Coming next in military tech

Michael C. Horowitz

Bulletin of the Atomic Scientists 2014 70: 54
DOI: 10.1177/0096340213516743

Bulletin of the Atomic Scientists

IT IS 5 MINUTES TO MIDNIGHT

Feature

Bulletin of the Atomic Scientists
2014, Vol. 70(1) 54–62

DOI: 10.1177/0096340213516743
http://thebulletin.sagepub.com
SAGE

Coming next in military tech

Michael C. Horowitz

Abstract

Despite uncertainty in defense funding levels, several emerging technology areas could shape the US military over the next decade or so, including unmanned systems, autonomous systems, cyber weaponry, three-dimensional printing, and directed-energy weapons. Whether the US military capitalizes on these technologies will depend greatly on organizational decisions. Given the likely fiscal challenge of sequestration, the US government may find it challenging to sustain funding for emerging defense technologies, but, the author writes, investing in the future is necessary if the US military is to retain the technological edge it holds today.

Keywords

3D printing, autonomous weapons, cyber weapons, directed-energy weapons, emerging military technology, unmanned weapons, swarming

Predicting the future of technology is hard, and it is much easier to be wrong than right. Americans are still waiting for the flying cars depicted in *The Jetsons* more than 40 years ago, though cleaning products created by companies like iRobot suggest that the Jetson family maid, Rosie the Robot, could become a reality. In the military realm, predictions that look smart in retrospect—for example, British Adm. John Fisher's premonition at the dawn of the 20th century about the significant effect of the submarine on warfare—are the exception rather than the rule (Horowitz, 2010).

Most Americans assume that the United States will lead the charge into the next generation of technology. Technological superiority is not a US birthright, however; it was hard earned throughout the Cold War and over the last two decades. Paired with the best-trained military forces in the world, technological superiority is the backbone of US conventional military power. Yet, there are reasons for concern about what the next decade may bring for US military technological superiority. The rest of the world has not stood still in its response to the US military's exploitation of unmanned aerial vehicles, precision strike weapons, and radar-evading stealth technologies over the last generation.[1]

Many countries have focused on developing anti-access and area-denial capabilities—for example, deploying high-speed anti-ship missiles—designed to raise the costs for the United States to use force. Moreover, investments by countries in the Asia-Pacific region, especially China, in missiles, space, precision guidance, cyber weaponry, and unmanned systems are already chipping away at the US high-end technological edge (Tellis, 2012). For example, a 2012 Defense Science Board report called the military significance of China's investments in unmanned aerial vehicles "alarming" (2012: 71). Also, the underlying basis of many future technologies, from guidance to unmanned systems, seems increasingly driven by off-the-shelf developments by commercial firms, an effect magnified by globalization (Brimley et al., 2013). This could make it easier for actors from Hezbollah to North Korea to acquire advanced avionics and military technologies once unattainable for everyone but the United States and its allies.

Combined with what appears to be an accelerating rate of technological change—evidenced by technologies that appeared all but unreachable a decade ago but today are in every smartphone—the US military needs to invest smartly in the next generation of technology to stay ahead. But forces affecting the US defense effort, from sequestration to the end of wars in Afghanistan and Iraq to the natural resistance within military organizations to certain types of disruptive change, have created uncertainty about investments in emerging technologies. Whether technological or organizational, new ideas often lack the political constituencies necessary to protect them from the budget ax during tough times. This effect is magnified as the threat to legacy platforms and existing core competencies grows (Brimley et al., 2013; Horowitz, 2010).

Despite this uncertainty, several emerging technology areas will likely shape the US military over the next decade and beyond, including unmanned systems, autonomous systems, cyber weaponry, three-dimensional printing, and directed-energy weapons, among others.[2] As in the past, the global winners when it comes to these new technologies will not be those who prototype the first new gadget, but those who figure out how to use it best to generate military power (Horowitz, 2010). History is littered with states that invented new technologies or new ways of applying technology, only to have others surpass them. The British invented the aircraft carrier with the deployment of the HMS *Furious* at the end of World War I, for example, but the United States and Japan were the countries that systematically exploited the potential of naval air power in World War II. Whether the US military ends up benefiting most from now-emerging technologies will depend as much on organizational decisions involving their incorporation in military practice and the training and expertise of the people who will use them as on the technologies themselves.[3]

To swarm or not to swarm: The future of unmanned systems

The unmanned aerial vehicle is perhaps the most recognizable technology associated with 21st-century warfare. While simple unmanned systems have been around for decades, the use of US unmanned aerial vehicles such as the Predator and Reaper to conduct precision airstrikes in Afghanistan and beyond (Obama, 2013) has thrust unmanned aircraft into a controversial spotlight. Unmanned ground systems, such as the improvised-explosive-device-detecting robot depicted in the movie *The Hurt Locker*, have similarly caught the eye of the public.

Many countries, including the United States, are now interested in a new generation of unmanned technologies. If the technology continues maturing, next-generation unmanned aerial vehicles could provide new advantages compared with their manned counterparts—for example, they might combine their existing ability to loiter in an area for hours with more stealthy profiles that can evade the eyes and ears of adversaries, and at a lower price point than some manned systems. They can also help militaries place fewer of their people at risk in an operation.

In the United States, the takeoff and landing of the X47-B experimental unmanned aircraft from the USS *George H. W. Bush* aircraft carrier in the summer of 2013 demonstrated the potential of the next generation of unmanned aircraft (Freedberg and Clark, 2013). Launching from and landing on an aircraft carrier is an incredibly complex and difficult task for even the best fighter pilots in the world, let alone a remotely piloted aircraft. The question is what comes next. The US Navy currently plans to develop an unmanned aircraft designed to operate from an aircraft carrier, called the Unmanned Carrier Launched Surveillance and Strike system (LaGrone, 2013a).

It remains unclear whether this program will be an incremental improvement on a platform like the Reaper, something best suited to conduct surveillance and strike operations against adversaries that lack sophisticated defenses, or whether it will be a next generation system designed with the ability to survive in an environment in which enemies are actively trying to find it and shoot it down. Early indications suggest that the Unmanned Carrier Launched Surveillance and Strike program has evolved toward something more akin to a Reaper (LaGrone, 2013a, 2013b). Combined with Air Force uncertainty about future unmanned aerial vehicle investments (Lee, 2013), these developments create a risk that the United States will fail to capitalize on its current lead in unmanned aircraft.

Changes in operating concepts for unmanned aircraft could, potentially, have an even more significant effect on warfare over the next decade than investments in particular platforms. Researchers have already demonstrated the potential for multiple small unmanned aerial vehicles controlled by a single pilot to fly in coordinated patterns, or swarms, something long discussed by researchers such as John Arquilla at the Naval Postgraduate School (Arquilla and Ronfeldt, 2000) as a way to overwhelm an adversary's defenses (Reed, 2013). Recently, Boeing flew an older-model F-16 aircraft remotely (Sterling, 2013). This could theoretically allow unmanned systems to fly alongside manned fighters in future combat operations, potentially increasing the flexibility and firepower of US military operations.

In particular, the US military could be able to exploit small unmanned aerial vehicles (if the unit cost of unmanned systems declines and the miniaturization of munitions continues) or repurposed older fighter aircraft in swarms or other formations. This approach could be difficult to adopt, because it would represent a dramatic change from how the US military has done business over the last several decades, emphasizing replaceable systems designed to be lost, rather than small numbers of systems with high levels of survivability.[4] If they become technologically plausible, however, such tactics could allow the United States to project power more cost-effectively—a must given ongoing fiscal austerity.

Upcoming unmanned investments are not limited to the air. For example, the US Navy had about 450 unmanned underwater vehicles in its inventory in April 2012 (Martin, 2012) and is investing in vehicles that will have weeks or even months of endurance to stay submerged at sea. From providing extended eyes and ears for US manned submarines to laying mines in areas too shallow for manned submarines to enter, unmanned underwater vehicles will represent a growing area of naval investment (Graham, 2012).

How much autonomy?

Over the next decade, the US military will likely continue integrating autonomy into more of its systems, with the functionality becoming increasingly sophisticated. Autonomous features today already include launch, recovery, and simple navigation for some unmanned aircraft. Future developments could include more advanced capabilities in navigation, aerial refueling, reconnaissance, maneuvering, swarming with multiple platforms, electronic warfare, and, perhaps, some aspects relating to the application of force. Many developments will be simply extensions of autopilot technology that has been employed by commercial airlines for a generation, but others could reflect advances in autonomy in the commercial sector (think: Google's car that can drive itself).

According to discussions surrounding the publication of a new Defense Department directive in November 2012, the United States is not currently employing or developing offensive autonomous weapons systems, systems that "once activated, can select and engage targets without further intervention by a human operator" (Defense Department, 2012). Such a move, according to the directive, will be allowed only after an extensive review process and approval by senior-level Defense Department policy makers. But why might the United States or other militaries pursue autonomous weapons? One reason is that autonomous weapons systems could allow faster reaction times in an engagement. The United States has employed defensive systems with human-supervised autonomous modes to defend against attacks from missiles and enemy aircraft for decades.[5]

On the other hand, some worry that autonomous weapons systems may lack the ability to discriminate between innocents and military targets or that they could trigger unintended escalation in a crisis. Indeed, nongovernmental organizations such as Human Rights Watch have launched a "stop killer robots" campaign designed to ban these systems now (Wareham, 2013). Exaggerated discussions can make autonomous weapons sound like science fiction and indeed range far outside the realm of the possible (for example, the artificially intelligent, humanity-exterminating Skynet of the *Terminator* films). But other, more prosaic forms of autonomous weapons are being used by militaries today.[6] The Israeli Harpy, for example, is an unmanned aerial vehicle programmed to attack particular types of radar systems in a given area without assistance from a human operator.

Clearly, autonomous weapons systems raise complicated ethical and policy issues. The basic question: Should humans be comfortable with a machine that makes decisions, without direct human supervision, about using lethal force? While issues like these mean the United States is likely to be cautious in its development of autonomous weapons systems, as demonstrated by the Defense Department's directive on the subject, other countries may find these systems attractive. Given the US advantage in fighters, tanks, bombers, and other platforms of the present, it is only natural to expect other countries to invest heavily in ways that aim to counter US superiority, potentially including autonomous weapons systems. Some report that China is developing autonomous weapons systems (Schmitt and Thurnher, 2013). If other countries do make advances in autonomous weapons, they could force the United States to decide whether to pursue its own autonomous weapons systems; develop them but restrain itself unless attacked with an autonomous weapons system first (i.e., a "no first use" policy); or restrict development.

The logistics revolution: 3D printing

Also called additive manufacturing, 3D printing involves converting a three-dimensional software model of a physical object into the actual object itself, layer by layer. It has rapidly advanced over the last few years from the realm of hobbyists to big business—with real military implications. As 3D printing advances from printing whistles and dinner plates to printing firearms (Bilton, 2013) and air ducts for fighter aircraft (*Economist*, 2013), it could have a significant effect on the US military.

The ability to prototype new designs for products at extremely low cost and print increasingly complex manufacturing products in a home or office could reshape the notion of production and logistics in the civilian economy (Gershenfeld, 2012). As the technology evolves, 3D printing could affect the US military in several ways. Most broadly, defense manufacturers such as Boeing and Lockheed already integrate 3D-printed replacement parts into fighter aircraft (*Economist*, 2013). In the future, 3D printing could enable the rapid integration of new technologies whenever a design breakthrough occurs, allowing for true plug-and-play with existing platforms (Cheney-Peters, 2013). The US Navy is already experimenting with using 3D printing to improve the quality and speed of maintenance. At the suggestion of the Navy's Rapid Innovation Cell, a group set up by the Chief of Naval Operations to advise him on new, innovative concepts, 3D printers are being placed at bases in Norfolk, Virginia, and San Diego, where they will produce customized replacement parts and allow sailors to experiment (Cheney-Peters, 2013; Fellman, 2013).

Finally, industrial-size 3D printers with multi-component capacity could serve as a game-changing technology for humanitarian operations and disaster relief, especially if they can produce products made of steel or other materials stronger than plastics. One challenge with humanitarian assistance is that it is often hard to know exactly what is needed before the relief operation gets under way; 3D printing could give relief organizations the ability to rapidly produce materials on the spot, from barricades to temporary housing for displaced people to daily necessities such as clothes and shoes. This flexibility could offer significant advantages in the early and most chaotic days following a disaster.

Of all the technologies discussed in this article, 3D printing may have the most promise and the longest time frame to become truly disruptive. There are practical limits that will restrict the effect of 3D printing over the next several years, including printing speed, the ability to print complex, multicomponent parts or systems, and the basic requirement for the necessary raw resources for 3D printers to operate. If technological developments continue to lower these barriers, however, the implications for US society—and the US military—will be tremendous.[7]

Cyber weapons: The two-edged sword

The word "cyber" is a loaded one, in part because many of the physical manifestations of use of the technology are hard to pin down, beyond a few famous incidents like Stuxnet and the crashing Iranian centrifuges. Despite large-scale recognition of the cyber challenge, the specific implications for the US military are also difficult to assess. Critics argue that the risk of cyber war is overblown, because truly devastating cyber attacks will be extremely difficult to execute (Gartzke, 2013; Rid, 2013); others worry that the US military and civilian economy is at risk of a cyber Pearl Harbor that will have catastrophic physical implications.

As the information age continues to decentralize control of information and the ability to use advanced computing, US military and commercial networks will require strong defensive capabilities. Indeed, the Chief of Naval Operations, Adm. Jonathan Greenert, has signaled that spending on cyber will remain a priority despite the budgetary pressure of sequestration (O'Callaghan, 2013). Investments over the next several years are likely to focus on building up the personnel necessary for cyber operations, especially cyber security, and attempting to leverage cyber capabilities as a force multiplier for physical military forces.

Of the technologies discussed in this article, cyber most closely approximates a double-edged sword. According to the Defense Department's Cyberspace Strategy (2011), the US military depends on secure access to cyberspace for operations and has exploited that access to effectively project power for more than a decade, but that dependence also creates vulnerabilities that adversaries are attempting to exploit. It is also unclear how exactly the United States should and will integrate its cyber forces into traditional military operations. Beyond defending its own networks and enabling military forces in the field, over the next decade, the US military will have to make decisions on whether, how, and when to use cyber to exploit adversary networks and attack adversary military systems.

Directed energy comes of age. Finally

After decades of research into directed energy, especially lasers and electromagnetic pulses, the US military could develop weapons that use such technologies over the next decade. Far from the phasers of *Star Trek* fame, tomorrow's directed-energy weapons appear most useful for defending US ships and other assets from air and missile threats. With a low marginal cost (O'Rourke, 2013), these weapons could enhance US air and missile defense efforts over the next decade with a price-per-shot much lower than the cost for adversaries of launching an attack, though much more testing and research is necessary.

Two efforts appear promising, though many others are in development. The US Navy is testing an electromagnetic railgun that could hurl projectiles 100 nautical miles or more, and a variant could reach initial operating capability by 2017 (Hoffman, 2013; Osborn, 2013). Additionally, the US Navy plans to deploy a solid-state laser aboard the USS *Ponce* as a test bed to evaluate the laser against potential targets (Jean, 2013). These developments suggest that directed energy may soon move from a long-awaited weapon of the future to reality.

Complacency: The wrong technological option

The technological areas outlined above are just a few of the promising areas for investment over the next decade. If key breakthroughs in the weight and duration of battery power occur, for example, exoskeletons that allow soldiers to carry heavier loads, run faster, and avoid harm could become relevant for the US Army and Marine Corps over the next decade—though the time frame is likely longer (Ponsford, 2013). Meanwhile, work on biological enhancement, designed to improve human performance, continues in science labs around the world and will raise important moral questions.

The backdrop of fiscal austerity will make it more challenging for the United States to maintain its technological superiority than at any point since the end of the Cold War. Keeping that in mind, one risk is that, in the bureaucratic competition for slices of a shrinking pie of resources, the US military takes its technological superiority for granted.

Currently, qualitative technological superiority undergirds US conventional military power. The combination of people, platforms, and force employment concepts have given US military forces a significant lead over the rest of the world. As part of its efforts to maintain this lead, the United States can and should invest significantly in unmanned systems, autonomous systems, 3D printing, cyber, and other areas, in an attempt to build the military of the future. Investing in the future is not a luxury; it is necessary to ensure that the US military of the next generation retains the technological advantages it holds today.

Acknowledgements

The opinions expressed in this article do not reflect those of the Defense Department or the United States government. The author would like to thank Danielle DeBroeck and Jordan Trafton for their research assistance, and Van Jackson for his helpful suggestions. All errors are the responsibility of the author.

Funding

The Noetic Corporation provided funding for the author to participate in the workshops described in this article.

Notes

1. Advanced unmanned aerial vehicles capable of intelligence, surveillance, and reconnaissance or strike missions are proliferating around the world. According to a Government

Accountability Office report (2012), 76 countries already possess some type of unmanned aircraft.

2. These insights are informed by the author's participation in the NeXTech project on the future of war run by the Noetic Corporation and funded by the Rapid Reaction Technology Office within the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics.
3. Emphasizing these investment areas is not an argument against ongoing modernization, including the Virginia Payload Module for attack submarines, a new long-range strike bomber, the Long Range Anti-Ship Missile, and the extended-range Joint Air-to-Surface Standoff Missile. These investments are critical to ensure qualitative US military superiority today and tomorrow. This article focuses instead on areas that will emerge over the next decade and beyond.
4. Also see Brimley et al. (2013). If the technology heads in this direction but the United States fails to adopt it—while other countries do—that decision could be one a series of choices through which the United States gradually loses its technological edge (Horowitz, 2010).
5. The Patriot land-based and Aegis ship-based missile defense systems both have the ability to operate in human-supervised autonomous modes. For some of the potential benefits of autonomous weapons systems, see Drennan (2010).
6. There is also the possibility of "hacking," though that could be true of unmanned systems in general or even manned but networked systems.
7. In particular, the interaction of 3D printing with other technologies, such as 3D-printed unmanned systems, could magnify the implications of both technologies. The Noetic workshops described above highlighted these potential combinations.

References

Arquilla J and Ronfeldt D (2000) *Swarming and the Future of Conflict*. Washington, DC: Rand Corporation. Available at: www.rand.org/content/dam/rand/pubs/documented_briefings/2005/RAND_DB311.pdf.

Bilton N (2013) How 3-D printers are now making weapons. *New York Times* 'Bits' Blog, March 27. Available at: http://bits.blogs.nytimes.com/2013/03/27/click-print-gun-how-3-d-printer-are-now-making-weapons/.

Brimley S, FitzGerald B, and Sayler K (2013) Game changers: Disruptive technology and U.S. defense strategy. Disruptive Defense Papers, Center for a New American Security, September. Available at: www.cnas.org/files/documents/publications/CNAS_ Gamechangers_BrimleyFitzGeraldSayler_0.pdf.

Cheney-Peters S (2013) Print me a cruiser! *Proceedings Magazine* 139(4). Available at: www.usni.org/magazines/proceedings/2013-04/print-me-cruiser.

Defense Department (2011) Department of Defense strategy for operating in cyberspace. Available at: www.defense.gov/news/d20110714cyber.pdf.

Defense Department (2012) Department of Defense directive 3000.09: Autonomy in weapon systems. November 21. Available at: www.dtic.mil/whs/directives/corres/pdf/300009p.pdf.

Defense Science Board (2012) Task force report: The role of autonomy in DoD systems. Office of the Under Secretary of Defense for Acquisition, Technology and Logistics. Available at: www.acq.osd.mil/dsb/reports/AutonomyReport.pdf.

Drennan JE (2010) How to fight an unmanned war. *Proceedings Magazine* 136(11): 58–63.

Economist (2013) 3D printing scales up. September 7. Available at: www.economist.com/news/technology-quarterly/21584447-digital-manufacturing-there-lot-hype-around-3d-printing-it-fast.

Fellman S (2013) 3-D printers will create parts and gear for sailors. *Navy Times*, June 7. Available at: www.navytimes.com/article/20130607/NEWS04/306070017/.

Freedberg SJ Jr and Clark C (2013) Navy, Northrop score historic first with (mostly) successful X-47B drone carrier landings. Available at: http://breakingdefense.com/2013/07/navy-northrop-score-historic-first-with-successful-x-47b-drone-carrier-landing/2/.

Gartzke E (2013) The myth of cyberwar: Bringing war in cyberspace back down to earth. *International Security* 38(2): 41–73.

Gershenfeld N (2012) How to make almost anything: The digital fabrication revolution. *Foreign Affairs* 91(6): 43–57.

Government Accountability Office (2012) Agencies could improve information sharing and end-use monitoring on unmanned aerial vehicle exports. Report no. GAO-12-536. Available at: www.gao.gov/assets/600/593131.pdf.

Graham C (2012) The future of maritime warfare: Unmanned undersea vehicles (UUVs). Maritime Security Challenges Conference Official Blog, August 20. Available at: http://mscconference.wordpress.com/2012/08/20/the-future-of-maritime-warfare-unmanned-undersea-vehicles-uuvs-2/.

Hoffman M (2013) Navy wants railguns for missile defense. DefenseTech.org, January 18. Available at: http://defensetech.org/2013/01/18/navy-railguns-future-is-in-missile-defense/.

Horowitz MC (2010) *The Diffusion of Military Power: Causes and Consequences for International Politics*. Princeton, NJ: Princeton University Press.

Jean G (2013) Navy League 2013: USN to deploy solid-state laser weapon on board USS Ponce in 2014. *Jane's Navy International*, April 8. Available at: www.janes.com/article/11811/navy-league-2013-usn-to-deploy-solid-state-laser-weapon-on-board-uss-ponce-in-2014.

LaGrone S (2013a) AUVSI 2013: UCLASS requirements modified due to budget pressure. US Naval Institute News, August 14. Available at: http://news.usni.org/2013/08/14/auvsi-2013-uclass-requirements-modified-due-to-budget-pressure.

LaGrone S (2013b) Report: Some in industry concerned with shift in UCLASS requirements. US Naval Institute News, September 23. Available at: http://news.usni.org/2013/09/23/report-industry-concerned-shift-uclass-requirements.

Lee C (2013) Staying the course: US UAVs advance on a shoestring. *Jane's Defence Weekly*, July 23.

Martin A (2012) U.S. expands use of underwater unmanned vehicles. *National Defense* 96(701). Available at: www.nationaldefensemagazine.org/archive/2012/April/Pages/USExpands UseOfUnderwaterUnmannedVehicles.aspx.

Obama B (2013) Obama's speech on drone policy. *New York Times*, May 23. Available at: www.nytimes.com/2013/05/24/us/politics/transcript-of-obamas-speech-on-drone-policy.html.

O'Callaghan J (2013) Top U.S. admiral puts cyber security on the Navy's radar. *Reuters*, May 13. Available at: www.reuters.com/article/2013/05/13/us-usa-defence-cyber-idUSBRE94C0B3201 30513.

O'Rourke R (2013) Navy shipboard lasers for surface, air, and missile defense: Background and issues for Congress. Congressional Research Service, June 27. Available at: www.fas.org/sgp/crs/weapons/R41526.pdf.

Osborn K (2013) Navy awards EM Railgun contract. DefenseTech.org, July 3. Available at: http://defensetech.org/2013/07/03/navy-awards-em-railgun-contract/.

Ponsford M (2013) Robot exoskeleton suits that could make us superhuman. CNN.com, May 22. Available at: www.cnn.com/2013/05/22/tech/innovation/exoskeleton-robot-suit/.

Reed J (2013) Air Force's new idea for spying on China: Swarms of tiny bug drones. ForeignPolicy.com, August 13. Available at: http://killerapps.foreignpolicy.com/posts/2013/08/13/the_air_forces_new_idea_to_spy_on_countries_like_china_swarms_of_tiny_bug_drones.

Rid T (2013) *Cyber War Will Not Take Place*. New York: Oxford University Press.

Schmitt MN and Thurnher JS (2013) 'Out of the loop': Autonomous weapons systems and the law of armed conflict. *Harvard National Security Journal* 4(2): 231–281.

Sterling R (2013) On target: F-16 flies with an empty cockpit. Available at: www.boeing.com/boeing/Features/2013/09/bds_qf16_09_23_13.page.

Tellis AJ (2012) Uphill challenges: China's military modernization and Asian security. In: Tellis AJ and Tanner T (eds) *Strategic Asia 2012–13: China's Military Challenge*. Washington, DC: National Bureau of Asian Research, pp. 3–24. Available at: www.nbr.org/publications/strategic_asia/pdf/SA12_Overview.pdf.

Wareham M (2013) Prevent 'killer robots' deciding when to kill on battlefield. *Public Service Europe*, May 30. Available at: www.hrw.org/news/2013/05/30/prevent-killer-robots-deciding-when-kill-battlefield.

Weisgerber M (2013) Sequestration could chop $33B from DoD investments. DefenseNews.com, July 10. Available at: www.defensenews.com/article/20130710/DEFREG02/307100020/Sequestration-Could-Chop-33B-from-DoD-Investments.

Author biography

Michael C. Horowitz is an associate professor of political science at the University of Pennsylvania. He spent 2013 as an International Affairs Fellow, funded by the Council on Foreign Relations, working for the Deputy Assistant Secretary of Defense for Force Development in the Office of the Under Secretary of Defense for Policy.