Fareed Zakaria in *The Future of Freedom: Illiberal Democracy at Home and Abroad* (New York: W.W. Norton, 2003).

employing them) and vertically (i.e. the technology is employed throughout an actor's military organizations).

These ongoing geopolitical trends and the diffusion of military power described above are causing the security environment to evolve at a pace that makes defense planners and strategists uncomfortable as it raises the risks of strategic surprise and the resulting consequences.

Contours of the Operational Environment

The forces driving the evolution of the security environment shape the contours of what defense planners call the "operational environment"—the space within which military forces will compete with one another in peacetime and engage in violent action when asked to do so. There is a spectrum of activity along which military leaders must prioritize the creation, training, equipping, readiness, and geographic posture of military forces. Assessments of the likely operational environment must inform such choices.

Based on the likely security environment outlined above and insight derived from assessments of recent conflicts, there are three trends that will directly shape the battlefields on which future U.S. military forces will fight: the proliferation of precision munitions; the expanding size of battlefields; and the increasing ability to find and target military forces.

First, precision munitions will dominate battlefields. The United States held a near-monopoly on the use of precision-guided munitions since they were introduced at scale during the 1991 Gulf War.[4] Precision munitions enable military forces to hit targets with near-zero miss—in other words, accuracy becomes independent of range. The introduction of precision munitions ushered in a revolutionary break in warfare that is accelerating throughout the international system. Precision munitions have now proliferated so extensively that nearly any actor who desires to employ them can do so effectively on the battlefield. Defense analysts refer to this dynamic as the ongoing maturation of the precision strike warfare regime.[5] As retired Lieutenant General George Flynn, U.S. Marine Corps, has noted, " … the prospect of even non-state actors being able to hit more or less everything they aim at with precision guided mortars, artillery, and short-range rockets is not only worrisome, but unavoidable as relatively inexpensive guided weaponry proliferates world wide."[6] The implications for military strategy are significant, and Pentagon planners must now assume that any future adversary will employ precision munitions against U.S. forces.

Second, the size of the battlefield will expand. The proliferation of precision munitions and the battle networks that support their employment are increasing the effective range of military units. The introduction of guided munitions at all levels of operation means not only that military units can hit

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[4] Early antecedents of guided munitions stem as far back as the wake-homing torpedoes that emerged at the end of World War II. See Barry Watts, *The Evolution of Precision Strike* (Washington DC: Center for Strategic and Budgetary Assessments, 2013). Also see Robert Work and Shawn Brimley, *20YY: Preparing for War in the Robotic Age* (Washington DC: Center for a New American Security, 2014).

[5] See Andrew Krepinevich and Barry Watts, *The Last Warrior: Andrew Marshall and the Shaping of Modern American Defense Strategy* (New York: Basic Books, 2015).

[6] As cited by Barry Watts in *The Maturing Revolution in Military Affairs* (Washington DC: Center for Strategic and Budgetary Assessments, 2011): p.11. Also see Dan Lamothe, "More Accurate Artillery Concerns General," *The Military Times* (April 20, 2010).

what they can see but also that the ranges across which they can do so can increase. This is not simply a challenge in the air and maritime domain, where U.S. forces have had to deal with the proliferation of precision munitions for some time, but increasingly will pose serious challenges for U.S. ground forces. The introduction of guided rockets, artillery, mortars and even bullets will make ground combat far more lethal, as the ability to maneuver using terrain features to shield forces from enemy fire will become much more difficult against an adversary with precision munitions and supporting battle networks. This dynamic will cause the ranges at which opposing forces first engage in violent action to increase across all operating domains.

Third, concealing military forces will be more difficult. More actors are developing sophisticated intelligence, surveillance, and reconnaissance capabilities designed to find and target their adversaries. From high-end capabilities including space-based surveillance, networked multi-static radars, and surveillance drones, to the effective use of cloud computing, commercial imagery services, and real-time analysis of social media platforms, it is becoming harder to conceal the presence and movement of military forces from adversaries who are determined to find them. The nature of an actor's awareness of adversary forces will differ, but it seems clear that on future battlefields, *finding* the enemy will be easier than *hiding* from him.[7]

These trends are distinct in nature, and will interact with one another in different ways depending on the particular theater and the domain (e.g. air, ground, maritime, space).[8]

A future operating environment characterized by the use of precision munitions, over larger areas, coupled with surveillance networks that make battlefields less opaque will require new vectors for force development, military posture, and concepts of operation. Moreover, it seems clear that the proliferation of precision munitions, expanding combat ranges, and a more transparent battlefield will result in future conflicts being far more lethal to all combatants.

The Erosion of America's Military Edge

The dynamics of the security environment outlined above coupled with the likely implications for how future battlefields will evolve are certain to require significant modifications to U.S. defense strategy. There is a broad and growing recognition that the proliferation of precision munitions and their associated battle networks throughout the international system and all the implications that stem from the shift from the unguided- to guided-weapons era are actively eroding long-standing pillars of U.S. defense strategy.

One must only take a cursory glance at recent newspaper headlines to see this dynamic at work. For instance, the obvious reticence of U.S. policymakers to challenge China's unilateral island-building activity in contested areas of the South China Sea is partly due to the fact that Chinese military capabilities are much more threatening to U.S. military forces than at any time before. China's acquisition and deployment of sophisticated integrated air defense systems and, in particular, precision-guided anti-ship ballistic and cruise missiles pose serious threats to U.S. air and naval forces. For

[7] This dynamic is explained well in Michael Vickers and Robert Martinage, *Future Warfare 20XX Wargame Series: Lessons Learned Report* (Washington DC: Center for Strategic and Budgetary Assessments, 2001).
[8] It's possible that many of the dynamics that are apparent in the physical domain also have some similarities to dynamics in the cyber domain. But for the purposes of this argument I focus only on the physical warfighting domains.

instance in March 1996, when China conducted live-fire military exercises and missile tests off the coast of Taiwan, the United States dispatched two aircraft carrier strike groups into the mouth of the Taiwan strait in a significant show of force and resolve. The United States could do so at relatively low levels of risk given the immaturity of China's air and naval forces. After nearly two decades of China's deliberate investment into modernizing its military forces however, the relative superiority of America's military posture in the Asia-Pacific is much less pronounced, and thus even traditional displays of military power such as freedom of navigation assertions through international waters have become more complex and potentially dangerous affairs. Through their patient and deeply strategic military investments, Beijing has now made significant progress in eroding America's military-technical edge in the Asia-Pacific. This dynamic has worrisome implications for regional stability, particularly given the rising military tensions between China and several key U.S. allies in the region including Japan and the Philippines.

The dynamics that are shaping military competitions playing out in the Asia-Pacific region are also becoming increasingly apparent in other theatres. Russian aggression in Crimea and Eastern Ukraine, as well as their operations in Syria, were facilitated by their ability to construct what top NATO commander General Philip Breedlove has called "anti-access bubbles" in these areas.[9] The rapid deployment of integrated air defense systems—radars, surface-to-air missiles, and modular ISR architectures—quickly gave Russia the freedom of action, in Crimea at least, to engage in rapid ground operations take and hold territory. And in Eastern Ukraine and Syria, the ability to quickly create "no-go" areas of airspace has helped to buttress Russia's partners and increase deterrence against other actors, including the U.S. and NATO. Moreover, Russia's recent cruise missile strikes against targets in Syria from naval vessels in the Baltic Sea is further evidence that America's competitors are confident in their abilities to fully employ advanced military technologies that heretofore only the United States could or would use in wartime.

Not only have major military competitors like China and Russia made great strides into the guided-munitions warfighting regime, but these technologies have diffused to the point where almost any plausible state or non-state actor will employ them in some way. For instance, Hezbollah employed guided anti-armor and also anti-ship munitions to notable effect during the 2006 war with Israel.[10] And today, U.S.-supported rebel groups in Syria are reportedly employing similar types of weapons against Assad's military forces. There is every reason to expect that any significant military actor will employ advanced anti-armor, -ship and –air munitions in the future. This dynamic will be extremely challenging to address if U.S. forces are ever asked to engage in sustained military operations against an adversary with access to these types of weapons. In this respect, recent large-scale conventional operations in Iraq and Afghanistan may turn out to be among the last sustained engagements against adversaries that are not fully able to employ guided munitions and rudimentary battle networks supporting their use.

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[9] Thomas Gibbons-Neff, "Top NATO general: Russians starting to build air defense bubble over Syria," *The Washington Post* (September 29, 2015).

[10] Deputy Secretary of Defense Robert Work, in an April 2014 speech at the Army War College described this at some length: "…when the IDF crossed swords with Hezbollah [in 2006], they were caught by surprise. Hezbollah – fighters were armed with advanced anti-tank missiles, thousands of long-range rockets, Chinese-made Silkworm anti-ship missiles, advanced man-portable anti-air missiles, and unmanned aerial vehicles (UAVs). They had very simplistic, but very effective battle networks to employ them. They practiced irregular warfare, but at the same time maneuvered effectively against Israeli armored columns, proved proficient in indirect fire, and they used swarms of heavy anti-tank missiles to great effect."

Clearly the ongoing diffusion of military power is problematic to U.S. defense strategy, and the loss of a near-monopoly position with respect to the employment of guided munitions on the battlefield will be a defining feature of the operating environment for U.S. forces, but one must be careful not to overstate the case. The United States remains the most capable military actor in the international system and will remain so for the foreseeable future, even given the constrained levels of defense spending seen in recent years. The erosion of America's military edge does not mean U.S. forces will be unable to fight and win the nation's wars, but it does strongly imply that battlefield victories will come at increasing levels of cost and risk in terms of lives lost and resources spent.

Reestablishing a Military-Technical Edge

Of all recent Pentagon leaders, current Deputy Secretary Robert Work has been the most detailed in his public accounting of how the U.S. military is losing technical dominance over its adversaries. It is worth quoting him at length describing the scope and scale of the challenge:

> "Looking back on the [1990s], we enjoyed conventional dominance across the spectrum. Our global command and control network was unparalleled and it really wasn't under any type of a cyber attack threat. Our space assets, which provided us the ability in a simple theater-wide battle networks, weren't really threatened. We enjoyed freedom of access on the land, in the air, on the sea, under the sea, in cyberspace. In contrast, we have potential competitors all across the spectrum, developing capabilities and challenges in all domains. Our space assets are now at more risk than they have ever been. Our global command and control system is at more risk than it has ever been. Several nations are developing capabilities that threaten to erode our ability to project power over trans-oceanic distances, which is what makes us the only global military superpower. The so-called A2/AD capabilities include advanced anti-ship and anti-air missiles, as well as new counter-space, cyber, electronic warfare, undersea and air attack capabilities. We are seeing levels of weapons development in other states that we have not seen since the mid-'80s, when we faced a near peer military competitor in the Soviet Union."[11]

The implications of what Secretary Work outlines are far-reaching, striking as they do at the very foundation of U.S. defense strategy and doctrine. Two paradigmatic cases are worth discussing: air and maritime power against near-peer competitors; and the likely contours of future ground combat.

Air and Maritime Power Projection

First, the increasing opacity of future battlefields, the expansion of engagement ranges, and the prevalence of guided munitions are combining in ways that call into question the ability of the joint force to project striking power against an adversary. Put another way, these dynamics mean that America's forward military presence, whether on land, in the air, or on the sea, will be within range of an adversary's guided munitions much earlier than was the case when they were designed and built; and that U.S. power projection capabilities will need to engage an adversary at much greater distances than previously planned.

The best contemporary case concerns the way U.S. defense planners conceive of the aircraft carrier and its embarked air wing. As military historian Jerry Hendrix describes in the recent report *Retreat from*

[11] Robert Work, *Speech to McAleese / Credit Suisse Defense Programs Conference* (Washington DC: March 17, 2015).

Range: The Rise and Fall of Naval Aviation, the singular purpose of U.S. aircraft carriers designed during the Cold War—the so-called "supercarriers"—was to launch and recover aircraft able to carry heavy ordnance payloads over long distances. This was to enable U.S. naval forces to project power (conventional and nuclear strike missions) beyond the engagement ranges of Soviet air and maritime defensive systems. With a complement of bombers, long-range attack aircraft, and air superiority fighters, the carrier air wings for most of the Cold War could perform deep strike missions at about 1000 nautical miles (nm) from the carrier.[12] For a variety of reasons, principally judgments about the favorable security environment in the immediate post-Cold War period, the Navy was permitted to emphasize operational concepts that prioritized the number of sorties the air wing could generate. This was not without some logic, for as Hendrix describes: "The campaigns that the nation and the Navy found themselves participating in gave a false sense of permanence. Operation Desert Storm in 1991, operations in Yugoslavia from 1995 to 2000, and the 2003–2012 Iraq War were all conducted in permissive maritime environments that allowed U.S. aircraft carriers to operate just offshore of target nations, maximizing the on-station time of their aircraft."[13] The prioritization of "close-in" operational concepts for carrier operations has resulted over time in an air wing with an average unrefueled range of less than 600nm.

Given the increased prevalence of long-range guided munitions and battle-networks—of the type that China has spent decades procuring, among others—operational concepts that presume an ability to establish air or maritime dominance sufficient to enable close-in engagement ranges seem quite unrealistic. Unless Pentagon and Navy leaders can drive change sufficient to enable long-range strike missions from aircraft carriers, this critical "day 1" mission will be deferred to other elements of the joint force, which would call into sharp relief the very purpose and mission of the aircraft carrier—heretofore the crown jewel of U.S. power projection.

The aircraft carrier is not the only element of America's power projection force that is increasingly vulnerable given the trends outlined above. Advances in air defense systems make stealth aircraft easier to detect; America's space-based satellite constellations are more vulnerable to attack and disruption; and U.S. military bases in and around contested regions are more exposed to higher volumes of accurate ballistic missiles that will stress even the most advanced defensive systems.

Ground Combat

Second, these trends will cause profound disruption in ground combat. While U.S. ground forces are and will remain the most effective in the world at the core mission of closing with and destroying the enemy, the U.S. Army and Marine Corps are likely to undergo a very disruptive period, as the guided munitions-revolution has not yet fully taken hold at the level of the individual soldier. The kinds of revolutionary air and maritime capabilities that became apparent to the world in the 1991 Gulf War—smart munitions and sensor grids—are rapidly now emerging in infantry combat. For instance, we are now seeing the emergence of precision-guided infantry weapons, including:

- Lightweight anti-personnel drones carried and employed at the infantry squad which can dive bomb targets from above;

[12] Jerry Hendrix, *Retreat from Range: The Rise and Fall of Carrier Aviation* (Washington DC: Center for a New American Security, 2015).
[13] See Hendrix, *Retreat from Range*, p. 50. See also Seth Cropsey, Bryan McGrath, and Timothy Walton, *Sharpening the Spear: The Carrier, the Joint Force, and High-End Conflict* (Washington DC: Hudson Institute, 2015).

- Handheld laser-guided grenade launchers that carry integrated electronics that enable precise detonation to maximize lethality;
- Miniature guided missiles launched from currently fielded grenade launchers that can hit targets beyond 2 kilometers;
- Large-caliber rifle rounds that can maneuver during flight to hit laser-designated targets; and
- Firearms with integrated fire control systems to counteract the effects of the shooter's movement and increase accuracy by an order of magnitude.[14]

These types of emerging technologies will likely first be employed by U.S. or allied forces but will rapidly proliferate globally in part because many of these capabilities are derived from commercial products. These technologies will expand the engagement ranges for mounted and dismounted infantry, significantly complicate or obviate the ability to use terrain features for cover and concealment, and hence make the battlefield far more lethal. All the while, the ongoing proliferation of anti-tank guided munitions will continue, as will the evolution of the kinds of sophisticated anti-personnel devices (e.g. IED and EFPs) seen in Iraq and Afghanistan.

In both these cases–air and maritime power projection and ground maneuver warfare – the loss or relative diminution of long-relied upon U.S. advantages will necessitate major changes in operational concepts and the capabilities required to execute them.

Vectors for Developing the Future Force

New operational concepts must be developed to address the vulnerabilities in defense strategy outlined briefly above. Operational concepts define the *ways* in which U.S. military forces plan to employ military means to accomplish desired political ends. They are the critical connective tissue that enables effective theater and operational planning, and they should guide the Pentagon's force development priorities. The credibility of these concepts undergirds U.S. deterrence just as much as the capabilities inherent in specific military platforms. "The United States must be able to give some sense of how it can *make war* against opponents who can contest U.S. military superiority in their regions…" argues defense analyst Elbridge Colby, "…and *how it can make such war in a way* that the costs and risks of the conflict would in some reasonable sense be correlated with the gravity of the interest at stake."[15]

Whether concerning air and maritime power projection, or in ground combat scenarios, the likelihood is rapidly rising that U.S. forces will soon encounter adversaries that can, in temporary or sustained ways, achieve a degree of parity or overmatch. Given this emerging reality, existing operational concepts will need to be updated and many will require revision to ensure U.S. forces can operate effectively and achieve success on future battlefields. While difficult to capture the range of current operational concepts with a broad brush, current planning tends to assume that qualitatively superior U.S. forces will be able to operate beyond adversary engagement zones, penetrate them if required, locate enemy forces, and prevail over numerical superior forces by concentrating precision munitions at the point of attack.

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[14] I am indebted to my CNAS colleague Paul Scharre, whose work in this area will soon be publicly available in his paper, *Uncertain Ground: Emerging Challenges in Land Warfare* that will provide greater context and description of these trends and the implications for strategy, planning, and procurement. Another recent publication worth examining is Michael O'Hanlon, *The Future of Land Warfare* (Washington DC: Brookings Institution Press, 2015).

[15] Elbridge Colby, "America Must Prepare for Limited War," *The National Interest* (October, 2015). Emphasis mine.

Given that future battlefields will be more transparent, the use of precision munitions ubiquitous, and engagement zones spanning larger distances, future U.S. operational concepts will require greater focus on the following characteristics:

- ***Range.*** U.S. forces in any domain will need to be able to target and engage adversaries over longer engagement ranges.
- ***Persistence***. U.S. forces, particularly in the air domain, will need to stay inside contested zones for longer periods of time to find and engage an adversary's mobile assets.
- ***Disaggregation***. Future military forces will often need to disaggregate into smaller components in order to present adversaries with more complex targeting challenges.
- ***Dispersion***. Forces will need to spread out those disaggregated units across wider geographic areas to fully take advantage of networked sensors and fires.
- ***Mass.*** Dispersed forces will still need to find ways to concentrate firepower and/or platforms at particular points to overwhelm an adversary.
- ***Concealment.*** Military forces will need to: improve core stealth technologies (e.g. to reduce radar cross-sections); shift emphasis within a certain warfighting domain (e.g. submarines as primary attack platforms instead of increasingly vulnerable surface ships); and create innovative ways to distract or distort an adversary's means of detection (e.g. advances in electronic attack and cyber capabilities).

It seems clear that if opposing forces are roughly in qualitative parity, battlefield outcomes may increasingly turn on which adversary can generate quantitative superiority at key points. Such superiority will stem from different platforms depending on the scenario, but will ultimately boil down to the number of munitions that can be brought to bear against an adversary. Whether long-range missiles, bombs dropped from aircraft, or munitions fired from armor or infantry units, battlefield outcomes featuring roughly equal opponents will tend to be governed by the one that can bring more mass to the fight.

It is important to underscore how different this dynamic is from much of current U.S. military strategy and force planning, which has spent decades planning and executing operations with technically superior forces that can detect, target, close with, and engage a surprised adversary with the overwhelming application of precise force. U.S. defense leaders must do all they can to maintain a qualitative military edge, for the modern history of U.S. military strategy suggests that competing for numerical superiority with an adversary plays to their strengths, not ours.[16]

Implications for Military Platforms and Posture

The transition from a world in which the United States has a clear qualitative military edge to one in which our military forces must "fight fair" against an adversary is a transition that must be prevented. A major focus for Congress, the Pentagon, and all those interested in preserving military-technical

[16] Some notable recent defense research is exploring ways in which the United States could attempt to generate numerical or quantitative battlefield advantages by fully embracing the emerging contours of robotic warfare. See two reports by Paul Scharre, *Robotics on the Battlefield Part 1: Range, Persistence and Daring* (Washington DC: CNAS, 2014), and *Robotics on the Battlefield Part 2: The Coming Swarm* (Washington DC: CNAS 2015).

superiority for U.S. forces should be the development of a comprehensive bipartisan strategy to do so. Thankfully, for nearly a year, the Pentagon, under the leadership of Secretary Ash Carter and Deputy Secretary Robert Work, has been developing the contours of such an approach. Hopefully, the ongoing FY2017 budget deliberations inside the Pentagon will soon result in a clear commitment to invest against the challenges outlined above. A notional list of priorities for capability investments and posture that stem from the above discussion would include:

First, shore up air and maritime power projection by:

- Employing land and carrier-based unmanned strike platforms that can penetrate sophisticated integrated air defense systems, locate mobile targets, and deploy significant munitions payloads. Automated aerial refueling would fully realize the game-changing ability of unmanned platforms, significantly extending the striking distance of U.S. military forces.
- Emphasizing submarines that can attack an adversary from concealed positions, ideally with platforms with larger payload capacities (e.g. the planned Virginia Payload Module designed to triple the strike capacity of future Virginia-class submarines; as well as the planned Ohio-replacement program).
- Developing dispersed undersea sensor grids and unmanned attack platforms that persist inside an adversary's contested zones for months at a time, credibly posing the threat of surprise close to an adversary's shores (e.g. DARPA and the Office of Naval Research are experimenting with long-duration unmanned underwater vehicles and so-called "upward-falling payloads").
- Ensuring the new Long-Range Strategic Bomber (LRS-B) is procured in numbers large enough (the planned buy of 100 planes) to constitute a credible ability to sustain power projection missions against an adversary over the course of a long-duration air campaign.

Second, ensure U.S. ground forces are rapidly adapting to guided-munitions warfare by:

- Pushing emerging guided munitions capabilities down to squad- and individual- level.
- Experimenting with robotic ground systems that can obviate the need to risk humans in some high-risk logistics and surveillance missions, and some "advance to contact" tasks.
- Ensuring that unmanned aerial systems are pushed down to the platoon and squad-level to better enable dismounted troops to find adversaries over longer ranges.
- Developing platforms that can deploy alongside dismounted units that can provide greater protection from an adversary's guided rockets, artillery, missiles and mortars.

Third, ensure U.S. forward bases and deployed forces can better defend against an adversary's guided munitions by:

- Aggressively funding continued research and development of directed energy systems that can defend against guided rockets, artillery, missiles, and mortars.
- Exploring innovative basing concepts that can disperse U.S. military forces across larger geographic areas (e.g. austere locations with prepositioned equipment that can be rapidly reinforced during a contingency).

Arrest the Erosion While We Can

America's finely honed military-technical edge is eroding, and U.S. policymakers have a closing window of opportunity to arrest this trend. The consequences of failure are clear and troubling. The

maintenance of a clear military-technical advantage is a foundational element of American defense strategy and must remain so. For decades, certainly since the 1991 Gulf War—America's adversaries were convinced that U.S. forces would be able to see them first and shoot them first due to our overwhelming advantage in precision-guided munitions and the means to deliver them at a time and place of our choosing. If this erosion is allowed to continue, the credible deterrent power of America's military forces will lessen as well, potentially causing significant disruptions to balances of power around the world.

The likelihood of America's adversaries employing sophisticated guided munitions against our forces and those of our allies and partners necessitates far-reaching changes to overall defense strategy, force development and modernization efforts, concepts of operation and contingency planning, and global basing and posture. An adversary that can establish even temporary advantages in guided munitions and the means of their delivery could potentially put U.S. forces on equal qualitative footing, which would foist the requirement to generate quantitative battlefield advantages back into the forefront of military preparations to a degree that today's defense planners would find extremely difficult to do successfully.

Fortunately, senior Pentagon leaders understand the scale and scope of this challenge, and are building on the strong history of previous attempts to offset an adversary's military advantages to do the same in time to prepare for future conflicts. The report of the 2014 bipartisan National Defense Panel also highlighted the erosion of America's military-technical superiority.[17] It is vital that Congress supports the Pentagon's efforts, and holds its civilian and uniformed leaders accountable for making the necessary changes in defense strategy and planning before it is too late. The stakes could not be higher, for they concern nothing less than the foundations of American military power and its beneficial effect on the stability of the global order.

[17] See report of the 2014 National Defense Panel, *Ensuring a Strong U.S. Defense for the Future* (Washington DC: U.S. Institute of Peace, 2015). The report argues in part: "In this rapidly changing environment, U.S. military superiority is not a given; maintaining the operational and technological edge of our armed forces requires sustained and targeted investment." (p.2).