The Human Domain and the Future of Army Warfare: Present as Prelude to 2050

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> "The ultimate cause of our failure was a simple one: despite all statements to the contrary, it was not due to lack of bravery on the part of our men, or to any fault of the Fleet's. We were defeated by one thing only - by the inferior science of our enemies. I repeat - by the *inferior* science of our enemies." – Arthur C. Clarke, *Superiority[1]*

Introduction

Much of the current focus on the future of warfare for the U.S. military centers on technology and place, largely at the expense of the actors at the root of conflict. Certainly, the physical environment of the future of warfare will be unlike that of the past—trading large, open expanses of terrain for sprawling, dense urban centers. Likewise, the democratization of technology will enable adversaries to cheaply and effectively counter costly and complex capabilities. The further diffusion of power from a unipolar order to a multipolar order and economic hyper-interconnectivity will continue to compound the difficulty of operating within the future environment.

Warfare in 2050 will be predominantly urban, utilizing advanced technologies and robotics, but remain an inherently human and political endeavor. Warfare in 2050 will not be fought and won by the military alone—it will require joint, interagency, international, and multinational collaboration to succeed. Despite the appeal, the U.S. Army must look beyond the strictly technological solutions offered by the Third Offset to improved methods of understanding and engaging the enemy. Every soldier is taught to "adapt, improvise, and overcome" in order to solve complex problems. Our adversaries do the same: from the development and employment of explosively formed penetrators (EFPs) to counter advancements in armor to increases in improvised explosive devices (IEDs) in Iraq and Afghanistan; Hamas' use of unmanned aerial vehicles in Gaza and the Islamic State use of drones in Syria and Iraq. Our adversaries are using off-the-shelf technologies and simple, cost-effective, locally sourced manufacturing, to great effect directly on the battlefield, and government-sponsored hackers to conduct penetration testing of secure U.S. government networks and "troll armies" to spread propaganda and misinformation.

Below, I discuss how current technological approaches and their corollaries are insufficient in gaining tactical, operational, or strategic advantage due to the democratization of technologies and the ease with which such technologies can be defeated. I then consider social trends that will shape the future

operational environment (OE), dictating the course of combat in the years to come. Next, I examine the trends in changing geopolitical power and the evolving role of the soldier to envision the future of conflict. Finally, I offer a synthesis and recommendations for the U.S. Army to consider.

Future Technology: Advanced, Accessible, and Democratized

The rate of technological change over the last half-century has been staggering. Advances in and the implementation of drones and other unmanned systems (UMS) over the last 15 years have largely characterized modern warfare. A pilot can now operate an aircraft flying virtually anywhere on the globe from a connex in the Nevada desert to conduct ISR or to find, fix, and finish an enemy target. The U.S., however, does not hold the keys to the castle. Currently, 11 states have armed drones, including China, Iran, Pakistan, and Somalia,[2] and many more are developing them.[3] Non-state actors, such as Hezbollah and the Islamic State are also purportedly using drones.[4] But UMS are not only airborne—they are being used in the oceans,[5] on land,[6] and in space,[7] and have already been deployed across the globe. China has been actively working to fill the void created by the U.S. by selling remotely piloted aircraft (RPA) to states which otherwise cannot access the technology,[8] and is likely to continue in the future. Russia already has plans to deploy unmanned ground combat vehicles (UGCVs) by 2018, and is actively researching further fully automated platforms.[9],[10] Robotics, it seems, have taken hold and are not likely to go away any time soon, as they provide access to areas deemed too dangerous to send humans, stand-off distance, and loitering capabilities that any manned system would little be able to provide.

Advances in artificial intelligence (AI) are likewise rapidly evolving the field, enabling a new generation of programs the ability to accomplish such tasks as sorting through extremely large datasets to identify items of interest for an analyst,[11] to Google's machine that *taught itself* to beat opponents in Go—a 2,500 year old game known for its almost infinite number of moves.[12] Such advancements in a programs ability to "learn" on the fly, rather than rely on human coding, appear to provide a wealth of solutions to a number of different problems. AI in 2050 may allow U.S. forces the ability to discern a greater number of items of interest with greater precision than their human counterparts, making split decisions on what to do with what they find—log as evidence, pass to a human for analysis, or perhaps eliminate a target? Such advances, however, are not without their drawbacks. Elon Musk considers AI, "our biggest existential threat,"[13] and has invested in Google's DeepMind, who are examining ways to create a "big red button to prevent the agent from continuing a harmful sequence of actions"[14] in order to prevent creating AI that learn to prevent their human counterparts from taking control (think SkyNet from *Terminator*). Human Rights Watch and the International Human Rights Clinic at Harvard Law School recently penned a report,[15] echoed by others, indicating that the legal and ethical challenges of fully autonomous "kill bots" far outweigh the advantages.

Additive manufacturing (AM) allows for virtually anyone in the world with access to a computer system and 3D printer the ability to "print" anything from drones to weapons, often with easily accessible blueprints. Replacements for damaged parts in 2050 will no longer have to be kept on hand or ordered, as they could be easily printed and quickly fielded to get damaged equipment back up and running. Expeditionary structures will be printed for soldiers, incorporating locally sourced materials with the latest in nanotechnologies to provide superior blast resistance. Specialty, individualized drugs will be printed for soldiers and perhaps even victims of natural disasters with precision dosing to optimize healing, as may food products with specific nutritional needs. Likewise, repairs to damaged muscular, skeletal, nervous, digestive, respiratory, and nervous systems may be made using AM techniques. Even explosives could be printed through additive manufacturing.[16]

Information rich environment holds both promise and pitfall. Misinformation, as the ARL authors suggest, [17]

may be king of the battle—look at Russian[18] and Chinese[19] use of propaganda online and in social media. Soldiers and civilians will have instant on-the-go access to information that can easily be spoofed, providing misinformation as a prime tool for the adversary. Virtual and augmented reality technologies are well under development by DARPA, and are likely to begin fielding in the near future.[20] While these technologies are expected to increase soldier performance and heighten their abilities, there is a chance that they could be used against the soldier by providing incorrect information. Ultimately, it will be up to the soldier to remain cognizant of their surroundings—building relationships with locals, aid workers, politicians, and shopkeepers—to stay on top in the future OE. Technologies such as Google-owned Terra Bella[21] will allow anyone, anywhere the ability to purchase extremely high-resolution satellite imagery and monitor activity.

As we have seen with the advent of the personal computer some 30 years ago, technology advances when it begins to democratize. The democratization of these technologies has already begun, and will continue well into the 2050s. As noted above, states have been using armed UMS in combat operations for roughly the last 15 years. Non-state actors engaged in terrorism and insurgencies have been using drones for, arguably, the last 5. Access to UMS has grown: they can be ordered online, shipped virtually anywhere in the world, transported to a battlefield, and employed. With the rise in AM technologies, such devices can now be printed virtually anywhere there is power. By 2050, swarms of robots could be likely printed, as well as the explosives needed to achieve the desired objective by our adversaries. Advancements in the open-sourcing of AI and availability of real-time satellite feeds to anyone with a credit card will allow greater for more precise targeting and far greater lethality. By 2050, swarm technologies will not be the staple of the U.S.—they will be used by a number of groups, both adversarial and not. Technology will serve the soldier of the future, as it does today, but not replace. This will be doubly so as we look to the future OE.

Rapid Urbanization, the Rise of the Megacity, and Shifts in Power

The UN estimates that by 2050, 66% of the world population will be urban.[22] Compounded with the rate of population increase expected to continue through 2050, we should reasonably expect approximately 6.4 billion people living in urban areas—roughly 87% of the current world population.[23] With such increases, megacities and dense urban areas are of preeminent concern to the military[24] as areas once predominantly seats of economic and political power also come to house large majorities of the population. Fighting and winning in such an environment is incredibly difficult both physically and technically.[25]

As of 2003, the UN estimated that approximately 33% of the world's urban population lived in slums, predominantly in the developing world. The number of those living in slums was expected to rise by the 2030's, if nothing was done, to approximately 40% of the world urban population.[26] By 2050, approximately 79% of the world population will reside in Asia and Africa, the latter of which is the fastest-growing major area,[27] though estimates on slum dwellings by that point are unknown. A recent report, however, shows a relative decline in the number of urban slums overall,[28] but climate change, ongoing conflict, and poor economic prospects could induce migration to these major economic and social hubs, quickly overwhelming the governments' very ability to govern the space.

While the global population grows and moves from rural to littoral urban spaces, we should likewise expect to see an expanding middle class. As the 2012 National Intelligence Council Global Trends notes, the global middle class is growing at an astounding rate, [29] though many are just barely rising out of poverty.[30] The median education for the individuals making up this new class will rise, as more parents are able to afford to send their children to school to become more educated than the last generation. With more disposable income and greater education, industry will continue to shift throughout the world from

less unskilled labor to skilled labor, and will likely lead to the Fourth Industrial Revolution utilizing more technical skills than have been required previously. This revolution, however, according to the World Economic Forum Report, *The Future of Jobs,* will face numerous challenges over the next five years.[31] By 2050, however, we should be well into this new era, characterized by advancements in nanotechnology, robotics, AI, AM, and biotechnologies to name a few.

As more and more people move from the countryside into these sprawling urban areas, the importance of these megacities will outweigh that of the state. As Khanna notes (see Figure 1 below), megacities represent, "a large percentage of national GDP (indicated by the larger circles) in addition to its role as a global hub."[32] Megacities, in well-established states, will prove to be major hubs of industry, economy, society, culture, and ultimately political capital. Those in less-developed areas may be prone to feast or famine conditions, leading to conflict and exploitation. The recent and on-going U.S. experience in Iraq and Afghanistan give us an idea of the difficulty in conducting operations in urban environments. While the necessity of combined arms/maneuver warfare may never completely go out of vogue, we should expect, given ongoing trends, to see continued and indeed increased wide area security (WAS) operations in the future OE.
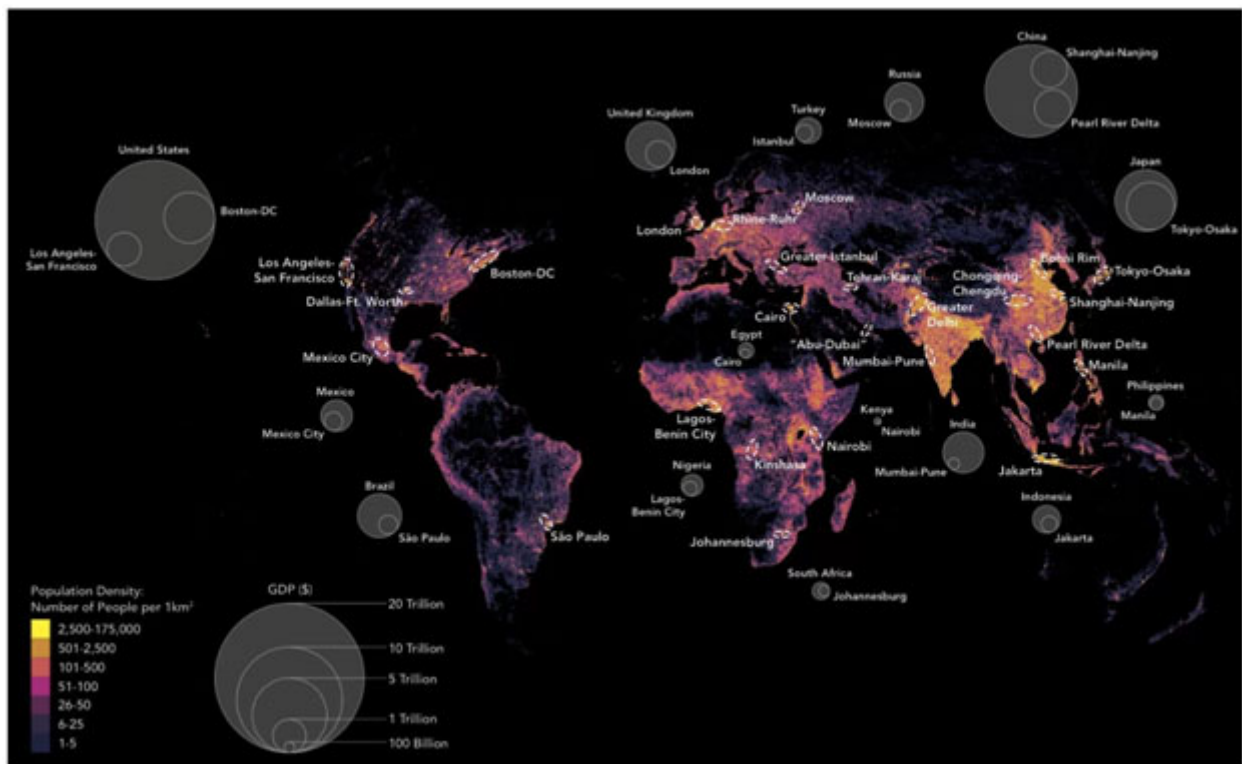

Figure 1: "Shifting the focus of global economic activity. (Connectography)"
http://qz.com/666153/megacities-not-nations-are-the-worlds-most-dominant-enduring-social-structures-adapted-from-connectography/.

The increase in population and urbanization, along with technological advances will give rise to the power of the individual. This, coupled with an expanding middle class will most likely result in a long term rise in human capital.[33] As the middle class grows, global literacy and educational attainment will follow suit, as will access to medicine and a longer-living population. A more educated and healthy global society will have never before existed, but that does not necessarily equate with a more peaceful and harmonious existence—at least not by 2050. Recent studies suggest that, in the current wave of terrorism

for example, a greater percentage of fighters are relatively well educated and come from relatively well-off families.[34] The reality remains that *absolute* deprivation—poverty and poor education—is likely not reason enough for something like terrorism or insurgency. Rather it is *relative* deprivation—what others are perceived of as having that the observer does not—that serves as a catalyst to act. Does the global rise from absolute deprivation/poverty lead us towards rise in relative deprivation, and a higher likelihood for conflict? Will individuals, rather than states, come together against their and other governments?

Recent events unfolding in the Middle East and North Africa seem to suggest that this may well be the case. The rise of the Islamic State (ISIS) in Iraq and the Levant has shown what is possible when a relatively affluent diaspora with a shared interest and ideology can coalesce around a central idea—and there is an ability to reach that diaspora with relative impunity and ease to radicalize and call to arms. This group has been vying for power among a sea of rebel groups with disparate goals. ISIS utilizes propaganda to effectively target and create supporters through online magazines, social media, and videos. They also utilize RPA for intelligence, surveillance, and reconnaissance, and are reportedly seeking to weaponize the off-the-shelf platforms for use as flying IEDs.[35] As we see technology further democratize and become readily accessible, U.S. forces will have to respond to protect themselves, allies, and civilians against attacks. Technology, however, is only a tool and symptom of the problems the U.S. will be called upon to face—at the core of current and future conflict are people.

Changing Power and the Role of Soldiers

The fall of the Soviet Union in 1991 was heralded as the beginning of a new world. Francis Fukuyama wrote of "the end of history,"[36] suggesting the international system would no longer be bound by ideological movements—that the triumph of western liberal democracy over communism would lead to a more peaceful world. This idea seemed to have been borne out, until the September 11, 2001 attacks, which brought home the reality of the importance ideologies hold across the globe. Western, in particular U.S., power was openly contested. Since these attacks, we have seen a number of terrorist organizations form, take hold, and defy the international community. Financial markets, in 2008, took the biggest hit since the Great Depression and, by 2011 a wave of protest spread across the West in response to corporate corruption in the form of the Occupy movement. The Arab Spring spread quickly across the Middle East and North Africa to topple dictators, providing both promise and pitfall. The Islamic State managed to coopt the Syrian civil war to oust Assad, bringing in an incredible number of foreign fighters from across the globe to Syria and Iraq to establish "the caliphate." We have seen a resurgent Russia openly defying international laws and norms under the pretense of consolidating and protecting their ethnic kin. China has made numerous claims to the South China Sea, giving the Chinese military a foothold while strong-arming other Pacific nations laying claim. The United Kingdom recently voted to leave the European Union largely due to nationalistic fervor, leaving a great deal of political and economic uncertainty. Turbulence, it seems, could be an apt description of the current era—one that, as others have noted,[37] may indeed not be the end of history, but the next revolution in modern history.

While globally, states seem to be moving from authoritarian to more democratic regimes,[38] there remains great uncertainty. People—citizens of the state—are becoming more empowered, educated, and affluent. This does not mean that the international order will cease to exist, or widespread rioting will force governments to crack down, or world economic systems will fundamentally change. Indeed, it appears as though a more integrated economic system may bode well for international order, though it could very well require the U.S. and other Western nations to cede the monopoly held on power during the last 25 years.[39] As Fischer notes, "though the [U.S.] remains dominant in military, political, economic, technological, and cultural terms, its global hegemony already seems to have slipped away."[40] Does the U.S. remain in a position of leadership into 2050? More than likely, yes, but perhaps not as the

powerhouse of global order that it once served. The strategic environment of U.S. national security interests will become more intertwined with those of our allies, and the spread of violent and anti-establishment ideologies will remain entrenched in a world characterized by individual empowerment.

With the democratization of technology, incredible demographic shifts, and a changing world order, soldiers in the future will be the face of both hard and soft American power. U.S. experience since the end of the Cold War has been one of soldiers filling multiple roles, especially so during the last 15 years.[41] Soldiers have been tasked ever more with solving local disputes, serving as go-betweens between the military, host nation, and State Department, and as problem solvers in Iraq and Afghanistan. As Clancy and Delwiche note, "units often work outside their designated mission (for example, infantry doing civil affairs work, engineers and artillery fighting as infantry, and so on)."[42] This has long been the case for U.S. soldiers and will not change by 2050, but the need for a more culturally competent force with formalized training is a must in order to remain competitive. The future OE will see soldiers utilizing augmented reality to assist in identifying threats, friendlies, and other items of interest, but the soldier will remain to interact with those in the local population. *Gray matter*, even in 2050, will remain key to affecting national security interests and goals. The institutionalization of regionally aligned forces (RAF) and formalized training, as the Root study suggests,[43] will bode well for U.S. forces, establishing relationships with counterparts, providing language and cultural expertise, and utilizing existing civilian experience to boost efforts in COIN and other support roles. [44] The "warrior-diplomat" should be embraced, and the "warrior-scholar" encouraged.[45]

Conclusion

We see the future of modern warfare, today. As then-Colonels Liang and Xiangui noted some 17 years ago in *Unrestricted Warfare*, warfare is no longer about militarily bending the adversary to your will—it is about waging war without limit: economic, political, social; using trade, environment, media, legal, and diplomatic means to exploit weakness in the opponent.[46] As we see more near-peer states rise from the post-Cold war era, the democratization of technology, the rise of the middle class, and a more highly educated, urban population, we should expect that by 2050 we will not see something so foreign from todays "gray zone" [47] activities—a thought echoed in a recent RAND study.[48] Indeed, the authors argue that China, Russia, and Iran are using the tactics laid out in *Unrestricted Warfare* to undermine U.S. credibility and power globally. They understand their adversary—an overreliance on technological overmatch and military solutions, not indoctrinating lessons learned, inaction and a bureaucratic acquisition system built during and for the Cold War—and are playing the long game. Our adversaries will catch up with our technologies, sometimes incrementally and other times jumping ahead, and effectively develop counters. Our adversaries will have access to our homes, our defense systems, and our banks, just as the U.S. will have access to theirs. Conflict has always been a game of cat and mouse, only time decides which side is playing which role.

But it isn't just China, Russia, and Iran making those gains and fighting on their terms. Non-state actors, violent extremist organizations, and organized crime syndicates are also wielding such authority over the current and future battlefield, and will continue to do so. The North Korean regime is pulling all the stops to expand technologically, economically, and militarily. While global stocks of nuclear weapons are decreasing overall, states such as the DPRK are continuing to test and attempt to expand their programs while other nuclear-armed states are modernizing their arsenals and developing new weapons/delivery systems.[49] By 2050 we could well experience the use of CBRN weapons by non-state or proxy groups in furtherance of adversarial interests. What could be objectively worse, however, would be the complete shutdown of global economic markets, power grids, communications systems, and infrastructure through the use of computer viruses or worms. Warfare, by 2050, will be all around us—in our refrigerators,

phones, A/C systems, and cars. But the goal of warfare will not change: people will remain at the heart of conflict, and people will be caught in the middle. Soldiers will continue to be required to act in multiple roles—humanitarian, diplomat, negotiator, and warrior—in order to win in a complex world.

Rise of the machines! But not so fast... Robotics, AI, additive manufacturing, nano- and bio-technologies, and computing/processing are rapidly advancing. It isn't too far a stretch to imagine an OE in 2050 where autonomous robots are working *with* augmented (and even biologically enhanced) soldiers on the battlefield. As policy begins to catch up with technology, however, we may see that switch mothballed. There is, as noted above, an inherent danger and distrust with fully automated weapons systems—SkyNet would, however, disagree. This is the fundamental challenge to automation: fear and distrust by the soldiers and thinkers who will work with (and maybe for) their robot overlords. This tension, present since ?apek's *R.U.R.: (Rossum's Universal Robots)* in the early 1920's, will likely keep the U.S. from fully embracing the automation of warfare. Despite the reluctance for the so-called "killer robots," drones will remain in widespread use, and likely take on a greater and greater role with humans ultimately behind the controls.

Recommendations

Learn to play the long game. Power is not dead, it is changing. The geopolitical landscape of 2016 is far different than it was in 1981, but perhaps not so different than what we will see in 2050. Trends seem to be pointing toward a future that leaves the U.S. in a position of leadership, though perhaps in a diminished role. Democratization of technologies and governments will have, by 2050, allowed people greater autonomy than ever, and spread ideas and ideals across the globe with the press of a button, a blink, or perhaps merely a thought. In order to win, the U.S. must invest in understanding our enemies, and working through allies and those who support U.S. national security interests. Having greater cultural and social understanding, and utilizing technologies to better gain this knowledge will serve to keep our forces competitive in an age where technological superiority no longer defines any one states' ability to fight and win. Likewise, soldiers will need to embrace the role of the warrior-diplomat and warrior-scholar—there is simply no other way to win in the future OE. It is possible that we may well see a return to state-on-state conflict, but shear technological superiority is no longer enough.

Focus on the human domain. Singer, perhaps, said it best in an interview with *WIRED* saying,

> "The robotics trend is revolutionary, but it also doesn't change the underlying fundamentals of war (something the Rumsfeld-era network-centric folks never got). The fog of war remains. While you may have Moore's Law, you can't get rid of Murphy's Law. The enemy has a vote, so while your technology may be amazing, people will rapidly make adjustments and develop their own counters."[**50**]

The tools of warfare may change, as will the actors and the methods used to achieve the desired outcome whether that be through gray zone conflict or counter-/insurgency, or a seemingly unlikely return to state-on-state conflict. While the technology and space within which future conflict will be fought will invariably change, we shouldn't expect to see fundamental shifts in the way warfare is fought—by, with, and through people. Even if the "U.S. way of warfare" becomes characterized by robotics, it will still be waged in large urban centers. Our adversaries will rely on any and every means to counter our technology—even if that means taking a play from senior al-Qaeda, Taliban, and IS leaders of old: stop using tech. By 2050, we should not expect conflict to be unmanned. Rather, we should expect UMS and other advanced tools to be utilized by all parties to conflict. The U.S. is entering into a new era—one in

which our adversaries have access to similar technologies. Failing to focus on the human domain will be to our detriment.

Formalize education and training in the human domain. Recent recommendations from the Carlisle Scholars Program at the U.S. Army War College *Elihu Root Study: The Total Army[51]* rightly propose the Army continue to refine and "elevate [WAS] significance in an effort to retain the gains made in the last 15 years of counterinsurgency and stabilization operations in Iraq and Afghanistan."[52] By placing the National Guard at the helm of this specialization, the authors contend, we can take advantage of the expertise of the citizen soldier—police, firemen, engineers, farmers, ranchers, etc.—with regard to civil-military relations. By creating proponents within the U.S. Army for varied mission sets, we may have a highly adaptable, ready, and relevant force capable of fighting and winning in any environment without the costly endeavor of re-learning from the past.

Shifting responsibility from the active component to the National Guard could offer immense benefit to both soldiers and the military through a combination of lived experience, training, and further education to hone skills. This begs the question: how successfully could a future social-science-based program fair in the future OE? One of the purported failures of the Human Terrain System (HTS) was that it was difficult to employ social scientists at the tactical level, and doubly so to integrate them into the military decision-making process.[53] By developing soldiers formally in their professional and academic understanding of both allies and enemies, we will be able to create a future force that is more adaptable to complex urban and human environments, facilitating the ability to win.

Look to sci-fi, artists, and industry. As the 2015 ARL workshop report notes, "the battlefield of 2050… [brings] reality more in line with the science fiction and fantasy the public is accustomed to viewing in the cinema and reading about."[54] It is important to take cues from the private sector and the arts. The Atlantic Council's Strategic Foresight Initiative[55] and Art of Future Warfare project,[56] for example, are both designed to creatively imagine the future international security environment. Singer and Cole's 2015 novel, *Ghost Fleet*, envisions the start of World War III between what was thought to be a technologically superior United States military, China, and Russia. Such non-traditional thought in policy and practitioner circles is desperately needed if we are to anticipate and adapt to the future OE—particularly as we examine the people involved and the tools they may have at their disposal.

These recommendations should be incorporated in order to maintain U.S. military superiority in the future OE. There are a number of efforts led through Army R&D examining the myriad ways in which the human domain can be re-examined for the future force. But technological solutions are not enough to win in 2050, just as they are not enough to win now. The U.S. must focus on understanding our enemies as well as our allies and learning to play the long game in international relations. Incorporating these recommendations, no matter what direction future megatrends take, will aid the U.S. military in maintaining the edge needed to fight and win.[57]

End Notes

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