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STRATEGIKA

CONFLICTS OF THE PAST AS LESSONS FOR THE PRESENT

New Military Technologies

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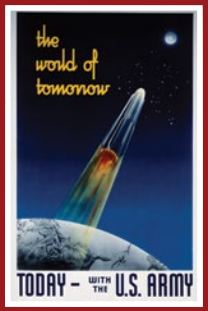

You Say You Want a Revolution?

Thomas Donnelly

To paraphrase the Beatles: Well, you know, you'd better free your mind instead; you may want a revolution but ought to settle for some evolution.

It is an article of revealed religion among defense elites that "we live in a relentlessly changing and fiercely competitive world." Those words were from former defense secretary Ashton Carter, once a physicist and someone deeply imbued with the idea that technological change and competition were the elements propelling change, and that those who failed to "innovate" were doomed to defeat: "Today's era of military competition is characterized by the additional variables of speed and agility, such that leading the race now frequently depends on who can out-innovate faster than everyone else, and even change the game."

Such attitudes took root in the late Cold War, back when the Pentagon had a "director for defense research and engineering"—a powerful post separate from the actual weapons-buying bureaucracy—and invested substantial sums in the Defense Advanced Projects Research Agency. These agencies were dominated by engineers, practical people whose goal was not science per se but to find ways to put new technologies into the hands of soldiers, sailors, airmen, and marines. But the combination of the Cold War's end and the endless small wars of the post-9/11 years has inverted this traditional approach; the leaders of the Defense Department have been driven by the immediate need to respond to today's enemies—all of them unpredicted—and have luxuriated in an extreme form of futurism—dreams that must inevitably go unfulfilled.

The failure to build and field in important numbers the weapons designs of the 1990s has all but deprived US forces of the conventional-force superiority that is a premise of their strategy. The past failures to innovate incrementally have added up, even though the Russians and Chinese—and, increasingly, their Iranian partners in what Walter Russell Mead has dubbed the "Axis of Weevils"—have done little more than attained the level of lethality and sophistication reached by US forces during Desert Storm. And since the Weevils are, for the moment, entirely engaged in moving into the vacuum created by American withdrawals rather than testing their strength directly, it is hard to know what level of tactical competence they have really derived from their belated modernization, but the balance of military power has undoubtedly shifted. National Security Advisor Lt. Gen. H.R. McMaster put the matter succinctly: "When we minimize our Army, we

maximize the risk to our soldiers, the risk that in a crisis they will be forced to enter a fight too few in number and without the training and equipment they need to win."

In such circumstances, broad programs of military "transformation"—Donald Rumsfeld's dream of a "third offset," and Ash Carter's homage to former defense secretary William Perry and the creation of "stealth" aircraft—are not relevant. Photon torpedoes, warp drives, and cloaking devices remain in the realm of the starship *Enterprise.* Better the urgency of President John Kennedy, who vowed to put an American on the moon "in this decade," than the spirit of Captain James Kirk. And in fact, there are fairly mature military technologies that meet the test of restoring the tactical advantages that US troops once enjoyed.

Perhaps the most tantalizing near-term technologies are related to the substitution of intense amounts of electrical energy for the explosive power of gunpowder. This comprises a kind of catchall category that subsumes several developments and could have—at least to leaders with an engineering mind set—multiple applications. Fielding electrical-energy-based weapons depends upon the ability to generate and to store immense amounts of power, and then release it either as a destructive force on its own or to propel a projectile at extremely high speeds. Stored electricity might prove to be the gunpowder of the future.

The Defense Department and the military services have been experimenting with these technologies for a decade and more. The army and navy have tested a number of "railgun" designs. Railguns are electromagnetic launchers with a parallel set of conductors—the "rails"—that accelerate a sliding armature by passing a very strong current down one rail, along the armature to the other rail. In essence, it's a twenty-first century slingshot that hurls a very dense, but inert, projectile about twice as fast as a traditional cannon; the kinetic energy of these projectiles is enormous.

It does appear that the science of railguns has reached some level of maturity. The main technological challenges are generating and storing enough electrical power—that is to say, a big engine and a good set of batteries—to allow for repeated pulses of direct current that would yield militarily relevant rates of fire of something like six rounds per minute. Other challenges are to build durable and practical rails, since the launch process generates extreme heat that stresses the rail materials. Further, designing guidance mechanisms that can withstand the heat generated by the speed of the projectile may be difficult. On the plus side, the design of munitions ought to be simplified, as should storage, handling, and logistics, since there is no "warhead" atop a railgun round and explosives are not required. Moreover, the range of railguns would far exceed that of any cannon.

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But again, the railgun literature strongly indicates that these are challenges for engineering, not basic science. The navy is interested in railgun technology as a potential solution to the rising challenges of surface fleet air defense and, especially, cruise and ballistic missile defense. Ironically, the otherwise-disastrous *Zumwalt*-class destroyer—which is now a $4 billion-per-copy pocket battleship—would make a practical platform for a railgun-based system. The ship is huge for a "destroyer"; at almost 15,000 tons it's almost twice the size of the current *Arleigh Burke*-class ships. And it has an electric engine that can not only drive the ship at 30 knots, but also generate huge amounts of additional electricity. The navy originally planned to buy thirty-two *Zumwalts,* but the program has long since run aground—because of its technological and cost problems, but also, most importantly, because the ship was misconceived—and halted at just three. To redesign and revive the project would involve great further expense and be an engineering risk, surely. But it could also result in fielding a game-changing technology that would go far toward solving the "anti-access" problem posed by the growing arsenals of Chinese, Russian, and Iranian anti-ship missiles within the next decade rather than several decades. There is no reason to believe that designing a new class of ships would be any less expensive; indeed it is irrational to think that starting over would save money.

On a smaller scale, electromagnetic guns might become the main armaments on tanks and howitzers. While all the same challenges would recur and be compounded by the need to reduce both the source of the electricity and the storage device to the size of a ground combat vehicle, the fundamental engineering challenges are the same as for ships. And the army already is experimenting with modifying existing howitzers to shoot the same projectile as an electromagnetic weapon. "It turns out that powder guns firing the same hypervelocity projectiles gets you almost as much as you would get out of the electromagnetic rail gun, but it's something we can do much faster," says Deputy Defense Secretary Robert Work, who has been held over from the Obama administration to ensure continuity in defense planning. "We are [saying to the next administration]: 'Look, we believe this is the place where you want to put your money, but we're going to have enough money in there for both the electromagnetic rail gun and the powder gun.'"

A related development, also resulting from the ability to generate and store immense amounts of power, that is on the cusp of science fiction and reality is the prospect of using directed energy itself as a weapon. Indeed, some low-level forms of directed energy have been employed by the military for some time: microwave systems that heat the water in skin cells, causing irritation, have been used as a crowd-control measure; microwaves also have been fielded to fry enemy electronic systems. Even the radars on combat aircraft may have limited applications in disrupting the sensors of attacking missiles. And, as far back as 2002, the US Air Force began flying an "Airborne Laser"—basically, a giant

high-energy chemical laser stuffed inside a 747 commercial aircraft body—as a missile defense test system. In January 2010 the system successfully passed an intercept test and a month later destroyed two targets in a single engagement. But shortly thereafter, amid one of the many rounds of defense budget reductions during the Obama administration, the effort was scrapped. In many ways, fielding the system as designed was a bad idea—the laser itself needed to be more powerful and would have required a large and vulnerable aircraft to fly within range of enemy air defenses—but the underlying concept was sound and indicative that such systems were technologically feasible, if tactically immature. Also, it was clear that using electricity rather than chemistry as a power source was a better solution.

Electromagnetic guns, hypersonic projectiles, or even directed energy death rays would by themselves not necessarily constitute a revolution in warfare. But these technologies could yield a substantial increase in the capabilities of a wide variety of legacy platforms—and, importantly, again provide US forces with a significant battlefield edge. Most of all, such investments could get the American military back in the habit of continuous modernization and the operational innovation that comes from actually fielding new capabilities. The enthusiasts for "transformation" of the past generation have been looking through the wrong end of the telescope; their model of innovation was that, starved of funds, the US armed services would have to think of new ways to fight. But, through history, the process of change in war has been one that more frequently rewards practical tinkering—matching organizations and doctrine to technologies—more than bold conceptualization. Imagining the tank or the fighter aircraft was the basis for a revolution, but realizing it demanded their integration into combined-arms formation and figuring out how to keep that organization supplied with fossil fuel.

Finally, the experience of recent decades ought to debunk the transformationists' idea that the United States could afford a geopolitical "strategic pause" to pursue a strategy of innovation. Nor can a global power afford an "offset" approach. To paraphrase the Beatles one last time: Evolution is the real solution. And you can see the plan.

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It's Not Just the Technology: Beyond Offset Strategies

Colonel Joseph Felter

A range of breakthrough technologies are emerging today that have the potential to radically change how we fight and deter threats across all conflict domains—air, land, sea, space, and cyber. Artificial intelligence, directed energy, robotics, and machine learning are just a few examples. Significantly, unlike in previous decades, defense-relevant technologies are increasingly being developed in the commercial technology base rather than in classified government R&D programs. States and non-state actors alike are now able to purchase, copy, or steal advanced technologies and exploit their military applications in unprecedented ways. This proliferation of technology is diffusing military power, and the United States must recalculate the current and anticipated relative military strength and capabilities of our enemies and competitors around the world.

How should the United States respond to this "leveling of the playing field" and the resultant waning of our comparative advantages? In the past, the United States has responded to such situations with so-called offset strategies that leveraged America's edge in technology. We innovated to offset the disadvantages we faced. For example, when NATO in the early 1950s found itself outmatched in conventional force strength compared to Warsaw Pact nations, President Eisenhower responded with the New Look strategy that bolstered United States nuclear deterrence capabilities. By fielding an increasingly capable arsenal of nuclear weapons both at home and in forward deployed locations, the US effectively offset the advantages of superior Soviet conventional forces and arguably helped deter Soviet aggression and adventurism in Europe.

A second offset was triggered after the Soviet Union attained near parity in nuclear weapons with the United States in the 1970s. Moscow's advances, and its strength in conventional forces, led to concerns in Washington that our capability to deter Soviet aggression was degrading. So Secretary of Defense Harold Brown and Defense Undersecretary Bill Perry initiated investments in stealth technology, long-range precision-guided munitions, and advances in intelligence, surveillance, and reconnaissance (ISR) systems. The fruits of these investments were made clear in the 1991 Desert Storm campaign and the 2003 invasion of Iraq, up through the toppling of Saddam Hussein's regime.

Russia's and China's significant investments in military modernization programs in recent years, such as their increasing anti-access and area denial systems capabilities, prompted Secretary of Defense Chuck Hagel to call for a "Third Offset Strategy" in 2014. Hagel argued we must exploit advances in areas like robotics, autonomous systems, miniaturization, big data, and advanced manufacturing, to counter our competitors' advances.[1]

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The technologies developed and deployed as part of previous offset strategies helped the United States achieve its intended purposes of deterring war with a major power. The advances in technology being pursued as part of the third and latest offset strategy promise to help the United States respond to emerging threats posed by China, Russia, and other "pacing competitors" that may arise in the coming decades. But technology advances alone do not constitute a strategy, and the advantages we can expect them to provide us will be short-lived when compared to previous offsets. It's not that technology isn't critical to sustaining an advantage in military strength, but it is better viewed as a constantly evolving means to achieve strategic ends, and not a static end in itself.

The democratization of access to cutting-edge technology is challenging the efficacy of traditional determinants of military power. Classic realist theories of international relations posit that a state's capacity to raise and employ a powerful military is well predicted by aggregate wealth and resources. In an anarchic international system where states must ultimately rely on themselves to survive and maintain their position, they will theoretically be driven to field the best military forces possible given their resources.[2]

Realist explanations for what predicts a state's military capabilities were largely accurate in the past: Strong states like the United States could develop and field the very best technology, while weaker states—not to mention non-state actors—were denied access to the most advanced military technologies given the barriers to entry that marginalized all but the most wealthy and powerful states.

But conditions have changed dramatically since the United States successfully competed with its Cold War rivals in the last century. These earlier struggles for technological dominance played out in secretive national labs and in other classified government sponsored domains where the nation's best and brightest scientists and technicians worked. Today, by contrast, state-of-the-art technology with military applications is being developed in the commercial sector more rapidly and at lower costs by the world's leading experts incentivized to work for private companies rather than for the military or government. States with far fewer resources and non-state groups like ISIS, al-Qaeda and others can purchase or otherwise appropriate many of these technologies. Thus, the advantages the United States maintained throughout the Cold War due to its vastly superior wealth and resources are now being diminished. The proliferation of these dual-use technologies has changed the calculus of how we should assess capabilities of states and non-state groups today and going forward.

We cannot predict with any certainty what the disruptive military technologies of the future will be. But we should expect that these technologies will be developed faster and more iteratively, and will be more widely available than ever before. Given this, military capability in this century will turn less on developing a particular "game changing" technology that provides long-term comparative advantages—like stealth and precision munitions did in the past—and more on the speed in which states and non-state groups alike can adapt and change to leverage emerging technological breakthroughs for maximum effect.

The US military will find it challenging to innovate and change at this speed. Our current defense acquisition processes, for example, work well when we can anticipate the outcomes we want years in advance, such as incremental improvements in submarines, aircraft carriers, and main battle tanks. But these acquisition processes break down when the solutions we need to deploy are not known years

ahead of time—and that's precisely the case for many of today's dynamic emerging threats. We must adapt and augment our current acquisition processes to reflect the critical need for speed and agility in procuring and fielding the latest advances in technology. And lastly, we must find new and creative ways to harness the potential of our best and brightest minds and bring them back to the table in support of our national security.[3]

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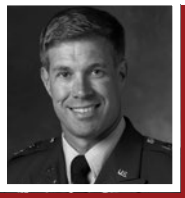
1 See Chuck Hagel, *Secretary of Defense Speech,* Reagan National Defense Forum Keynote, Ronald Reagan Presidential Library, Simi Valley, CA (November 15, 2014), https://www.defense.gov/News/Speeches/Speech-View/Article/606635

2 Kenneth Waltz (1979) provides the core realist assessment of how a state's resources and relative material advantages predict its ability to prevail in conflict between states.

3 For example, *Hacking for Defense,* a university course developed by Steve Blank, Joseph Felter, and Peter Newell and piloted at Stanford in 2016, provides opportunities for graduate students from all disciplines to work on pressing problems facing the DoD and the intelligence community using powerful Lean innovation methods. Their book, *Hacking for Defense: Lean Innovation, Speed, and the Future of War,* is forthcoming from Wiley Press.



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Moving Forward: The Need for Innovations in Technology and Strategy

Kiron K. Skinner

Two broad sets of US military strategies during the second half of the twentieth century combined ideas, innovation, and technology in ways that offset Soviet conventional (and later nuclear) superiority in arms and military forces. These strategies also contributed to the overall state of cold war, as opposed to hot war, between the two superpowers. Today, the Pentagon is hard at work on a framework to achieve military dominance over a far more diverse set of adversaries. The defining features of this strategy are automation and artificial intelligence, and the core challenge is to determine whether international peace and stability are being enhanced or put at risk by them.

President Dwight Eisenhower recognized that the US military was no match for the sheer size of the Soviet Union's Red Army, especially in Europe, the central theater of that era. He understood that financial pressures, among other factors, would make it impossible for the United States to compete against its principal adversary on a conventional military level. His response was to invest in American nuclear superiority as a strategic offset.

Over time, Eisenhower's New Look policy of offsetting Soviet conventional power with a major arsenal of nuclear weapons was met with a buildup of Soviet strategic nuclear forces. In turn, Secretary of Defense Harold Brown supported the expansion of research and development, as well as the fielding of precision-guided weapons, new intelligence, surveillance, and reconnaissance (ISR) apparatus, and other cutting-edge weapons systems. Like New Look, this so-called second offset strategy capitalized on the technological superiority of the United States. President Ronald Reagan continued the investment in advanced military technology, and US military overmatch contributed to the defeat of the Soviet Union in the Cold War.

In recent years, however, China and Russia have made significant advances in all types of technologies, including conventional weapons such as those developed by the United States in the second offset period. Highly competitive with the United States in cyber and electronic capabilities, the Chinese and the Russians have theater-wide networks that rival the technological sophistication of US battle networks, and middle-tier powers are stockpiling advanced weapons. Secretary of Defense Chuck Hagel tackled twenty-first century threats from great powers, other state actors, and transnational threats in a speech at the Reagan Library on November 15, 2014, and announced a framework for prevailing against a range of competitors: "Technologies and weapons that were once the exclusive province of advanced nations have become available to a broad range of militaries and non-state actors, from dangerously provocative North Korea to terrorist organizations like Al Qaeda and Hezbollah—all clear threats to the United States and its allies. . . ."[1] Hagel also identified cyber-attacks

and transnational criminal activity as additional threats to US security.

The development of anti-access and aerial denial (A2/AD) capabilities by Iran, Russia, and other states is particularly worrisome for the US defense community and is seen as another rationale for the third offset strategy. Defense analysts note that these capabilities could compromise the ability of the United States to protect NATO allies, deter the Chinese in areas of competition, and project power globally.[2]

To counter the various global threats, Secretary Hagel proposed the Defense Innovation Initiative: "Today I'm announcing a new Defense Innovation Initiative—an initiative that we expect to develop into a game-changing third 'offset' strategy. . . . Our technology effort will establish a new Long-Range Research and Development Planning Program that will help identify, develop, and field breakthroughs in the most cutting-edge technologies and systems—especially from the fields of robotics, autonomous systems, miniaturization, big data, and advanced manufacturing, including 3D printing. This program will look toward the next decade and beyond."[3]

As Kori Schake has observed, the third offset is not a well-defined strategy.[4] It is, however, an organizing framework that pulls together some of the threads of ideas, technology, and innovation expressed in Hagel's speech as well as in statements by former secretary of defense Ash Carter, Deputy Secretary of Defense Robert Work, and other military strategists.[5] According to Work, "the Third Offset Strategy. . . is not about technology per se; it is about technology enabled operational and organizational constructs that give us an advantage at the operational level of war, which is the surest way to underwrite conventional deterrence."[6]

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The architects of the strategy seek operational advantage for the United States through breakthrough technologies involving artificial intelligence, automation, human-computer interaction, new ideas and doctrines, and institutional reorganization. This operational mix requires a kind of analytical innovation that is in tune with a range of international threats far exceeding the danger posed by one nation, the Soviet Union, during the Cold War. This diverse threat vector is a feature that distinguishes the strategies used in the Cold War from the offset strategy of this century.

In addition to his speech at the Reagan Library, Secretary Hagel sent a memorandum on the Defense Innovation Initiative, which encompasses the third offset strategy, to the department's leadership

team. He galvanized his comments by declaring that "American dominance in key warfighting domains is eroding." To counter this development, he proposed: rethinking how leaders and managers are identified and trained so that the best human capital is available for twenty-first century challenges; engaging in new long-range research and development efforts that will ensure the United States has the technological lead when it decides to project military power; using new war-gaming activities and operational concepts that will encourage alternative hypothesizing about security threats and technological innovation; and ensuring that all parts of the Defense Department are engaged in the effort, and that best business practices are infused throughout all of the department's activities.[7]

Fundamental to this comprehensive list of third offset priorities is determining how humans and computers will interact. As technology becomes more intelligent, numerous questions arise. What work should robots do alone? What are the scenarios in which humans will be out of the loop (with robots making and executing decisions), in the loop (with robots taking orders from humans), or on the loop (with robots managed by humans yet retaining some autonomy)?[8]

In defensive scenarios, such as cyber warfare, time constraints and other exigencies may necessitate greater robotic autonomy. In offensive scenarios, however, the use of autonomous robots is fraught with numerous troubling implications. Are there any conditions under which robots should be allowed to kill humans?[9]

Warfare among robots from opposing sides could save soldiers from fighting, but it could also escalate conflicts to the nuclear level. While it is true that humans write the algorithms encoded in robots and computers, robots (and software programs) that are allowed to engage in warfare without constant human guidance could make decisions inconsistent with those made by a human in situations of extreme uncertainty.

These are just a few of the concerns that third offset strategists must consider as they make research investments and devise war plans. Robots are here to stay, and warfare and all sorts of international conflicts are being transformed by their use. Defense planners must guard against warfare becoming so futuristic that the human role in it is dangerously diminished.

States and non-state actors will have varied assessments of autonomy and artificial intelligence. Thus, US defense planners will be forced to make decisions in terms of strategic interaction. For instance, the United States may have ethical standards that are not adhered to by adversaries and competitors. Some adversaries may want weapons that are as autonomous and artificially intelligent as possible, and thus can shoot to kill on their own. It is hard to imagine the American public and their leaders deciding to embed that choice into strategy and doctrine. Theorizing about the full range of strategic interaction games is the reason that technology-driven war-gaming is as important now as it has ever been.

Still, however, politics, economics, religion, culture, personal ambition, and avarice are enduring causes of war. As a tool of war rather than one of its causes, technological innovation will have to be paired with the innovation of ideas, strategy, and doctrine. These latter factors have more to do with enhancing credible deterrence, peace, and stability than rapidly changing exotic technologies.

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1 Chuck Hagel, *Reagan National Defense Forum Keynote,* United States Department of Defense, November 15, 2014,

https://www.defense.gov/News/Speeches/Speech-View/Article/606635

2 James R. McGrath, *Twenty-First Century Information Warfare and the Third Offset Strategy,* (*Joint Force Quarterly 82,* July 1, 2016), http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-82/Article/793229/twenty-first-century-information-warfare-and-the-third-offset-strategy/; Timothy A. Walton, *Securing the Third Offset Strategy: Priorities for the Next Secretary of Defense,* (*Joint Force Quarterly 82,* July 1, 2016), http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-82/Article/793224/securing-the-third-offset-strategy-priorities-for-the-next-secretary-of-defense/; and William T. Eliason, *An Interview with Robert O. Work*, (*Joint Force Quarterly 84,* January 26, 2017), http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-84/Article/1038783/an-interview-with-robert-o-work/

3 Chuck Hagel, *Secretary of Defense Speech,* Reagan National Defense Forum Keynote, Ronald Reagan Presidential Library, Simi Valley, CA (November 15, 2014). https://www.defense.gov/News/Speeches/Speech-View/Article/606635

4 Kori Schake, *Strange Planning: What's Missing From DOD's Third Offset,* (*Military History in the News,* October 31, 2016), http://www.hoover.org/research/strange-planning-whats-missing-dods-third-offset

5 Ash Carter, *Secretary of Defense Speech: Remarks on 'The Path to an Innovative Future for Defense',* CSIS Third Offset Strategy Conference, Washington, DC (October 28, 2016), https://www.defense.gov/News/Speeches/Speech-View/Article/990315/remarks-on-the-path-to-an-innovative-future-for-defense-csis-third-offset-strat

6 Eliason, op.cit, http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-84/Article/1038783/an-interview-with-robert-o-work/

7 Chuck Hagel, *Memorandum: The Defense Innovation Initiative,* (November 15, 2014), http://archive.defense.gov/pubs/OSD013411-14.pdf

8 Peter Warren Singer, *The future of war will be robotic,* CNN (February 23, 2015), http://www.cnn.com/2015/02/23/opinion/singer-future-of-war-robotic/

9 Eliason, op.cit, http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-84/Article/1038783/an-interview-with-robert-o-work/

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Technological Advances, Diminishing Results

Max Boot

The former secretary of defense, Ash Carter, fervently hoped that technology would transform military operations in the near future in ways favorable to the United States. He put billions of dollars behind what is called the "third offset strategy."

The first offset was the Eisenhower administration's New Look—designed to use America's nuclear arsenal to offset the Soviet Union's larger army. The second offset was the strategy of the Carter and Reagan administrations to use Information Age systems, primarily Stealth aircraft and precision-guided munitions, to offset the Soviet Union's continuing advantage in military size. And now, with Russia and China expanding their defense budgets and fielding increasingly sophisticated weapons systems including ultraquiet diesel submarines, cruise missiles, and Stealth fighters, the third offset is supposed to use America's cutting-edge technologies to maintain our military edge.

Which technologies? That's a little hard to say. Unlike the 1950s or 1980s there are not one or two major technologies that the Pentagon is focused on. The Defense Department is investing, as noted by defense analyst Dan Goure, "in groundbreaking technologies in such areas as undersea systems, hypersonics, electronic warfare, big data analytics, advanced materials, 3D printing, energy and propulsion, robotics, autonomy, man-machine interfaces and advanced sensing and computing."[1] The hope is that some of this work will produce a war-winning bonanza. The possible results very quickly enter the realm of science fiction, with work on, among others, laser weapons, exoskeletons, microscopic drones, and, of course, killer robots.

It is likely that some of these projections will come to fruition. If history shows anything, it is that you should not bet against American inventors who have given the world everything from the airplane to the Internet. But will any of the future inventions deliver an enduring American military advantage? On that score there is room for skepticism.

There is no question that some technological breakthroughs in the past have had a dramatic impact on the battlefield. One thinks of the German blitzkrieg through Europe in 1939–1940 utilizing panzers and dive-bombers linked together by radio. But it's important to recall that the Allies rapidly matched the German innovations and that Germany wound up losing the war. Likewise, today the Pentagon is looking for a third offset because the edge produced by the second one, thirty years ago, is fast dissipating.

The pattern of history is clear: Good ideas travel fast, and effective technologies are disseminated quickly. It is doubtful that any future invention will allow the United States to dominate the military sphere for long. In fact, it is sobering to realize that despite its recent technological dominance, the United States has not been winning wars in places like

Afghanistan and Iraq against low-tech adversaries. Superior weapons don't necessarily deliver superior strategic results. While the Pentagon rightly devotes considerable resources to R&D, it should save some mental room for grappling with why the United States has not had a better record of achieving its aims by force—and how it can improve in the future.

1 Dan Goure, *The Pentagon's Third Offset: Just a Smoke Screen for a Shrinking US Military?*, (*The National Interest*, June 14, 2016), http://nationalinterest.org/blog/the-buzz/the-pentagons-third-offset-just-smoke-screen-shrinking-us-16583

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Defending the Final Frontier

Angelo M. Codevilla

The capacity to protect one's own military satellite network while destroying the enemy's—entirely feasible well within a decade—would relegate an enemy's military operations to premodern levels.

There is no comparison between a military force that commands a panoply of satellites and one that does not. GPS practically eliminates the question "where are we?" People and machines guide themselves and communicate worldwide. Information on whatever radiates or reflects energy in any wavelength on, over—and even in some cases—under the earth is used to direct decisions and weapons.

But even though the US government knows that Russia and China have long practiced destroying satellites, it is well aware of the many ways in which satellites can be destroyed. While our military maintains a token capacity to destroy enemy satellites kinetically and continues to harden our own against low-level directed energy attacks from the ground, it is not even considering nonpassive measures to defend its own satellite network. It should.

While attacking satellites individually—whether kinetically by co-orbital, counter-orbital, or direct ascent interception—is as straightforward as putting them into orbit, it is impractical to escort each with devices to destroy interceptors that violate keep-out zones around them. Because any rocket that rises above the atmosphere can then target a satellite, the only practical way of defending one's own satellites against kinetic interception is to control others' access to orbital space.

Any country that acquires the capacity to destroy launches of which it did not approve would put itself in a position analogous to that which the US-British alliance seized during World War II. At that time, the Allies had agents in every major port that inspected cargoes and issued "Certificates of Navigation" (NAVICERTS) to vessels and destinations of which they approved. Ships sailing without NAVICERTS would be sunk. Merely acquiring the capacity to control access to outer space would obviate the need for a similar warning, because all would know that this capacity would be put to use in a crisis.

This capacity is inherent in the deployment of just a few orbit-based laser weapons with power sufficient to destroy space launch vehicles during boost phase (several kilojoules per square centimeter at circa 800 km). Not incidentally, the deployment of even one such weapon, even a low-power prototype (one-tenth that power) unsuitable for boost phase interception, would be more than sufficient to disable enemy satellites.

In 2000–2001, this weapon's ground-based version, known as the Theater High Energy Laser (THEL), also known as the Nautilus, shot down twenty-eight Katyusha rockets fired into Israel. The weapon had been designed for deployment in orbit. Political considerations—especially its potential for missile defense—foreclosed its originally intended use. Adapting it for ground use required overcoming technical hurdles. Returning it to its original configuration would be simpler.

Once upon a time, the technologies required to produce this weapon existed exclusively in the United States. That has not been the case in this century. Were Russia or China to launch their version of it, the question would arise of why the US government had let itself be bested in this epoch-making category of military equipment.

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POLL: In twenty years will there still be contemporary manned bombers and aircraft carriers?

- ☐ No, both systems are too expensive and too vulnerable to cheap swarms of drones and missiles.
- ☐ Maybe, but computers, drones, and robotics will vastly reduce their crews.
- ☐ Yes, any new offensive capability can be nullified by an equal novel defensive weapon.
- ☐ Yes, but their designs and appearance will hardly resemble contemporary models

The Next Revolution in Military Affairs

Peter R. Mansoor

History is replete with examples of revolutions in military affairs, or RMAs, the name for changes in warfare wrought by a combination of technological breakthroughs, organizational adaptations, and doctrinal innovations that lead to new and more effective methods of conducting military operations. Examples include the adoption of firearms and the socket bayonet, which when combined with linear infantry formations, overcame the armored knight and unwieldy formations of archers and pikemen of the early modern era; the dreadnought battleship revolution in the early twentieth century, which briefly revolutionized sea warfare until surpassed by carrier aviation several decades later; and the adoption of armored combat vehicles and motorized combined arms formations that made "blitzkrieg" a household word during World War II. Militaries that have adopted and perfected these revolutions have won impressive victories, at least until their adversaries copied their methods and evened the playing field once again.

For the past seventy-five years a new revolution in military affairs has unfolded, one that has featured guided munitions coupled with sophisticated intelligence, surveillance, and reconnaissance systems. Although in the popular imagination the Gulf War of 1991 was the debut for precision guided munitions, in fact they were part of the battlefield at least as early as 1943, when a German radio-guided bomb, the Fritz X, heavily damaged the US Navy cruiser *Savannah* off the coast of Salerno. Since then tens of thousands of radio, radar, laser, and GPS guided munitions have been dropped in combat, altering battlefields spanning the globe, from Vietnam to Kuwait and from Kosovo to Iraq. Advanced intelligence, surveillance, and reconnaissance systems have made drone warfare an effective military tool, at least in areas bereft of effective air defense systems. The United States as well as its NATO and Pacific Rim allies has fully embraced guided munitions, and Russia and China have likewise developed sophisticated technologies in this regard. Although organizational and doctrinal adaptation has lagged behind technological evolution, there is little doubt but that the information-precision RMA, although it still has room to run, is getting long in the tooth.

The question is what comes next? Predicting the next great leap forward in military effectiveness is no idle exercise, especially given the rewards accruing to early adopters and the consequences that await those militaries that fail to adapt in a timely manner. There are a number of candidates. Cyber technologies are already being used in the world of espionage, but as an instrument of warfare, they will likely be employed as an adjunct to other forms of combat. The digital revolution has made satellite communications a vital aspect of command and control, so the militarization of space will proceed apace. One of the most promising new technological advances is the robotics revolution. Autonomous or semiautonomous systems may come to dominate future battlefields as robotic technology evolves. This evolution will bring with it significant military developments as well as

challenging ethical issues, especially concerning fully autonomous robotic weapons that lack a human in the decision-making loop when it comes time to pull the trigger. Weapons that lack spaces for humans (with their attendant life-support needs) can be made smaller, faster, more heavily armed and armored, and cheaper than today's weapons such as the F-35 fighter, M1A2 main battle tank, and the *Seawolf*-class submarine. Future battlefields may feature swarms of robots battling one another, with their human commanders controlling the action online but offsite.

Such advances will do little to affect irregular warfare, however. We would do well to remember that no matter how technology evolves, the weapons of the weak—hybrid war, guerrilla war, insurgencies, and terrorism—will remain largely unchanged. While preparing for war against future major state adversaries, therefore, the US military must not jettison the hard-won lessons learned in the past fifteen years of war in Afghanistan and Iraq.

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The Key Technological Breakthrough: Avoiding Death

Bing West

What technological breakthroughs could recalibrate military operations in the tradition of the tank, guided missile, jet aircraft, or nuclear weapon? It's not the technologies; rather, it is the motivation driving the technologies that has changed. The American Way of War has reverted back to the pre-1775 style called "skulking": you try to kill your enemy while staying alive. That is quite different than the Decisive Battle theory and practice of war that dominated in the Civil War, World War I, World War II, Korea, Vietnam, Desert Storm, and the 2003 March to Baghdad.

In comparing, say, Vietnam with Iraq and Afghanistan, no variable is more telling than the avoidance of casualties on our side. We have entered a different cultural era, a different way of thinking about war. What does this mean? Simple: avoiding casualties has emerged as the motivating force behind technological breakthroughs.

The technology of social media—TV, cell phones, the Internet, et al.—has created a global commons. Barbarians and atavistic tribes rub digital elbows with American college students inside the cocoons of their "safe houses." The universal effect has been the intensification of solipsism, as every human being has become more aware of his individual worth—a feeling that he counts for more. Thus, he is less willing to risk dying. This affects the selection of tactics, the style of operations, and the chances of winning. It can prolong suffering and increase casualties.

Before you dismiss that as absurd conjecture, look at the trends. Sixty million were killed in history's most savage war seventy years ago. My two uncles were marine platoon commanders on Guadalcanal and Okinawa. The stoic outlook of such men greatly affected how we fought for the next several decades. In Vietnam, we "grunts" accepted as normal combat seeing the bodies of the enemy after every battle. We carried our fallen in poncho liners to the nearest LZ and went on with the mission. We didn't dwell on death.

In Desert Storm, we and our allies won with scant fatalities. We also forbore, choosing not to kill our enemies trapped on the "road of death." This ushered in a different attitude about sacrifice, cost, and the infliction of destruction in war. For the past fifteen years, we have fought two wars while expecting to suffer few losses. Each individual struck down was treated with solemn reverence and remembrances. That observation is not intended in any way to suggest callousness toward any warrior who has given the last, full measure of devotion.

But gradually as a military we did become exceedingly sensitive to casualties, with senior commands overseeing individual small patrols and setting limits upon even squad tactics. The fundamental infantry principle of "fire and maneuver" was changed to "fire, get down, and call in more fire from the air." Massive and heavy protective armor prevented maneuver, while not wearing the armor

was subject to court-martial. The lack of any sensible strategy compounded the desire to avoid casualties. Nation-building as a military mission—twenty-year-old grunts expected to convert fifty-year-old tribal chiefs by sipping tea—was risible at the level where the wars were fought. So many small-unit leaders decided their real mission was to bring everyone home in one piece.

The avoidance of casualties quickly evolved to include civilians. This led to rules of engagement that shackled our relative advantage in employing firepower and gave an edge to our enemies.

Fighting a war while eschewing death extended to all our allies, European and Arab. It was not an American-only phenomenon. Over the past fifteen years, I have embedded with over fifty platoons of various nations in the course of dozens of trips to Afghanistan and Iraq. The commonality observed over more than one hundred combat patrols was the caution exhibited *on both sides*.

This was in marked contrast to my grunt tours in Vietnam, where the North Vietnamese would dig in like badgers or slip through the wire to engage us. Battles were fought until one side or the other was exhausted or torn apart and forced to retreat.

That's not how the jihadist terrorists and other insurgent gangs in Iraq and Pakistan fought. Yes, the suicide bomber does reflect a warped religious ideology even more murderous than the World War II kamikaze pilots with their Bushido creed. But they are a distinct minority. Among our enemies, the cell phone is ubiquitous, and access to the Internet by individual jihadists is far more common than most realize. Most fight like Apaches, sniping and hiding, usually keeping a canal or tree-line behind them and the allied patrol in order to escape intact.

The nature of warfare in the twenty-first century—the willingness of the combatants at the fighting level—has changed. It may shift back, but for the first decade and a half, battles have not been fought to the death. Even the jihadists in the three battles for Fallujah (April 2004, November 2004, and June 2016) did not stay and die; they ran away. Winning by standing on the enemy's ground at battle's end happens very rarely. And this skulking way of war, common in America in the eighteenth century, seems to affect all parties—Russians, Americans, Europeans, and our enemies. I attribute this to an enhanced sense of self-worth sparked by the interactivity that flows from the Internet. Each fighter is more aware of the sweetness of normal life, even when he is on the battlefield. He's not alone with his unit, writing a letter a month home, as in World War II, Korea, or Vietnam. Instead, he hops on the NET that provides constant reminders of a better life.

In conclusion, I expect Europeans and Americans to focus their efforts upon developing warfighting technologies that reduce casualties among our warriors.

Bing West is an author and former assistant secretary of defense for International Security Affairs during the Reagan administration. He is a graduate of Georgetown and Princeton Universities where he was a Woodrow Wilson Fellow, and served in the marine infantry in Vietnam. He is the best-selling author of nine books on military history; he travels frequently to war zones. His latest book is entitled *One Million Steps: A Marine Platoon at War* (2014).

Discussion Questions

1. Are there any technological breakthroughs on the military horizon that might radically change air, land, or sea warfare, or redefine current relative military strength?

2. Are most military breakthroughs aimed more at defensive or offensive operations?

3. Does the United States still maintain its lead in developing breakthrough military technology?

4. Will robotics and drone technologies radically reduce human losses or increase them?

5. Are there military systems in development that will substantially reduce the threat of nuclear warfare?

Suggestions for Further Reading

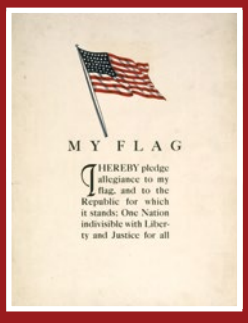
Railguns

- Julian E. Barnes, *A First Look at America's Supergun* (*The Wall Street Journal,* May 30, 2016), https://www.wsj.com/articles/a-first-look-at-americas-supergun-1464359194
- Douglas Ernst, *Pentagon expands Rail Gun weapons tests to Army Howitzer* (*The Washington Times,* January 3, 2017), http://www.washingtontimes.com/news/2017/jan/3/pentagon-expands-rail-gun-tests-to-army-howitzer-y/
- James Mugg, *US Navy's Railgun Dream Could Be Denied By Two Big Problems,* http://nationalinterest.org/blog/the-buzz/us-navys-railgun-dream-could-be-denied-by-two-big-problems-17301
- Kris Osborn, *The US Army's Ultimate Super Big Gun (Firing 5,000 Mile Per Hour 'Bullets') Is Almost Here,* (*The National Interest,* January 3, 2017), http://nationalinterest.org/blog/the-buzz/the-us-armys-ultimate-super-big-gun-firing-5000-mile-per-18922

Directed-Energy Weapons

- Jason D. Ellis, *Directed-Energy Weapons: Promise and Prospects* (*Center for a New American Security,* April 2015), https://www.cnas.org/publications/reports/directed-energy-weapons-promise-and-prospects
- George Leopold, *Study: DOD needs to field laser weapons ASAP,* (*Defense Systems,* June 5, 2015), https://defensesystems.com/articles/2015/06/05/dod-diected-energy-weapons-study.aspx
- Loren Thompson and Daniel Goure, *Directed-Energy Weapons: Technologies, Applications and Implications,* (*Lexington Institute,* February 2003), http://lexingtoninstitute.org/wp-content/uploads/directed-energy-weapons.pdf

In the Next Issue
America's Nationalist Foreign Policy



Military History in Contemporary Conflict

As the very name of Hoover Institution attests, military history lies at the very core of our dedication to the study of "War, Revolution, and Peace." Indeed, the precise mission statement of the Hoover Institution includes the following promise: "The overall mission of this Institution is, from its records, to recall the voice of experience against the making of war, and by the study of these records and their publication, to recall man's endeavors to make and preserve peace, and to sustain for America the safeguards of the American way of life." From its origins as a library and archive, the Hoover Institution has evolved into one of the foremost research centers in the world for policy formation and pragmatic analysis. It is with this tradition in mind, that the "Working Group on the Role of Military History in Contemporary Conflict" has set its agenda—reaffirming the Hoover Institution's dedication to historical research in light of contemporary challenges, and in particular, reinvigorating the national study of military history as an asset to foster and enhance our national security. By bringing together a diverse group of distinguished military historians, security analysts, and military veterans and practitioners, the working group seeks to examine the conflicts of the past as critical lessons for the present.

Working Group on the Role of Military History in Contemporary Conflict

The Working Group on the Role of Military History in Contemporary Conflict examines how knowledge of past military operations can influence contemporary public policy decisions concerning current conflicts. The careful study of military history offers a way of analyzing modern war and peace that is often underappreciated in this age of technological determinism. Yet the result leads to a more in-depth and dispassionate understanding of contemporary wars, one that explains how particular military successes and failures of the past can be often germane, sometimes misunderstood, or occasionally irrelevant in the context of the present.

Strategika

Strategika is a journal that analyzes ongoing issues of national security in light of conflicts of the past—the efforts of the Military History Working Group of historians, analysts, and military personnel focusing on military history and contemporary conflict. Our board of scholars shares no ideological consensus other than a general acknowledgment that human nature is largely unchanging. Consequently, the study of past wars can offer us tragic guidance about present conflicts—a preferable approach to the more popular therapeutic assumption that contemporary efforts to ensure the perfectibility of mankind eventually will lead to eternal peace. New technologies, methodologies, and protocols come and go; the larger tactical and strategic assumptions that guide them remain mostly the same—a fact discernable only through the study of history.

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