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U.S. ARMY WAR COLLEGE

FUTURES SEMINAR
WHAT KIND OF ARMY DOES THE NATION NEED IN 2035 AND BEYOND?
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Samuel R. White, Jr.

Editor

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FOREWORD

In 1994 the Army embarked on the Army After Next (AAN) study plan to explore new concepts and think innovatively about how the Army would fight in the future. Envisioned as a way to develop the Army after Force XXI (thought to be the Army of 2025), the AAN project was chartered by the Chief of Staff of the Army and grew to involve a wide range of participants. Think tanks, scientists, federal laboratories, and organizations across the Army undertook study projects and thought deeply about what "could be."

The Army War College also contributed to the AAN effort through strategic wargames, experimentation, and student and faculty research. One of the initiatives was the AAN Seminar – a special program in Academic Year 1997 – composed of students who were interested in contributing to the development of the future Army. The students studied, debated, researched, and wrote about the AAN. A compendium of their papers was published to inform senior leaders on a range of issues regarding the Army's future.

In 2014 the Army War College established the Futures Seminar – a seminar loosely modeled on the AAN Seminar. As with the AAN seminar, Future Seminar students and faculty collaborate to explore the Army of the Future. In this case, they explore the Army of 2035 and beyond. As with previous years, the seminar focused on the requirements for an Army of the future – and sought to explore the question:

> "What kind of Army does the nation need in 2035 and beyond?"

This 6th annual compendium is the result of the student requirement to write a paper addressing this question. In Academic Year 2019, the Futures Seminar students

and faculty, in collaboration with the Assistant Secretary of the Army for Installations, Energy, and Environment (ASA IEE), examined Installations of the Future. This ASA IEE initiative to think about the future roles and capabilities of Army installations provided a wide array of research topics to contribute to the ASA IEE for its consideration. The students focused their study on four areas that could impact future installations and collaborated with each other and with external organizations to help deliver their ideas to the ASA IEE. These students learned about concepts and technologies from academics and agencies within city, state and federal governments to gain understanding and appreciation of Installations of the Future.

These students contributed greatly to this initiative and provided the ASA IEE with many ideas for these critical Army platforms.

Samuel R. White, Jr

Deputy Director, Center for Strategic Leadership

Faculty Lead, The Futures Seminar

Part I
Future Talent

Talent Management for the Army of the Future

COL Steve Tabat, U.S. Army

As the Army and the Department of Defense (DoD) prepare for the future, one area that must adapt to the realities of a very different environment is human resources or personnel management. In September of 2015, Secretary of Defense Ash Carter unveiled the "Force of the Future" initiative. This was the first step in restructuring the DoD policies and methods to attract new, talented personnel. Secretary Carter specifically pointed out that the focus of the initiative was the development of new and innovative ways to recruit, develop, reward, and retain talented service members and civilian personnel to the Department of Defense.[1]

As the Army changes the existing personnel system, service leadership must understand that the future success of the All-Volunteer Force is dependent on making changes to the current system to make military service more attractive to the future generations of military service members and leaders. The Army and the DoD must restructure the military personnel system to recruit, develop, reward, and retain quality personnel for future military service. Changes are necessary because of a competitive employment marketplace, new and emerging threats that require new skills and talents to help solve complex and difficult issues that will arise, and the basic economics of investing and training personnel to serve.

The matter of importance for the Army and the DoD to recruit quality personnel to its ranks is of

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1. David Barno and Nora Bensahel, "Can the U.S. Military Halt Its Brain Drain?" The Atlantic, November 5, 2015, http://www.theatlantic.com/politics/archive/2015/11/usmilitary-tries-halt-brain-drain/413965/ (accessed May 18, 2019).

great significance. It is doubly important that Army and service leadership understand that a change in the approach to recruiting must occur to reflect the societal and cultural changes that have taken and are taking place. One of the most significant reasons to change the way that the services recruit and retain individuals has to do with basic market factors. The pool of future service members exists in a competitive environment that includes US corporations and multinational and foreign companies.[2]

The United States is currently in a good period of economic growth making it difficult to attract quality personnel to serve because of limited financial opportunities in the military compared to many civilian employers and the very different demands of military life. Additionally, the US Army seeks to grow to 500,000 or more, but the available pool of personnel in the 17-24 year old age group that are physically, mentally, or morally able to serve is estimated at less than 30% and getting smaller every year. In a 2018 Associated Press News article, only one in eight persons in the target age group are even interested in serving.[3]

The US Census Bureau projects that the overall resident population growth of the United States will steadily decline between now and 2060 due to declining birth rate projections. For the same period, the Census Bureau projects a significant growth in the immigrant population. Even though population projections show growth due to an increase in immigration, the Bureau of Labor and Statistics projects that there

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2. Phillip Brown, Hugh Lauder and David Ashton, "Introduction" and "War for Talent," in The Global Auction: the Broken Promises of Education, Jobs, and Incomes (New York: Oxford University Press, 2011), 87-88.

3. Lolita C. Baldor, "Army Misses 2018 Recruiting Goal", *AP News Break* (September, 21, 2018), https://apnews.com/4e920aeff0ee41caa152a12df6d89600 (accessed May 17, 2019)

will be a growth in the civilian noninstitutional population. This population is significant because it is the segment of the population that is not "in a mental institute, home for the aged or in the Armed Forces."[4] This is important because this noninstitutional population is where the seven out of eight members of the target age group that are not interested in military service exist. This is the target audience for future recruiting for military service.

Another factor that Army leadership must address is the generational changes affecting the current force, particularly the current leadership, and the newest target population group known as the Millennial Generation. "Millennials" are different from earlier generations because of their desire for doing something that will allow them to "leave a mark" on the larger world.[5] The approach to recruiting, developing, rewarding, and retaining talent requires a cultural change that is less a product of the large industrial era system focused on interchangeability and standardization and is more focused on the alignment of talent to specific tasks and functions that is more responsive to the generation of people that are products of the Information Age.[6]

What are some of the ways that the Army can adjust their recruiting practices to attract quality candidates? One recommendation is to establish programs in various schools throughout targeted recruiting areas

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4. Mitra Toossi, "A Look at the Future of the U.S. Labor Force to 2060" September 2016, linked from the United States Department of Labor Home Page at Bureau of Labor Statistics, https://www.bls.gov/spotlight/2016/a-look-at-the-future-of-the-us-labor-force-to-2060/pdf/a-look-at-the-future-of-the-us-labor-force-to-2060.pdf (accessed May 17, 2019).

5. U.S. Department of the Army, Accessing (Acquiring) U.S. Army Officer Talent, https://www.youtube.com/watch?v=VkEm0F5WxKg, video file (accessed May 18, 2019)

6. U.S. Department of the Army, Developing U.S. Army Officer Talent https://www.youtube.com/watch?v=hvQA_IZgOxQ, video file (accessed May 18, 2019)

to help prepare young adults for potential service and perhaps inculcate the local communities with a physical fitness culture.[7] Lack of physical fitness is preventing many potential recruits from being able to meet initial entry requirements. Some estimates place as many as one-third of all youth between the ages of 17-24 as overweight or physically incapable of meeting initial entry physical requirements; many of those recruits are in the South from where a majority of recruits come. This is another cultural change that requires not just the Army, but the entire US government because of the larger, strategic issues related to the ability of maintaining an All-Volunteer Force with a large enough pool of eligible, potential recruits.

Another area that the Army needs to address is how to attract and recruit talented individuals with unique skills and attributes to fill gaps in specialized skill sets or to deal with new and emerging threats. An example of an emerging field requiring attention is cyber operations. Although the Army has used direct commissioning policies to pursue specialized medical or legal personnel, the Army is now allowing cyber commands to offer direct commissions to personnel who meet the established criteria for acceptance as a Cyber Warrior. With recent changes to policy, Army Cyber Command is now seeking cybersecurity experts for direct commissions at higher ranks such as colonel.[8] This is a step in the right direction, but one that is met with caution because of the relative high rank given to people with a significant lack of military experience. Rather than offer commissions as senior officers, why can't

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7. Drew Brooks, "The Army's Next Crisis: Americans Aren't Fit Enough to Fight", linked from Task and Purpose Home Page, https://taskandpurpose.com/army-physical-fitness-crisis/ (accessed May 17, 2019)

8. Lauren C. Williams, "Army Extends Higher Pay, Colonel Rank to New Cyber Entrants", linked from FCW.com, https://fcw.com/articles/2018/10/09/army-cyber-direct-colonel.aspx (accessed May 14, 2019).

the leadership offer entry to the services as warrant officers? Warrant officers are the technical experts in various fields in the Army. While a direct commission as a colonel or lieutenant colonel comes with significantly higher pay, the Army could offer direct commissions as warrant officers and add in bonus or professional pay to make up any differences in salary to stay competitive with private industry. This could help to alleviate any issues with such high ranking direct commissions going to militarily inexperienced individuals.

Identifying and developing quality personnel with the traits and necessary attributes of future leaders for service in the military is another area that the Army should address. In terms of measuring aptitude, the military uses the Armed Forces Qualification Test (AFQT) to assess the quality of the enlisted force, but there is no real qualitative test for officers. The services all use varying methods for assessing officer quality such as undergraduate grade point average (GPA) or standardized test scores like the ACT or SAT. These are not necessarily good indicators of cognitive ability. A recommendation is to use a standardized test like the AFQT for officers.[9] Using an AFQT-like assessment for officers may better align talents to specific tasks or functions.

Development of future officers is a critical aspect for the future of the Armed Forces. From an Army perspective, there is a potential for significant impact by placing the right senior officers in pre-commissioning programs such as ROTC. The Army can explore placing successful, promotion competitive, former battalion

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9. Stephen Gerras and Leonard Wong, "America's Army: Measuring Quality Soldiers and Quality Officers," April 13, 2016, linked from War on the Rocks Home Page, http://warontherocks.com/2016/04/americas-army-measuring-quality-soldiersand-quality-officers (accessed May 12, 2019).

commanders, who are ROTC graduates, into all ROTC programs as Professors of Military Science (PMS) and ensuring that they are stable and not impacted by centralized selection boards. A recommendation for stabilization would be to temporarily remove the PMS from centralized selection boards for Senior Service College (SSC) or command until they have completed a two- or three-year period. This provides a stable, positive role model for a generation of future officers while also ensuring that the PMS maintains upward mobility and potential for future service. This is particularly important as Army ROTC produces nearly 60% of all lieutenants annually for the Army.[10]

Another recommendation for aligning talent to task would be for the Army to explore administering personality tests to determine individual traits and behaviors for future assignments. Previously, the Army administered the Myers Briggs Type Indicator (MBTI) test or other tests to determine the individual's preferred learning styles to captains at their respective Career Courses or to majors attending the Command and General Staff College. Officers attending the US Army War College take the Big Five Personality Trait test. These tests provide the individual with an assessment of how they best interact with others or work on a team. It should be asked why cadets or even potential enlisted recruits do not take these tests in pre-commissioning programs, officer basic courses, Military Entrance Processing Stations (MEPS), initial entry training for enlisted personnel, or at enlisted and NCO professional military education courses. Why are the results not used to place the officer or enlistee into a branch or duty position that might better suit

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10. MG Christopher Hughes, US Army Cadet Command, ROTC Mission Command Workshop, September 26, 2017, Fort Knox, KY.

the individual? Why not track the results over time to show how individuals change or not? Why not use the results to place them in better suited duty positions or even in entirely new career tracks such as a command, staff, specialty, or functional tracks? The Army can use a simple tool like this to give opportunities to individuals that might otherwise leave the military because they do not desire to be a battalion operations officer or operations NCO because that is what the current, rigid personnel promotion system mandates. Again, this will require a cultural shift away from the inflexible promotion system to one that focuses more on the individual and the development of unique talents and skills that can be exploited by the various branches of service.

How to recruit quality personnel is another major issue that the Army must address. Future recruiting practices, particularly for highly specialized personnel, should incorporate new forms of communication and media. This is an opportunity for the Army and DoD to partner with private companies such as LinkedIn, Monster.com, or Indeed to search out and work with potential new hires to fill critical and specialized positions.

In addition to recruiting, the Army must change retention practices to keep those new, highly specialized recruits. In the past, bonuses or other programs such as graduate school opportunities or guaranteed duty assignments could entice personnel to continue to serve. Unfortunately, this may not be enough for the future generation of military service members. Other ways to help retain quality, talented individuals might be to allow for more cross-service opportunities. If jointness is still a premium and if the services place a value on diversity of thought, why not allow a Marine to apply for a duty position in the Army or allow an Army pilot to apply for a position at a Navy aviation unit?

Clearly, the individual has to have skills that match the duty position, but this could be a way to entice individuals to broaden their experiences and bring a different perspective to, and from, the other services. This could be done by utilizing social media platforms that are recognizable to the Millennial generation.[11] Other recommendations include an increase in sabbaticals for education or to start a family.

Another popular recommendation is to allow service members to remain at one location for a longer period of time. This would reduce costs associated with Permanent Change of Station moves, provide more stability for the individuals and also for the unit(s) of assignment, and potentially allow for more job opportunities for spouses.[12] The Army can explore ways to make it easier for personnel to transition between the active, Guard, and Reserve components or expand partnerships with private industry and academia to allow for more personnel to work in their fields of expertise (particularly those in highly technical or specialized fields).

The Army has done well addressing things like retirement by creating a new retirement system that allows for personnel to opt in to a 401(K)-like program that allows service members to take their investment with them when they depart the military.[13] This is an example of changing policy with innovative solutions that results in a shift of thinking and the military culture.

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11. U.S. Department of the Army, Employing U.S Army Officer Talent, https://www.youtube.com/watch?v=TCehOFxocqE video file (accessed May 12, 2019)

12. Meghann Myers, "New Army Secretary Looks to Reduce Mandatory Training, PCS Moves", The Army Times (December 14, 2017), https://www.army-times.com/news/your-army/2017/12/14/new-army-secretary-looks-to-reduce-mandatory-training-pcs-moves/ (accessed May 14, 2019)

13. United States Department of Defense Finance and Accounting Service, Military Compensation, Blended Retirement, https://militarypay.defense.gov/blendedretirement/, (accessed May 14, 2019)

Talent management and the challenges posed to the Army and the services are difficult, but they must be addressed with new approaches to recruit, develop, reward, and retain the future generation of military service members. Moreover, the Army and service leadership must be willing to set aside their biases based on their military experience and come up with new approaches that better employs the right talent to the problems that need solutions. This requires a change to the culture and will rely heavily on the current leadership making these changes to lay the groundwork for a future that is vastly different in terms of how the Army managed personnel and operated in during the last century.

Colonel STEVEN TABAT is a 1996 graduate of Texas Christian University with a degree in history and was commissioned as an Infantry Officer. He holds an MS from Central Michigan University. COL Tabat has commanded at the company and battalion level and served in a variety of staff positions in the Army and Joint Community. COL Tabat most recently served as the Chair of the Military Science Department and Professor of Military Science for Texas Christian University Army ROTC, preceding that as the Division Chief of Staff for Division West, First Army, Fort Hood, TX.

The Challenge of Change: Strategic Leader Development Beyond 2035

LTC Eric McCoy, U.S. Army

Whether it is fighting against intelligent machines or through an endemic apocalypse, entertainment studios respond to our fears. When the technologies of fiction became a reality so did our fear of its capabilities. Despite the range of science fiction interests, one constant remains clear: the future consists of people.[14] In masonry mortar is a workable paste used to bind building blocks together, fill and seal the irregular gaps between them, and sometimes add decorative colors or patterns to existing structures. While dictionaries define masonry as the building of structures from building blocks, there is utility in applying some its practicalities to human-capital centric organizations as leadership is the mortar that holds building blocks of teams together to fulfill a variety of purposes. Strategic leaders run organizations with impact at the national and international level. They must be adept at understanding the complexity of their environment, balancing competing requirements from various constituencies, and making timely decisions to move the organization forward.[15]

From a national security perspective, war remains fundamentally political, people-centric, and complex.[16] These three aspects, along with violence

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14. "Envisioning Leadership in 2050", *Leadership 2050: Critical Challenges, Key Contexts, and Emerging Trends,* ed. Matthew Sowcik, Anthony Andenoro, Mindy McNutt, and Susan Murphy, Bingley, UK: Emerald Group Publishing Limited, 2015), 3.

15. Department of Command, Leadership and Management, *Academic Year 2019 Strategic Leadership Course Directive* (Carlisle Barracks, PA: U.S. Army War College, July 2018).

16. Christopher Mewett, *Understanding War's Enduring Nature Alongside Its' Changing Character*, https://warontherocks.com/2014/01/understanding-wars-enduring-nature-alongside-its-changing-character/ (accessed September 15, 2018)

and coercion, have been essential aspects of conflict since the dawn of recorded history. As we explore what the operational environment of the future will look like, modern security practitioners argue that this nature of warfare does not change; even with technological advances the role of leaders in the organizing and motivating human capital will remain the same. Conversely, modern security practitioners categorize environmental changes typically associated with technological and societal advances as features of the character of war. The operational environment of the future will be different in new ways requiring leaders to have a new set of knowledge and skills to succeed and win. Maintaining dominance in the operational environments of land, sea, air, space, and cyber (along with better understanding of integration between these domains), the effects of space and cyber on the global commons, and the impact of revolutionary technologies such as artificial intelligence, the internet of things (IoT), robotics and autonomous systems (RAS), creates new leadership challenges that have not been previously addressed by contemporary or historic leaders. As such, there are three meta-trends on the rise that will influence the interaction between leaders and the led in the joint operating environment of 2035: globalization, urbanization, and environmental change.

Globalization is a process of interaction among the people, companies, and governments of different nations driven by international trade and investment.[17] Entrepreneurs, politicians, academics, and military professionals study globalization to better understand the dynamics behind these connections. Thomas Friedman identified ten forces in *The World is Flat*

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17. *Globalization 101*, http://www.globalization101.org/what-is-globalization/, (accessed September 12, 2018)

that fundamentally changed how nations pursue their interests. A mix of international events, new business processes and emergent technologies have made the borders between nations and operational domains porous. Typically thought of as Western businesses finding labor and supply markets in the East, security practitioners expect this to flow from East to West as the Asian middle class exponentially grows. These new middle classes will emerge in more countries, each with its own set of consumer demands, creating opportunities for "glocalizing"[18] markets; developing and distributing products or services globally, but having the flexibility to adjust for accommodating users or consumers in local markets.[19] As influence over the global commons impacts the elements of national or organizational power, it is essential for strategic leaders to understand how globalization affects their views of the joint operational environment of 2035. [20][21]

The second meta-trend is urbanization. The world's urban population first exceeded the rural population about a decade ago and it continues to grow through natural causes and migration while rural-population growth has been flat in recent years. By 2035, scientists expect the global population to increase by another 1.8 billion people to a total of nearly 9 billion people with almost all this growth occurring in the developing world and largely centered in urban areas. Urbanization will shape global social and political

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18. the practice of conducting business according to both local and global considerations.

19. Georg Vielmetter and Yvonne Sell, *Leadership 2030: The Six Megatrends You Need to Understand to Lead Your Company Into the Future,* (New York, NY: American Management Association, 2014), 13.

20. Thomas L. Friedman, *The World Is Flat: A Brief History of the Twenty-first Century*, (New York, NY: Farrar, Strauss and Giroux, 2005), 50.

21. U.S. Army War College, Department of National Security and Strategy, *Theory of War and Strategy Directive,* (Carlisle Barracks, PA: U.S. Army War College, 2018), 1.

dynamics, but its effects are likely to be uneven and depend on states' capacity to manage the political, economic, and social stresses that urban growth causes. With proper planning, urbanization can provide the setting, underlying population base, and momentum for sustainable growth by enabling governments, businesses and individuals to reduce transaction costs, more efficient public infrastructure and services, and greater knowledge generation and diffusion. By some estimates, the world's "megaregions"—networks of metropolitan areas that share environmental systems and topography, infrastructure, economic links, settlement, and land-use patterns—account for 66 percent of the world's economic activity and are the breeding ground for 85 percent of all technological and scientific innovation. Poorly-managed cities and urban centers, however, can serve as incubators for inequality, crime, pollution, and disease.[22] Near-term decisions on infrastructure for developing megacities will determine their vulnerability to extreme events and will create opportunities for competition and cooperation between leaders of public and private organizations in the joint operational environment of 2035.

The third meta-trend is environmental change. While there may be contention on the causes and effects of environmental change, it is a reality that futurists, scientists, and politicians continue to address around the world. Global warming, because of economic activity, can be correlated to extreme weather events worldwide that cause death, displacement, and considerable economic damage. Societies continue to compete and conflict with one another over the depletion of critical natural resources.[23] Diversity in the biosphere will continue to decline despite ongoing national

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22. National Intelligence Council, *Global Trends: Paradox of Progress*, January 2017, 166.
23. Vielmetter and Sell, 33.

and international efforts. Environmental change will increasingly amplify ongoing habitat loss and degradation, overexploitation, pollution, and invasive alien species— adversely affecting forests, fisheries, and wetlands.[24] From a national security standpoint, environmental change will threaten agricultural output and increase fragility in rapidly growing poor countries.[25]Accordingly, nations and organizations will need to embed environmental awareness into their processes and policies in order to create cultures that minimize environmental impact.

As an institution, the U.S. Army will build and sustain multi-domain formations for the future through the selection, training, and education of the human capital that comprises these organizations. Multi-domain operations will require new skills, competences and attributes that facilitate strategic leadership across a range of hyper-competitive and collaborative environments. Current Army doctrine states that an ideal Army leader has strong intellect, physical presence, professional competence, moral character and serves as a role model. While position, rank, or authority does not always designate leaders, when in charge leaders must be able and willing to act decisively, within the intent and purpose of superior leaders and in the best interest of the organization. Army leaders recognize that organizations, built on mutual trust and confidence, successfully accomplish missions.[26]

24. Global Trends: Paradox of Progress, January 2017, 25.
25. Global Trends: Paradox of Progress, 210.
26. Headquarters Department of the Army (HQDA), Army Doctrinal Reference Publication (ADRP) 6-22, *Army Leadership*, September 10, 2012, iv.

While no longer formally defined in Army doctrine, attributes are a characteristic or fundamental property of an individual.[27] Current doctrine can simplify attributes as what leaders are whereas competencies are what a leader does. In the debate on whether leaders are born versus made, attribute identification can help to predict who may be suited for leadership versus competency identification allowing for the association of certain skills with positive organizational outcomes. As we design organizations of the future, there is value in U.S. Army Training and Doctrine Command (TRADOC) formally defining the desired competencies and attributes of strategic leaders so that doctrine authors adjust the requisite experiences within the institutional, operational, and self-developmental domains of the Army's Leader Development Strategy (ALDS) to facilitate the growth of the strategic leader bench for 2035 and beyond.

New technologies and novel applications of existing technologies will have potential to disrupt labor markets and change health, energy, and transportation systems. Multiple technological developments, to include biotechnology and communications sectors, will likely to outpace regulation. This may result in international norms that are contrary to U.S. interests and increase the likelihood of hyper competition. Emerging technology and new applications of existing technology will also allow U.S. adversaries to more readily develop weapon systems that can strike farther, faster, and harder and challenge the U.S. across multiple domains.[28] In the joint operating environment

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27. Jeffrey Horey, Jon Fallesen, Ray Morath, Brian Cronin, Robert Casella, Will Franks Jr. and Jason Smith, *Technical Report 1148: Competency Based Future Leadership Requirements*, (U.S. Army Research Institute for the Behavioral and Social Sciences, July 2004), 28.

28. Daniel R. Coats, *Statement for the Record: Worldwide Threat Assessment of the US Intelligence Community made to the Senate Select Committee on*

of 2035, positional power and hierarchical power structures will become smaller as leaders operate across a range of hyper-competitive to collaborative situations. Power will shift to stakeholders, reducing the authority of the people who are supposed to lead organizations. Based on an increase in population size and globalization trends, if there are projections in 2035 of two billion people in the middle class who are potential customers versus 800 million today, local leadership within organizations must become stronger versus looking to centralized management and organization.[29] These environmental factors will force a shift in the context of how leadership is practiced from a focus on the role of individuals as leaders, stylized as egocentric leadership, to a focus on the importance of leadership being diffused within groups or teams, stylized as allocentric leadership.[30] Additionally, ongoing changes in technology and people will affect the human dimension of leadership through the potential of dehumanizing select operational environments.[31]

From an egocentric leader, dehumanized operating environmental perspective, we can anticipate increased reliance on technology to enhance human performance. As the world population continues to increase, seismic changes in demographics, geography and technology create pressure on organizations

Intelligence, February 13, 2018, https://www.dni.gov/files/documents/Newsroom/Testimonies/2018ATA---Unclassified-SSCI.pdf (accessed November 24, 2018), 12.

29. Jena McGregor, *Leadership Skills for the Year 2030,* February 24, 2014, https://www.washingtonpost.com/news/on-leadership/wp/2014/02/25/leadership-skills-for-the-year-2030/?noredirect=on&utm_term=.de9052b11d61 (accessed November 24, 2018)

30. Jeffrey Suderman and Phillip Foster, "Envisioning Leadership in 2050: Four Future Scenarios", *Leadership 2050: Critical Challenges, Key Contexts, and Emerging Trends,* ed. Matthew Sowcik, Anthony Andenoro, Mindy McNutt, and Susan Murphy, (Bingley, UK: Emerald Group Publishing Limited, 2015), 31.

31. Suderman and Foster, Envisioning Leadership in 2050.

to produce results. In this environment, one could envision a world where organizations will outfit workers with suits of armor like Tony Stark's Iron Man armor that augment their ability to conduct manual labor, work in harsh environments, or wage war. In this future environment, technological advance minimizes the separation between humans and machines. Rather than the technology being adapted to the needs of humankind, human behavior will likely shift to adapt to the needs of technology. Leader competencies for this future environment include aptitudes for coordination, control, organization, synthesizing, and monitoring[32]. Team competencies for this future environment will focus on increasing performance, teaming with technology, promoting efficiency, individualistic consideration, and role specialization.[33]

Conversely, egocentric leadership in an environment more dependent on human interaction than empowering technology will encounter different challenges. While the pace of change and role of technology will continue to exponentially increase, organizational goals will adjust from an emphasis on quantity to quality. In this environment, futurists anticipate the society will use technology humanely for improving quality of life. Based on evolutionary leaps in knowledge acquisition, organizations will look to network structures as a mechanism for problem solving. Network structures will balance the poles of specialization and generalization through the building of teams or partnerships to develop overarching competencies that extend beyond an organization's sole capacities. Organizations will have subordinate departments equipped with plug and play capacities that enable it to achieve results in multiple domains. The larger network of organizations

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32. Suderman and Foster, Envisioning Leadership in 2050, 32.
33. Suderman and Foster, Envisioning Leadership in 2050, 32.

and technology connect each unit to larger networks which allow for operation in concert with external partners to achieve results through bending technology to the will of society.[34] Leader competencies for this future environment include aptitudes for innovation, entrepreneurship, synthesis, and promoting specialization. Team orientation for this future environment will focus coupling innovators with altruistic goals, human development, organizational transformation, and multidisciplinary collaboration.[35]

In an allocentric[36] environment that emphasizes the human dimension, global complexity will likely match evolving organizational norms that can shift as needed to support the performance of complex, multidisciplinary tasks. In this environment, organizations are temporary and can come together on request – akin to gig economies and cloud-based technologies. In addition to temporary work agreements, organizations will disperse teams across domains and some team members will not be human as robotics and artificial intelligence continue to evolve. Like observing flocks of birds in migration patterns that shift forms but remain visible as a single entity, leaders in this environment must be skilled at blending several unique and complex parts into an overarching whole.[37] Leader competencies for this future environment include innovation, entrepreneurship, creative vision, provision of mentorship, and team-building. Team orientation for this future environment will focus on empowerment, self-leadership, and transparency.[38]

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34. Suderman and Foster, Envisioning Leadership in 2050, 33.
35. Suderman and Foster, Envisioning Leadership in 2050, 33.
36. having one's interest and attention centered on other persons
37. Suderman and Foster, Envisioning Leadership in 2050, 34.
38. Suderman and Foster, Envisioning Leadership in 2050, 34.

Shifting to potential environments where organizations use allocentric leadership to address challenges of dehumanized organizations, leaders will shape human capital to the structure of automation instead of modeling automation from human characteristics. A perfect storm of decreasing full-time labor forces and economic collapse will accelerate the embrace of technology into aspects of daily life. Most notably, organizations will integrate humans into the digital commons with technology having the capability for sensing and responding to human thoughts and movements. In this environment, leaders will leverage technology to have direct control over employees and create hive-like organizations that act and think in a collective manner. Rather than society defining organizations by the size of their workforce or geographic space, it will define organizations by the size of their networks and operational efficiency.[39] Leader competencies in this future environment include taking the initiative, understanding competition, emphasizing production, and a tendency for micromanagement. Team orientation for this future environment will focus on responding to competition, hierarchal bureaucracy, and groupthink.[40]

From an attribute perspective, strategic leaders must be creative to address the resource constraints of a hyper competitive operational environment. Being creative involves strategic leaders immersing themselves into the problem, looking broadly for connections – whether in the past, laterally among peer organizations, or brainstorming, letting ideas incubate, and having the courage to select one or more to pilot. Promoting creativity requires strategic leaders to overcome upbringing, schooling, and the narrowness of

39. Suderman and Foster, Envisioning Leadership in 2050, 35.
40. Suderman and Foster, Envisioning Leadership in 2050, 35.

our career fields.[41] Organizationally, strategic leaders should look to remove constraints; use creative thinking strategies such as carving out dedicated time, thinking out loud, practicing picking out anomalies, and looking for distant parallels; applying standard problem-solving skills, and promoting diversity in order to expand the range of experiences for leaders to draw from.[42] This requires an egocentric leadership approach oriented towards self-management. Some experiences to seek within the organization to improve this competency include: managing dissatisfied external or internal customers, taking on tough or undoable projects, launching a new product, service or process, relaunching an existing product or service, or helping someone external to the immediate organization solve a business problem.

Conversely, strategic leaders must be relationship oriented and empathetic to address the challenges of management through technology in a hyper competitive operational environment. This requires an allocentric leadership approach oriented towards relationship management. Moving away from the egocentric leader models of the early 20th century, modern theorists emphasize the importance of interconnectedness, broadening spheres of concerns, building systemic capacity, and leaders seeing their communities and organizations in which they function as living, dynamic systems.[43] While these themes have informed the work of scholars in leadership development for several

41. Michael Lombardo and Robert Eichinger, *FYI: For Your Improvement: A Guide for Development and Coaching For Leaders, Managers, Mentors, and Feedback Givers 5th Edition* (2009, Lominger International), 82-83.

42. Michael Lombardo and Robert Eichinger, 84-85.

43. Rian Satterwhite, Whitney McIntyre Miller, and Kate Sheridan, "Responding to the Wicked Challenges of the Future", *Leadership 2050: Critical Challenges, Key Contexts, and Emerging Trends,* ed. Matthew Sowcik, Anthony Andenoro, Mindy McNutt, and Susan Murphy, (Bingley, UK: Emerald Group Publishing Limited, 2015), 65.

decades, their influence in shaping the approaches for leader education, development, and preparation for future operating environments continues to evolve.[44]

The range of challenges across the future operational environment has several implications for strategic leaders. Future strategic leaders must be flexible in dealing with multiple environments. Future strategic leaders must expand their skill sets to be successful in an operational environment with an increasingly joint character.

The increasing emphasis on joint operations requires coordination with all services and an understanding of occupational specialties from diverse perspectives. Company grade officers and non-commissioned officers may need earlier exposure to joint concepts to acquire the necessary experience and exposure to fully function in the

Joint environment. Finally, the U.S. Army may need to explore alternative models for developing senior leaders, recognizing there may be value in a staffing model which provides short-term, highly experienced company or field grade officers without the commitment of a long-term career in either the active or reserve component.

As globalization, urbanization, and environmental change influence the future of leader selection, education, and training, leader development will reach across multiple domains to incorporate a mix of physical, virtual, and hybrid methods for experience, knowledge acquisition, and reflection. Personnel charged with the education of strategic leaders for 2035 and beyond must teach these leaders to be future oriented

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44. Satterwhite, et al, Responding to the Wicked Challenges of the Future.

as to where organizations will need their leadership, when key stakeholders will call on their competencies and attributes, and in what situations can leaders align organizational vision, culture, and resources to win in an increasingly complex and more connected world.

Lieutenant Colonel Eric McCoy is a 1998 graduate of Morgan State University and received master's degrees from Central Michigan University, Georgetown University, and the U.S. Army War College. He entered the Army as an Ordnance Officer and has served as a multifunctional logistics officer in tactical, operational, and strategic formations. Prior to attending the War College, he served as the Chief of Sustainment for the 25th Infantry Division. Following graduation, he will serve as the Chief, Subsistence Supply Chain, Defense Logistics Agency - Troop Support.

The Strategic Support Area and Future Installation Leaders

LTC Brian Jorgenson, U.S. Army

What will the future hold? This is a puzzling question for one to answer with any reliability. Predicting the future may be impossible, but there are ways to focus one's efforts to prepare for future threats. The United States government publishes strategic guidance that directs the nation's efforts toward common goals and future threats. One of the strategic documents, the 2018 *National Defense Strategy*, states, "It is now undeniable that the homeland is no longer a sanctuary…attacks against our critical defense, government, and economic infrastructure must be anticipated."[45] This idea that the continental United States is no longer safe from attack led the United States Army to develop a new warfighting concept. The Army Training and Doctrine Command published *The Army in Multi-Domain Operations 2028*, to illustrate a way to counter future threats. The concept describes a new fighting area, the strategic support area. It is defined as, "…the area of cross-combatant command coordination, strategic sea and air lines of communications, and the homeland."[46] The future threat environment requires United States Army installation leaders to possess specific knowledge, skills, and behaviors to ensure the strategic support area remains focused on generating and sustaining combat power. This paper

45. James N. Mattis, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: The Department of Defense, January 19, 2018), https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf (accessed October 12, 2018), 3.

46. Headquarters, U.S. Army Training and Doctrine Command, *The Army in Multi-Domain Operations 2028,* TRADOC Pamphlet 525-3-1 (Fort Eustis, VA: Headquarters, U.S. Army Training and Doctrine Command, December 6, 2018), https://www.tradoc.army.mil/Portals/14 /Documents/MDO/TP525-3-1_30Nov2018.pdf (accessed December 12, 2018), C-4.

will analyze the current process for preparing United States Army installation leaders, identify challenges with the current process, and propose a novel paradigm to meet the future demands of the strategic support area. Progressing toward a new desired end state first requires an awareness of the current state, in this case the Installation Management Command.

> The United States Army Installation Management Command and their subordinate installations operate in a supporting role to the rest of the Army. The 2018 Installation Management Command Annual Command Guidance expounds upon this support role and describes the command and installations as, [A] customer service-based organization delivering prioritized infrastructure and services that support readiness for combat. Without this support and the actual installation infrastructure, Army forces are unable to train and prepare for combat. Given this it is no surprise that the number one priority for the Installation Management Command this year is infrastructure readiness.[47]

Infrastructure support allows installations to become the integrators of readiness for combat forces. The integration of readiness is more than just training support, it includes medical, emergency services, public works, information technology, family morale and welfare, and recreational services. This integration does not come without challenges given the Installation Management Command's support role and the current resource constrained environment of today.

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47. Kenneth R. Dahl, "FY19 Installation Management Command Annual Command Guidance," *Memorandum for Distribution* (Joint Base San Antonio Fort Sam Houston, TX: IMCOM, August 20, 2018), 3.

Installation Management Command has sought cost reductions and efficiencies at each installation. LTG Dahl, the previous commander of the Army Installation Management Command, provided the following guidance to Army installations in 2018, "We must divest of [the] lowest priority services; reshape programs and services to align with force structure, statutory requirements, and the fiscal environment; and invest in infrastructure and services that support training and power projection."[48] There are other ways besides divestment to improve the efficiency of Army installations including the investment in people and installation leaders.

Preparing Installation Leaders Today

The United States Army Installation Management Command has two distinct groups of leaders at each camp, post, and station: uniformed military members and government service civilians. While both groups perform similar functions at the installation-level, the training process is vastly different. Installation leaders today require the requisite knowledge to manage the day-to-day operation of a small city. This includes governance and policy actions, protection of people and property, seamless delivery of public works and utilities, religious support, installation planning, acquisition planning and management, human resources management, childcare oversight, operation of Army support programs (Better Opportunities for Single Soldiers, Army Substance Abuse Program, Army Community Support, Soldier for Life, etc.), and the overall safety of everyone on the installation.[49]

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48. Dahl, "FY19 Installation Management Command Annual Command Guidance", 2.

49. U.S. Department of the Army, "IMCOM Garrison Pre-Command Course 19-001 Schedule," (Fort Sam Houston, TX: U.S. Army Installation Management Command, October 15, 2018), 1-2.

Uniformed military members serve as installation leaders in the commander and command sergeant major billets. The Department of the Army centrally selects both installation commanders and command sergeants major via the command select list process. This method ensures that only the best leaders command installations. The Army selects the best 'leaders' through this process, but prior skills and experience are immaterial to the actual duties and responsibilities required of the installation leader.

Department of the Army civilians makes up the second group of installation leaders. The Army Civilian Workforce Transformation created Career Program 29 (CP29 – Installation Management) in 2011 to "institutionalize the deliberate development of Army Civilians" in support of current and future installation missions.[50]

Current Challenges

The United States Army Installation Management Command's priority for 2019 remained focused on installation infrastructure.[51] While installation readiness is important, it does not address the issues of training installation leaders. The current process for preparing installation leaders creates three challenges: a training disparity between civilian and military installation leaders, a tension between installation leaders and senior mission commanders, and a lack of talent management for uniformed installation leaders. If the Army does not address these challenges now, installations of the future will be ill-prepared to overcome the competitive environment of the year 2035 and beyond.

50. U.S. Department of the Army, "Career Program 29 Army Civilian Training, Education and Develop System," (Washington, DC: Career Program 29 Proponency Office, June 2018), 4.

51. Dahl, "FY19 Installation Management Command Annual Command Guidance," 3.

The training disparity between the civilian and uniformed service members for installation management is the first challenge. Installation planning and the day-to-day management of garrison functions require leaders with specific knowledge, skills, and behaviors on how Army installations operate. These required attributes are essential for all installation leaders.

The disparity in the experiences and skills of incoming uniformed military installation leaders has led the Army Installation Management Command to develop a preparatory course. The Garrison Pre-Command Course is a 67-hour, two-week training event to introduce and prepare uniformed military members to assume the duties of installation commander and command sergeant major.[52] The course covers a broad range of topics highlighting functions required to manage the day-to-day operation of a small city. This training event might serve as the only preparation a uniformed military member receives before running an installation.

In contrast to the installation uniformed military members, installation management civilians have a multitude of training opportunities outlined in the CP29 Army Civilian Training, Education, and Development System Plan.[53] The CP29 training plan is not an isolated event, but a continuous training evolution throughout an individual's career. This training ensures that the government civilian workforce remains highly trained and ready to respond to the challenges of installation management. The CP29 Proponency Office provides several graduate-level programs to maintain relevancy

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52. U.S. Department of the Army, "IMCOM Garrison Pre-Command Course," 1-2.
53. U.S. Department of the Army, "FY19 CP29 Training, Education and Professional Develop Catalog," (Washington, DC: Career Program 29 Proponency Office, November 2018), 5.

and an elevated level of knowledge among its civilian workforce. This includes the City-County Management Senior Fellowship Program and the Public Administration Graduate Certificate Program.[54] Both credentialing programs focus on CP29 civilians who are slated to be Deputy Installation Commanders or Installation Commanders. These programs provide advanced management training and partner the individual up with a city/county administrator to provide a real-world training experience over a six-month period. The difference in training between installation uniformed military members and their civilian counterparts introduces challenges to the standardization of installation operations.

The second challenge is the tension between installation leaders and the senior mission commanders. LTG Dahl described the situation of Army installations as, "We continue to operate in a resource constrained environment which demands we have clear priorities and adhere to them."[55] This tension revolves around the establishment of priorities for installations. Installations fall under the direction of the Army Installation Management Command, however, the local senior mission commander, typically a two- or three-star division or corps commander, has a significant role in establishing installation priorities. A critical question is: whose guidance do installation leaders follow, the senior mission commander or the Installation Management Command commander? The answer could vary by individual and by location. However, without proper training, uniformed military installation leaders might follow the local direction of the senior mission commander. This may not be the typical, but the Garrison

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54. U.S. Department of the Army, "FY19 CP29 Training, Education and Professional Develop Catalog, 35-36.

55. Dahl, "FY19 Installation Management Command Annual Command Guidance," 2.

Pre-Command Course program of instruction for uniformed military leaders in October 2018 did not specifically address the relationship between the senior mission commander and the installation leader.[56] The lack of training for uniformed military installation leaders adds to this tension.

Third, the lack of talent management for uniformed installation leaders is not advantageous to the installation nor the individual service member. The current method of selecting and placing uniformed military leaders in installation key billets, such as the commander and command sergeant major, is not adequate to the knowledge, skills, and behaviors required. The United States Army selects uniformed military leaders based on their prior experiences, which could have no association to installations. Selectees are, more than likely, high performers in the tactical Army, but are ill-prepared to operate an installation. The two-week Garrison Pre-Command Course does not prepare one for the complexities of the installation now let alone considering future threats. The future of 2035 and beyond may include threats involving advanced technologies, artificial intelligence, and robotics. Placing an 'unqualified' uniformed military leader into a command billet neither helps the installation prepare to operate against future threats, nor does it benefit the individual assigned to an unfamiliar duty position. The United States Army owes it to the nation to find an alternative solution to installation talent management.

A Different Way

The United States Army Installations of the Future Campaign Plan has the end state of "Modern

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56. Department of the Army, "IMCOM Garrison Pre-Command Course 19-001 Schedule," 1-2.

installations will provide a modern Army with the infra-
structure, services, and security required to build
readiness and project power as an integral part of
the multi-domain battlespace."[57] However, there is
no mention or focus on the people, specifically lead-
ers, to enact this change at the installation-level. The
Army Talent Management Task Force describes talent
as "the unique intersection of skills, knowledge, and
behaviors in every person."[58] Installations of the future
require uniformed military leaders that are both expe-
rienced warfighters and have the skills, knowledge,
and behaviors required to operate Army installations. A
unique way to achieve this balance of warfighter expe-
rience with installation skills, knowledge, and behav-
iors is to create an installation management functional
area for officers and a career management field for
NCOs. These personnel management fields would
provide training in city planning/operation, data man-
agement, and artificial intelligence to achieve the skills
required to operate United States Army installations in
peace, competition, and armed conflict. Department
of the Army Pamphlet 600-3 describes the purpose of
a functional area as, "Identifies a requirement and an
officer possessing specialized skills to perform duties
of a specific position that may require significant edu-
cation, training, and experience."[59] The creation of a
functional area for installation management to provide
uniformed military leaders that have the skills, knowl-
edge, and behaviors required to meet the current and
future threats easily fits within the purpose outlined in

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57. Richard Kidd, "Installations of the Future: Providing the backbone for
Army to prepare and engage in war," (Presentation slides from AY19 Futures Sem-
inar class, October 26, 2018), 3.

58. *The U.S. Army Talent Management Task Force Home Page*, https://
talent.army.mil/ (accessed April 17, 2019).

59. U.S. Department of the Army, "Officer Professional Development and
Career Management," *Department of the Army Pamphlet 600-3* (Washington, DC:
U.S. Department of the Army, June 26, 2017), 46.

Department of the Army Pamphlet 600-3. This functional area could provide similar training that the CP29 civilian workforce receives in the city planning and management arena. The rise of advanced technologies has shown that future conflicts will include battles over data and information. Installation leaders must have the technical credibility to operate in this new environment. The Department of Defense defines technical credibility as one who "Understands and appropriately applies principles, procedures, requirements, regulations, and policies related to specialized expertise… [while] remaining current with technology…"[60] Installation leaders require specialized skills, experiences, and behaviors to succeed now and in the future.

Counter Argument

Some might argue that the installation commander does not have to be a uniformed military leader. Not all United States Army installations have uniformed military leaders as the installation commander. The Army Installation Management Command maintains a professional government service CP29 civilian workforce that perform the duties of installation commander throughout the force. The CP29 civilian workforce receives reoccurring relevant installation-focused training throughout their career, while the uniformed military leaders only receive installation-focused training upon selection to a two- or three-year command. Despite this training deficiency, the uniformed military leaders are very much value added. Uniformed military installation leaders bring a wealth of experience as warfighters to the installation community. The creation of a functional area for installation management achieves warfighter experience as officers would not

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60. Department of the Army, "Career Program 29 Army Civilian Training, Education and Develop System," 42.

access into the functional area until the officer achieved a field grade rank. This would ensure that officers have the necessary tactical warfighting skills, knowledge, and behaviors needed to operate in conflict. The strategic support area, including installations, will be subject to future attacks. Installation leaders require both the warfighting experience and the installation-related skills, knowledge, and behaviors to achieve success.

Summary

United States strategic documents describe a future threat that will affect the homeland. The continental United States is no longer a sanctuary. To prepare for this threat, the United States Army developed a multi-domain operations strategic support area to focus military support domestically. Army installations are susceptible to this emerging threat. The future threat environment requires United States Army installation leaders to possess specific knowledge, skills, and behaviors to ensure the strategic support area remains focused on generating and sustaining combat power. This will require a change to the current process for preparing United States Army installation leaders to meet the future demands of the strategic support area.

Lieutenant Colonel Brian Jorgenson is a 1998 graduate of Gonzaga University. He holds master's degrees from the U.S. Naval War College and USAWC. He commissioned as a Signal Corps Officer and has held a variety of command and staff positions in Army, Joint, and Special Operations organizations.

Competition's New Imperative: The Army's Need for Agile and Adaptive Artificial Intelligence (AI) Practitioners in 2035 and Beyond

LTC Bernard Brogan, U.S. Army

Artificial intelligence (AI) is having a moment in the national security space.

— Michael C. Horowitz [61]

In 2035 and beyond, the Department of Defense (DoD) needs agile and adaptive leaders to help revolutionize Artificial Intelligence (AI) technologies for the Joint Force. According to University of Pennsylvania Professor Michael C. Horowitz, "Given the possible upsides of AI integration, many militaries will fear being left behind by the capacities of other actors."[62] The Joint Force needs to partner closely with the Intelligence Community (IC) to identify creative thinkers, resilient data engineers, and data scientists to help build, implement, and manage AI capabilities. This paper addresses the importance of a diverse AI workforce capable of supporting the Army's Multi-Domain Operations (MDO) concept in the future environment. It also provides a brief excerpt on employing aspects of the U.S. Army's AI Strategy, utilizing the U.S. Army Pacific's Multi-Domain Task Force as a proof of concept, and leveraging the Director of National Intelligence's (DNI) Augmenting Intelligence using Machines (AIM) Initiative. The paper concludes with a summary on the importance of the Army building a diverse AI

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61. Michael C. Horowitz, "The promise and peril of military applications of artificial intelligence," Bulletin of the Atomic Scientists, (April 23, 2018), 1. (accessed April 22, 2019).

62. Horowitz, "The promise and peril of military applications of artificial intelligence," 1.

workforce trained to enable emerging AI technologies in 2035 and beyond.

Future Environment

In the future operational environment, the Army needs agile and adaptive leaders to employ AI technologies. An AI workforce needs to mitigate hybrid threats and protect the interests in service members, partners, and allies using AI technologies in 2035 and beyond. The Joint Force will need time, training, preparation, and authorities to mitigate probable threat vectors that include drone swarming and hypersonics. As a result, hybrid threats in the future will significantly reduce a defender's response time during the Competition and Armed Conflict phases of multi-domain operations. The Army's ability to deter and defeat aggressive competitors will depend upon the execution of the MDO concept options to compete, penetrate, dis-integrate, exploit, and re-compete across the warfighting domains. Continual investments in and application of AI technologies across air, land, sea, space, and cyberspace domains may also enhance the options to execute MDO.

In the future, the Joint Force will use AI capabilities that reside and operate in the cyberspace domain. To ensure success, Army organizations may need an updated force structure that integrates AI capabilities with trained personnel, cloud storage capabilities, and software defined networks at echelon. It is imperative that the AI workforce protects data against cyber-attacks on commercial and mission command networks. In the future environment, an AI workforce needs continuous training on innovative software and modernized network architectures to enable cross-domain synergy for operations and logistics as highlighted in the MDO concept. Moreover, there are two strategic phases of

operations captured in the MDO concept that address Russian and Chinese Anti-Access and Area Denial Systems (A2AD). The first phase is Competition, and the other includes Armed Conflict. In the future environment, the implementation of AI during the Competition phase should generate flexible mission command options. In this instance, AI uses big data analytics in the future to inform commanders and implement autonomous weapon systems. An AI workforce is important because it consist of agile leaders who can ensure the Army is able to perform the tenets of the MDO concept. In 2035 and beyond, the competition imperative for an agile and adaptive AI workforce is centered on the Joint Force being empowered with robust quantum computing and reliable network architectures for AI to operate. For example, the use of AI can help War Fighters process timely information needed to advise decision-makers on the need for national-level capabilities or conducting independent maneuver at their PPPs or Strategic Support Areas (SSAs). The AI workforce is a critical enabler for the MDO concept because they will provide the Army and Joint Force with innovative AI technologies that are interoperable with Combatant Commands and Theater Army units.

Employing the U.S. Army's AI Strategy

It is imperative that the Army implements a strategy to employ AI. In the recent 2018 Department of Defense *Artificial Intelligence* Strategy, "AI can help better maintain our equipment, reduce operational costs, and improve readiness."[63] As advanced information technologies (IT) evolve in 2028 and beyond, the use of AI as an optimization tool can inform decision

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63. U.S. Department of Defense, *Summary, 2018 DoD Artificial Intelligence Strategy* (Washington, DC: U.S. Department of Defense, February 12, 2019), 6, https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF (accessed February 13, 2019).

makers, enable the Joint Force to achieve freedom of action promptly from multiple theaters of operation, and increase the lethality needed at PPPs. In the future, Theater Army and below units will need to successfully employ AI against competitors, however, in the interim, leaders need to align their priorities with the critical initiatives captured in the Army's AI Strategy. The key initiatives consist of MDO Solutions, Soldier and Leader Cognitive Load, Army Enterprise, and Protect the Force. It is imperative the U.S. Army is ready to Fight Tonight with future AI technologies. Therefore, the Joint Force's employment of secure AI technologies is ideal because autonomous systems can help deter belligerent competitors, such as China and Russia, who are using advanced IT to seek regional primacy. The 2018 Department of Defense *Artificial Intelligence* Strategy states, "Other nations, particularly China and Russia, are making significant investments in AI for military purposes, including in applications that raise questions regarding international norms and human rights."[64] The employment of AI supporting MDO may require time to implement AI if the objectives and policies established do not empower Commanders with the right force structure, training, and authorities needed to operate in the future environment.

Leveraging Joint Strategic Initiatives

In 2035 and beyond, the Joint Force may benefit from two strategic initiatives that include AI capabilities in the Army's Multi-Domain Task Force and DNI's AIM Initiative. The first initiative is the Intelligence, Information, Cyber, Electronic Warfare, and Space (I2CEWS)

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64. U.S. Department of Defense, *Summary, 2018 DoD Artificial Intelligence Strategy* (Washington, DC: U.S. Department of Defense, February 12, 2019), 5, https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF (accessed February 13, 2019).

detachment. According to the U.S. Army Pacific Commanding General, GEN Robert B. Brown, "The brain of the task force, the I2CEWS detachment, can effectively penetrate an adversary's anti-access/area denial shield."[65] In order for the Army to be MDO ready, the I2CEWS provides an ideal formation and also serves as a sound proof of concept or pilot program structured for employing innovative technologies such as AI.

GEN Brown states, "In essence, I argue the future of warfare is not just artificial intelligence and long-range precision munitions: it is also, and more importantly, thinking, acting, innovating and empathizing people. In this regard, American soldiers are the best in the world and the envy of our adversaries."[66] The I2CEWS will serve as an ideal example for the Army to test new capabilities and the principles of Mission Command at the Joint and Multi-National Task Force level in any future or simulated environment. To avoid challenges with the future employment of new AI technologies, building a diverse AI workforce needs to include adaptive leaders, recruiting data engineers, retaining data scientists with incentives, and successful implementation of new AI capabilities in a synthetic or simulated environment. The Army and the Joint Force must train as we will fight with AI or commanders will not trust the capabilities. In this context, GEN Brown also stated, "Additionally, the Army continues to provide and cultivate the one consistently proven ingredient for military success: innovative teams and adaptable leaders. Throughout history, we have been iteratively obsessed by the capabilities and potential of

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65. GEN Robert B. Brown, "How To Keep Ahead of a Changing China", Association of the United States Army (AUSA), (May 2019), 44, https://www.ausa.org/articles/how-keep-ahead-changing-china (accessed May 15, 2019).
66. Brown, "How To Keep Ahead of a Changing China", 44.

new bombs, guns, and gadgets."[67] The Army's force structure will improve if I2CEWS organizational processes, capabilities, and critical functions get adopted within the Joint Force. The second strategic initiative includes the Army potentially leveraging DNI's AIM Initiative and the four primary investment objectives the IC will employ for AI. The AIM Initiative states, "Invest in programs for training and retooling the existing workforce in skills essential to working in an AI-augmented environment."[68] Training is critical because AI technologies used in the Army may require individual and collective training to help the Army employ the tenets of MDO. Overall, the four objectives address AI assurance, understanding AI algorithms, increasing data sharing, and building transparency with the information needed to enable AI systems such as Machine Learning (ML). The first AIM objective is "Immediate and ongoing – Digital Foundation, Data, and Science and Technical Intelligence (S&TI)."[69] The second objective consist is "Short term – Adopt Commercial and Open Source Narrow AI Solutions."[70] The third objective consists of "Medium term – Invest in the Gaps (AI Assurance and Multimodal AI)."[71] The last object includes "Long term – Invest in Basic Research Focused on Sense-Making."[72] To enable AI, the IC needs a robust Information Technology Enterprise (ITE) infrastructure that serves as their backbone for operating AI capabilities and supporting the objectives.

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67. Brown, "How To Keep Ahead of a Changing China", 44.

68. Director of National Intelligence, "The AIM Initiative – A Strategy For Augmenting Intelligence Using Machines", (January 16, 2019), 4, https://www.dni.gov/index.php/newsroom/reports-publications/item/1940-the-aim-initiative-a-strategy-for-augmenting-intelligence-using-machines (assessed May 15, 2019).

69. Director of National Intelligence, "The AIM Initiative, 6.

70. Director of National Intelligence, "The AIM Initiative, 6.

71. Director of National Intelligence, "The AIM Initiative, 6.

72. Director of National Intelligence, "The AIM Initiative, 6.

A key reason the DNI may successfully employ the AIM initiative is because "The IC needs to establish new incentive and hiring models and stop competing internally for the same scarce resources."[73] The AIM framework is ideal because the IC also focuses the DNI's framework on sustaining a diverse workforce resourced to analyze big data for AI technologies. The DNI Director, Mr. Dan Coats, defines the AIM Initiative as "The Augmenting Intelligence using Machines (AIM) Strategy provides the framework for the incorporation of AIM technologies to accelerate mission capability development across the IC."[74] It is imperative that senior leaders identify talent and allocate resources for AI training in their organizations. In 2025, the IC plans to focus on attracting and hiring a diverse workforce with attributes in high demand. Interestingly, coding skills, data engineers, and data scientist are crucial for the Army also to pursue because they require unique skills, knowledge, attributes, and cognitive behaviors need to operate AI capabilities. For example, the AIM initiatives state, "These alternative terms include analytics, data science, data wrangling, statistics, ML, deep learning, and modeling. These cover both the researchers who propose and test new methods, as well as model builders who use these algorithms to create and validate models."[75] In 2035 and beyond, the Army will need to structure training to include technical training, and potentially internships, with industry in order to build a bench of leaders and Soldiers in the emerging field of AI.

In the future, the Army can also learn from DNI's investments captured in their AIM initiative. The more essential investment the Army can leverage from

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73. Director of National Intelligence, "The AIM Initiative, V.
74. Director of National Intelligence, "The AIM Initiative, I.
75. Director of National Intelligence, "The AIM Initiative, 7.

the AIM initiative is training. The AIM initiative states, "Invest in programs for training and retooling the existing workforce in skills essential to working in an AI-augmented environment."[76] The DNI relies heavily on big data capabilities and provides the DoD with relevant all-source information used by the Joint Force. Susan Gordon, the Principal Deputy Director of National Intelligence, stated, "To meet its vision of ensuring intelligence advantage, the IC must adapt to the rapid global technological democratization in sensing, communications, computing, and machine analysis of data."[77] Similarly, leveraging DNI's objectives may help the Army with investment in research and development (R&D) efforts aligned against AI initiatives supporting similar AI workforce requirements. To reinforce the need to attract expertise in AI, the corporate and the academic industry is leading efforts to train and incentivize their workforces. Therefore, to build a bench of AI trained leaders and Soldiers, the Army may need to adopt similar practices. In this instance, the AIM states, "As competition for talent continues to increase outside of the IC, the community must leverage the IC Civilian Joint Duty (JD) program to share and retain talent across the IC and provide the workforce opportunities in other IC missions."[78] In 2035 and beyond, the Army may need to expand joint and strategic training opportunities to leaders, soldiers, and civilians to increase AI preparedness within the Joint Force.

Recommendations

Going forward, recommend the Army identify resources the AI workforce will need to enable the tenets of MDO, leveraging lessons learned from U.S.

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76. Director of National Intelligence, "The AIM Initiative, 4.
77. Director of National Intelligence, "The AIM Initiative, I.
78. Director of National Intelligence, "The AIM Initiative, 8.

Pacific Command's I2CEWS pilot, and adopt areas of the DNI's AIM initiative to increase training and opportunity for the Army's AI workforce. Although there are many incentives for attracting AI trained personnel, recommend the Army offers more JD training with partners like the DNI and industry to attract leaders and soldiers. The investments may produce a well-trained AI workforce with relevant ways to employ AI as an essential member of the Joint Force.

Conclusion

In conclusion, the employment of AI in 2035 and beyond will depend on a trained AI workforce. The AIM states, "A successful AI strategy requires engagement USG-wide, with the private sector, educational institutions, Federally Funded Research and Development Center (FFRDCs), national laboratories, and international partners (particularly Five Eye [FVEY] Partners)."[79] Additionally, the AI workforce is critical for enabling the tenets of MDO because leaders, civilians, and soldiers will need familiarization with coding for deep learning, implementation of modernized digital network architectures, and the ability to protect data using cyber defense. As a result, a trained AI workforce in the Army requires agility and adaptivity like the IC. Therefore, in the future, the 2018 U.S. Army's AI Strategy serves as a map and compass for aligning resources and priorities to support both MDO concept and the implementation of AI for Theater and below units. As the Army prepares for the next Armed Conflict, partnering with the DNI and leveraging their AIM initiative on AI will help the Joint Force deploy, fight, and win.

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79. Director of National Intelligence, "The AIM Initiative, 4.

Lieutenant Colonel Bernard Brogan is a 1998 graduate of Tuskegee University with a Bachelor of Science in Electrical Engineering. He also holds a master's degrees from Webster University. He is a Signal officer and has held a variety of command and staff positions in Army, Special Operations and Joint organizations.

Part II

Future Operations

Stability Cyber Operations in the Networked Future

COL Ken Slover, U.S. Army

Social constructs through multiple media and interpersonal connections are methods the United States (U.S.) population receives information to influence decision making. With an ever connected "internet of things," influencing behaviors of a willing population that sacrifices privacy for social access will continue to be a threat to national security now and in the anticipated threat environment of 2035.[80] The U.S. Army cohort, as a representation of an American population, must adapt to a future socially transparent environment where conditioned indifference will be the primary method to attain a relative advantage of national power. The Army will need to adapt its practices of doctrine and organization to conduct a Stability Cyber Operations (SCO) proposal to maintain a competitive advantage over the future adversaries of 2035 and beyond.

In order to provide context for U.S. Army operational and force requirements, a description of the anticipated threat environment is necessary. The character of conflict is changing as the cyber domain is not overly violent.[81] Lucas Kello, a quoted expert in the Joint Operating Environment (JOE) 2035, states "interpretation of cyber phenomena involves analysis of a new body of experience that existing theories may be unable to clarify."[82] Manipulation and weaponization

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80. U.S. Joint Chiefs of Staff, *Joint Operating Environment 2035: The Joint Force in a Contested and Disordered World*, (Washington D.C.: U.S. Joint Chief of Staff, July 14, 2016).
81. U.S. Joint Chiefs of Staff, *Joint Operating Environment 2035*, 33.
82. Lucas Kello, "The Meaning of the Cyber Revolution: Perils to Theory and Statecraft," *International Security*, (38, no. 2, Fall 2013), 7, https://

of cyber social networks are operational and strategic level efforts by all near-peer and regional adversaries.[83] Corporations own social networks seeking revenue, and many of them operate mostly outside the U.S.[84]

Adversaries influence these networks with unified purpose across the instruments of their national power: diplomatic, information, economic, and military. As evident in recent Russian meddling in the 2016 U.S. election, social media can present valid social engineering targets.[85] According to the U.S. Army's Training and Doctrine Command (TRADOC), the primacy of information will become the most useful warfare tool in the mid-21st century, able to target the enemy's will with little effort expended on means.[86] The will of the population is and will continue to be under attack in the future threat environment.

Distilling the future environment to those tactics that have the most significant effect on the will of the population, social engineering and manipulation will continue to occur. In order to counter this, the nation must first develop an understanding of how to influence individuals and groups. An affective social network consists of nodes which represent a person's

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www-mitpressjournals-org.usawc.idm.oclc.org/doi/pdf/10.1162/ISEC_a_00138 (accessed May 12, 2019).

83. Jim Mattis, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: U.S. Department of Defense, 2018), https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf, (accessed February 6, 2019).

84. Kevin Roose, "Social Media's Forever War," *New York Times Online*, (December 17, 2018), https://search-proquest-com.usawc.idm.oclc.org/docview/2157614361?pq-origsite=summon (accessed May 11, 2019).

85. Russell Jackson, "Pulling Strings: High-level hackers are using social engineering tactics to manipulate employees into giving up vital information," *The Internal Auditor*, (75, no. 4, August 01, 2018), 36.

86. U.S. Army Training and Doctrine Command, *The Operational Environment and the Changing Character of Future Warfare*, (Fort Eustis, VA: U.S. Army Training and Doctrine Command, May 31, 2017), 18.

emotion and the relationships between the nodes.[87] It is this emotion that is ultimately the target to compel an act, or inaction, by a population within various influenced networks. Members of a social circle influence personal spending choices expanded through social media mimicking their likes and dislikes of the larger group. Personal preference fuels an empathy economy that relies on branding and emotion over facts and evidence.[88]

Contributors to a social media network refine content to enlist an emotional acknowledgment. This edited content creates a false view of reality as compared to daily life.[89] To capture a user's attention, emotional high points and low points of postings enlist the essential network connection.[90] At the macro population-level within the network, their influence is recalibrated of highs and lows as the new median. A social network participant can influence the entire group without having to validate substance if it is within a plausible standard deviation to the median. However, this recalibration will continue indefinitely until a network or population becomes desensitized to information accuracy without an understanding of reputable sourcing morphing over time to become the new normal for the network. Conditioned indifference of the social average, or median, provides an opportunity to future warfighters

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87. Hyun-jun Kim, Seung-bo Park and Geun-sik Jo, "Affective Social Network--Happiness Inducing Social Media Platform," *Dordrecht*, (68, no. 2, January 2014), 355-374, https://search-proquest-com.usawc.idm.oclc.org/docview/1761810972?pq-origsite=summon (accessed May 12, 2019).

88. Michael Rock, "Human Emotion: The One Thing the Internet Can't Buy," *New York Times Online*, (October 14, 2015), http://www.nytimes.com/2015/10/14/t-magazine/human-emotion-the-one-thing-the-internet-cant-buy.html?partner=bloomberg (accessed May 12, 2019).

89. Trent Hamm, "The Power of Social Indifference," *The Simple Dollar Online*, (February 24, 2016), https://www.thesimpledollar.com/the-power-of-social-indifference/ (accessed May 13, 2019).

90. Hamm, "The Power of Social Indifference".

to manipulate adversarial audiences without violating the values of access over censorship within the U.S. constitutional represented democracy. State actors that can hide in plain sight among a network adjusting the emotional median to align with national interests for and by the voluntary participants will be a method of influence in 2035 and beyond.

Social networking is a lucrative target within the information environment. However, the doctrine and organization within the U.S. Army will have to adapt just as the targeted median of social awareness evolves. Cyber operations are a current, single-domain precedent for the Department of Defense and the U.S. Army to conduct offensive and defensive tasks to protect national interests. The U.S. Army can leverage current Offensive Cyber Operations (OCO), Defensive Cyber Operations (DCO) for countering cyber hacking and intrusion threats.[91] However, a Stability Cyber Operational effort is necessary to counter the human manipulation and develop a future Social Cyber Capability. This currently nonexistent capability can evolve with the social networking trends of not only the U.S., but, just as current social networks, the human condition globally.

Doctrine analysis examines the way the Army currently operates interpreting the operational approach toward the anticipated future environment to determine if there is a better way that might solve a capability gap. Existent doctrine relates with the purpose of the Stability Cyber Operations, such as Army Doctrinal Reference Publication (ADRP) 3-0, *Operations*. In ADRP 3-0, Stability Operations within the current U.S. Army

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91. U.S. Department of the Army, "Cyberspace and Electronic War Operations," *Field Manual 3-12*, (Washington D.C.: U.S. Department of the Army, April 2017), 1-6.

construct of Unified Land Operations (ULO) enables activities within Decisive Action (DA); complementary efforts of Offensive, Defensive, and Defense Support to Civil Authority (DSCA) tasks. Stability tasks are the primary method through which friendly forces affect civilians in order to attain conditions that support establishing lasting, stable peace. Mechanisms include compel, control, influence, and support to promote specific U.S security interests through political, legal, social, and economic means.[92]

Army Field Manual (FM) 3-12, *Cyberspace and Electronic Warfare Operations*, describe social networking as a "cyber persona." This persona only describes a user without human emotion, such as an internet protocol (IP), email address, or phone number.[93] This physical descriptor does not focus on the emotional and psychological motivations of the user or their motivations. This open-source document goes on to describe social empowerment as a characteristic of the cyber domain, but not how to manipulate the users. A significant hazard identified is the risk of network disruption leading to riots and civil unrest.[94] Doctrine is required to solve a capability gap if Stability Cyber Operation is to become a reality.

The operational concept that addresses the future threat environment is Multi-Domain Operations (MDO), unique in its importance on the tenet of convergence. Convergence is a rapid and continuous integration of capabilities in all domains to include the

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92. U.S. Department of the Army, "Operations," *Army Doctrine Reference Publication 3-0*, (Washington D.C.: U.S. Department of the Army, October 2017), 2-3.

93. U.S. Department of the Army, "Cyberspace and Electronic War Operations," Field Manual 3-12, (Washington D.C.: U.S. Department of the Army, April 2017), 1-14.

94. U.S. Department of the Army, "Cyberspace and Electronic War Operations," 1-20.

information environment that "optimizes effects to over-match the enemy through cross-domain synergy and multiple forms of attack all enabled by mission command and disciplined initiative."[95] It also brings forth the notion of enduring competition below the threshold of armed conflict; acts of deception and counter-reconnaissance within social networks and human terrain.[96] Within the MDO concept, enabling unit echelons with access to intelligence, cyberspace, and EMS capabilities is necessary. Relevant authorities and permissions are usually reserved for conflict or at higher echelons, and policy guidance is expressed as intent rather than narrow, restrictive directives.[97] The MDO concept provides a requirements model (access, authorities, and intent) for the future doctrine that requires little refinement to incorporate a new method of social engineering, such as with SCO.

The capability gap still needs to address the methods of influence within a social networking system that relies heavily on the future assumption of conditioned indifference. While FM 3-12 describes OCO and DCO in open-source detail, focusing on architecture and system dynamics, the SCO requires social science emphasis on harnessing those elements of the social network landscape that resonate with the population, such as poignant images, sentiment, or statements that incite an emotional response. This emotional response will recalibrate the standard deviation of the social network norm. The purpose of SCO would be the active pursuit of adjusting, assessing, and readjusting a social

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95. Headquarters, U.S. Army Training and Doctrine Command, "The U.S. Army in Multi-Domain Operations 2028," *TRADOC 525-3-1*, (Fort Eustis, VA: Headquarters U.S. Army Training and Doctrine Command, December 6, 2018), vii.

96. U.S. Army Training and Doctrine Command, "The U.S. Army in Multi-Domain Operations 2028," 27.

97. U.S. Army Training and Doctrine Command, "The U.S. Army in Multi-Domain Operations 2028," 29.

network's perception toward the national interests. Tasks would be less focused on the network physical architecture and more on the stability mechanisms — fewer tangible methods of competence, control, influence, and support. The social network dynamic can meet the tasks through minor course corrections of the group's collective opinion and the dissonance if rebelling from the group norm.

The Army professionals would be hiding in plain sight with this change in doctrine. Overly sensationalized information that is easily digested by the population will create indecision, incompatible to the social network norm. The indecision creates a conditioned indifference to espoused and unspoken values, beliefs, and mental models. The human connection through social media is an emotionally invested contract to adapt to the median of the group, subject to the national interest. Organization analysis examines how the Army needs to organize to conduct stability mechanisms within cyberspace; specifically, these social networking groups. The organizational structure exists currently within a Functional Combatant Command of United States Cyber Command (USCYBERCOM) and within the Amy as a force provider. Expanding roles to maintain a small team approach to conduct SCO would ultimately drive organizational expansion; not defined geographically, but by the ease of access into the network and social-cyber landscape.

There are current formations that are uniquely designed to conduct stability operations that could be the blueprint for a future organizational model to conduct SCO. The first is Security Force Assistance Brigades (SFAB). These formations security-advisor is centric with a high leader to led ratio providing a capability to conduct stability operations influencing foreign

audiences. Another organization uniquely designed for stability operations is Army Special Forces branch. Again, a leader-centric organization that credits experience and niche capabilities to conduct stability operations harkening back to the necessity of convergence in MDO across all capabilities in all domains, introducing SCO into cyber complements already robust stability focused force.

As Special Forces and SFABs primarily outfit their ranks from combat arms personnel in the Army, it is warranted to look toward an organizational re-design completely nested with the tenets of MDO. Looking past current existent organizational solutions to one to solve a capability gap within the MDO concept would be to leverage the additional two tenets: multi-domain formations and calibrated force posture. Calibrated force posture leverages national-level capabilities and authorities. Already relevant within the cyber domain, OCO and DCO are examples of national-level authorities that translate to future SCO. Authorities within these organizations require those social networks that originate, impact, or involve American active and willing participation. Calibrated force posture also speaks to expeditionary and geographically dispersed capability. Within the cyber domain, an Army professional can influence a population unilaterally from any location worldwide with access or by MDO having complementary effects by optimizing with other stability tasks.

The multi-domain formations tenet resonates with the necessity of SCO incorporation into future doctrine and Army organizations. It is building an organization that collectively possess a significant breadth and depth of technical and professional expertise, specifically with social engineering, human psychology, and geopolitics. The development of such a formation will be a significant cultural change to the Army because

the Army requires mass over precision and as the specific requirement increases, the less standardization that can and will occur in recruitment and maintenance of a multi-domain formation.

Highly qualified experts will replace rank and file, trade soldiers, and warfighters. Special Forces are recruited, trained, and applied in what they have demonstrated competence just as SFABs stabilize operations as part of DA. SCO will require trained experts of human emotion and how to manipulate the median of their shared cyber identity. Formations need to gain an excellent understanding of the information environment and the combined effects of social networks, personal interactions, and civil-military operations alike in order to successfully leverage SCO in 2035 and beyond.[98]

Echoes of the past resonate today and provide a possible roadmap to the future. Social networks are complex, adaptive systems always evolving with the emotional investment of the group. The future U.S. Army prepares to gain a competitive advantage of understanding the information environment quickly and acts to dominate by influencing adversarial populations. In conjunction with a whole of government approach enabled by a well led, resourced, and trained Army, SCO will evolve into national security relevance as humanity continues to redefine methods of social interaction. Today's value of interconnectedness compels the indifferent social awareness defense of tomorrow. The day after that could be back to a value of interconnectedness for social worth, transactional reliance for

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98. Headquarters, U.S. Army Training and Doctrine Command, "The U.S. Army Concept: Multi-Domain Combined Arms Operations at Echelons Above Brigade: 2025-2045," *TRADOC 525-3-8*, (Fort Eustis, VA: Headquarters U.S. Army Training and Doctrine Command, December 6, 2018), 21.

basic needs, or independent survival. How the Army and nation adapt in this lucrative security venue will determine if the U.S. will prevail in the information environment for generations to come.

Colonel Kenneth D. Slover is a 1995 graduate of Clarkson University where he earned a Bachelor of Science degree in biology and was commissioned as a Field Artillery officer. Additionally, he received a master's degree in Emergency and Disaster Management from Trident University. In 24 years of service, he has served in various tactical and operational assignments. He is currently serving as the 8th Army Fire Support Coordinator at Camp Humphreys, ROK.

The Importance of Improving Mission Command

LTC Jennifer Reynolds, U.S. Army

During his service as the Chairman of the Joint Chief of Staff, General Martin Dempsey introduced Mission Command by stating that it "is critical to our future success in defending the nation in an increasingly complex and uncertain operating environment."[99] The philosophy and concept of mission command are vital, but are failing in implementation and as a result, in practice. Mission command as a philosophy, War Fighting Function (WfF), and systems must improve to be more effective for commanders.

The mission command philosophy, WfF, and use of mission command systems can be better reinforced, implemented, and inculcated into the Army culture. This paper presents two ways to address the challenges in implementation from simply using the words "mission command" as a catch phrase to include systems and the WfF. Those ways are: leaders understanding how to conduct mission command, and the evaluation and training of subordinates.

Leaders understanding how to conduct mission command

Knowing what mission command means is not enough; leaders must understand how to put the concept into practice. The first principle of mission command is, "build cohesive teams through mutual trust."[100] The establishment of trust and team building are pathways to facilitating mission command. "Mission

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99. General Martin E. Dempsey, "Mission Command," White Paper, 3 April 2012

100. Headquarters Department of the Army (HQDA), "Mission Command," ADP 3-0 C2, 12 March 2014, p2

command is the exercise of authority and direction by the commander using mission orders to enable disciplined initiative within the commander's intent to empower agile and adaptive leaders in the conduct of unified land operations. Mission command is one of the foundations of unified land operations."[101]

The question of how a leader enables disciplined initiative and empowers their subordinates is complicated; shared trust is critical. Leaders who build a culture of trust will enable subordinates to act within their intent with capability and confidence. A model used to build trust and collectively understand the desired end state is one that eschews the removal of barriers. It is also known as flattening an organization. Identifying and removing obstacles that engender trust is necessary. John P. Kotter's book, *Leading Change,* identifies those obstacles as structure, skills, systems, and supervisors.[102]

Structure

A flat organization built on trust and empowerment is reliant on communication both horizontally and vertically. A balance between speaking and listening are keys to establishing effective communication. Four goals of effective communication are described by John Baldoni in his article "Powerful Leadership Communication" as inform, involve, ignite, and invite.[103] What is usually missing in communication is the "why." The reason "why" is essential is because it leads to the accomplishment of all four goals. The

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101. Headquarters Department of the Army (HQDA), "Mission Command," ADP 3-0 C2, 12 March 2014, p1

102. John P Kotter, "Empowering Employees for Broad-Based Action," Leading Change, Harvard Business School Press, 1996, chapter 7 p 101-115

103. John Baldoni, "Powerful Leadership Communication," Leader to Leader, no. 32, Spring 2004, accessed from USAWC Blackboard, LM 2201 Strategic Leadership course

"why" informs the formation of the importance of their role in the organization. The "why" also involves and ignites the formation through the establishment of their purpose, and how to work together towards a common goal. It removes "us vs them" and flattens the organization. All four goals remove barriers which could lead to assumptions. Assumptions can be dangerous when based out of context and without horizontal and vertical communication which informs and invites subordinates to voice questions or concerns, which lead to clarity and assumptions based on fact and clear intent and guidance.

Skills

Skills are taught at many levels of education in the Army and experience is gained during a variety of assignments. Training and evaluation, as ways to ensure skills, will be addressed further in the "evaluation and training of subordinates" section.

Systems

One more factor is the proliferation of mission command systems that enable mission command. However, it can hinder the ability for subordinates to exercise disciplined initiative. These capabilities have increased the capacity of leaders to monitor, and at times interfere with, their subordinates. These tools must be used appropriately to avoid being used as a safety net by subordinates, or to micromanage, both of which violate the principles of mission command. The way a leader commands affects the use or misuse of these systems.

Supervisors

If a leader does not possess the attributes and capabilities needed for mission command to be successful, then the barriers referenced above become a hindrance or insurmountable hurdle to overcome depending on the severity of the supervisors missing attribute(s) or abilities. Self-awareness and the willingness to address weaknesses are decisive to the success of mission command. There are a wide variety of established tools that are effective in increasing self-awareness. The Strategic Leadership Feedback Program (SFLP)[104] is one such tool used by the U.S. Army War College to assess strategic leaders.

A flat organization, enhanced through communication, and empowered subordinates are keys to the success of mission command. General Stanley McChrystal transformed the Joint Special Operations Command (JSOC) into a "fast and flat" organization, which he maintained created self-management and more agility.[105] These align with the principles of mission command and is an example of how a leader can effectively employ mission command in complex and challenging missions. A challenge to the establishment of a flat organization is the very thing that makes up the Army, its people. People differ in their maturity, talent, decision-making ability, and a wide range of other factors. A leader must know the skills and capabilities of those who will be executing within their intent and with disciplined initiative. The Army needs a method of evaluating subordinate leaders as it pertains to mission command is lacking.

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104. U.S Army War College, "Introduction to Strategic Leadership/Self-Awareness," Strategic Leadership Course Directive, 20 September – 18 October 2018, p11

105. Jamie Schwandt, *"An outside-the-box approach to Mission Command,"* Task and Purpose, 15 March, 2019, https://taskandpurpose.com/an-outside-the-box-approach-to-mission-command, (Accessed 12 May, 2019)

Evaluation and training of subordinates

The Army's methodology for inculcating mission command is through doctrine (ADP 6-0/ADRP 6-0), taught and discussed during multiple occasions throughout a career. The ability of a leader to evaluate their subordinates concerning their ability to conduct mission command is a missing aspect of the success of mission command. How well a leader knows subordinates affects how much or how little they should provide oversight and give guidance.

One way to address this is a tool designed to assess various attributes of subordinates, one similar to the Multi-Source Assessment and Feedback (MSAF-360).[106] Although a canceled program, some key aspects can be used in the implementation of a newly developed assessment tool. The MSAF provided the ability to become more self-aware, but allowed those being evaluated to select who conducted the evaluation. The leader must be the one to select a sample of the individuals, peers, and subordinates to develop a better understanding across multiple levels.

In addition to the collection of evaluations from multiple levels, self-assessment is essential. Self-awareness builds insight, for the supervisor, into the capabilities, as well as blind spots that the evaluatee may possess. The SFLP, discussed earlier in the paper, is a tool used to assess strategic level attributes. A modification of the SFLP to address tactical and operational aspects is needed to fill the gap between strategic leaders and those executing operations.

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106. Stand-To, "The Multi-Source Assessment and Feedback (MSAF) Program, Thursday, May 22, 2008, https://www.army.mil/standto/2008-05-22, (Accessed May 8, 2019)

A blend of the SFLP and MSAF-360 would be an ideal way to assess subordinates and provide the means for leaders to understand and know their people on a deeper level. This level of understanding will enhance the ability to deliver directed guidance and commander's intent with the ability to tailor it to the capabilities of their subordinates. It can also inform the leader of when to monitor and when to provide additional guidance thorough the use of orders and mission command systems. Truly knowing and understanding leaders will result in the proper execution of the guiding principles of mission command of "create shared understanding, provide a clear commander's intent, use mission orders and accept prudent risk."[107]

Leaders learn about Army doctrine, but training programs that ensure subordinates are tested and evaluated on their capabilities are absent. Results of an assessment such as the MSAF and SFLP, adapted for mission command, would assist in the development of focused training. Training which uses the practical application of mission command, uses the following principles; "exercise disciplined initiative, use mission orders, and accept prudent risk." Missing endnote number

An example of an effective training program is in use by Army Aviation. This program is designed to produce pilots capable of making decisions within the commander's intent, while unable to ask higher for instruction, and when the situation does not permit waiting for direction and guidance. The nature of the missions conducted results in situations requiring immediate decisions to be made by very junior leaders. The importance of cohesion, trust, clear intent, use of

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107. Headquarters Department of the Army (HQDA), "Mission Command," ADP 3-0 C2, 12 March 2014, p2

orders, accepting prudent risk, and using disciplined initiative is inherently vital.

How aviation provides training, evaluation, and certification of leaders in small groups (crews of 2-5 people) is the Pilot In Command Program (PIC). The missing piece of this program is that it is unique to each aviation brigade. The Army Aviation Center of Excellence in Fort Rucker is in the process of standardizing programs across Army Aviation.[108] The program is designed to qualify a pilot (regardless of rank) to act as the leader and decision-maker during a mission. Each airframe requires a qualified PIC for each mission conducted. Aviation units also require annual check rides to be performed by certified instructors. This test requirement ensures that both PICs and all crew members maintain knowledge about their specialty and understand how to put that knowledge into practice.

Similar programs should be developed and implemented in a manner that addresses branch specific (Armor, Infantry, Signal, and so on) requirements. Programs that result in special qualification and evaluation ensure that quality and capability are maintained. Additional certifications could also assist in promotion and are effective in ensuring that the formation maintains their skill well past rote memorization and into practical application. Each branch's Center of Excellence would be the ideal stakeholder with respect to the development and standardization of these programs.

Mission command systems are useful, but at times intrusive. The key is knowing when to be restrained and when to get involved. It is a balance of risk and empowering junior leaders. Restraint and

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108. Army Aviation, Department of Evaluation and Standardization, Fort Rucker Alabama, www.rucker.army.mil/usaace/directorates/des/, (Accessed May 14, 2019)

patience engender and build trust, build confidence and ability, and grow leaders into taking increasingly complex and challenging jobs. A cohesive training program designed to enable subordinates to act under the principles of command.

One can expect that the Army will be increasingly operating in the joint and multinational environments. As discussed in a Mission Command Center of Excellence white paper, "our nation cannot predict who it will fight, where it will fight, or in what coalition it will fight."[109] As such, if our leaders and subordinates are not effectively taught, evaluated, and exercised in mission command at the Army level, then the increasing complexities faced will present a possibility for failure.

The Multi-Domain Operations concept asserts that the homeland will no longer be a safe haven.[110] Conflict can be expected along a wide range of domains and as such mission command and its effective employment will increase in importance as the environment becomes more complex and complicated in 2035. Two ways to combat against the ineffective use of mission command are; leaders understanding how to conduct mission command, and the evaluation and training of subordinates. Not only do subordinates need to be evaluated, additionally leaders need to be taught to avoid micromanaging and sabotaging the intent mission command. The combination of the two will increase the likelihood of continued growth and success of the philosophy and, as a result, translate the often-used words "mission command" into Army

109. Mission Command Center of Excellence, "Army Mission Command Interoperability White Paper," 9 May 2012, p5

110. U.S. Army Training and Doctrine Command, "The U.S. Army in Multi-Domain Operations 2028," *TRADOC Pamphlet 525-3-1*, (6 December 2018), https://www.tradoc.army.mil/Portals/14/Documents/MDO/TP525-3-1_30Nov2018.pdf, (Accessed 19 May, 2019)

culture and successful implementation. An article written by Adam Drake states that "The modern version of military command and control is all about establishing and encouraging autonomy while simultaneously maintaining alignment."[111] Improving mission command will enable the conduct of a wide array of operations along the spectrum of operations in the kinetic and non-kinetic ranges.

Lieutenant Colonel Jennifer Reynolds is a 1998 graduate of Colorado State University and commissioned as an Aviation officer. She also holds a MS from Kansas State University. LTC Reynolds served in a variety of staff and command positions from the tactical to strategic levels. Her previous two assignments were as the senior aviation trainer at the Joint Readiness Training Center in Fort Polk, LA, and as the battalion commander for 3-1 Assault Helicopter battalion in Fort Riley, Kansas.

111. Adam Drake, *"Command and Control,"* Case studies, January 28, 2017, https://adamdrake.com/command-and-control.html, (Accessed 14 May, 2019)

Future Installation Management

Mr. Ron James, Department of the Army Civilian

The National Defense Strategy proclaims that the homeland is no longer a sanctuary. Threats from China, Russia, Iran, North Korea, and transnational threat organizations are not specific to a single service. All U.S. military installations will be threatened and all branches of the armed forces will be required to combat threats to our country and our way of life, as directed by the Commander and Chief.

The Army, Air Force, Marine Corps and Navy all have commands that are responsible for the management of their military installations. These redundant services could be combined, made more efficient, and as a result increase readiness by returning warfighters back to their military specialties, rather than performing installation management. Re-directing the resources currently allocated for installation management across the services would not create immediate savings. It would create cost saving conditions that the services used previously. Since the services have already experienced this type of transformation, they have established best practices and efficiencies that could be capitalized on at the Department level. With a methodical approach, built on the previous experience of the services, this reorganization could be conducted in a manner that adjusts over time. It could take advantage of natural attrition of civilian personnel and the reassignment of the military personnel back to their specialties, in an effort to minimize disruption. This would allow military installations across DoD to be managed in a, future focused, efficient manner.

Current Situation by Service:

Air Force

In 2014, a "need for increased efficiency drove the U.S. Air Force to pursue its biggest reorganization in the last 25 year, the creation of the Air Force Installation and Mission Support Center, or AFIMSC."[112]

AFIMSC is, "responsible for providing installation and mission support capabilities to 77 Air Force installations, nine major commands and two direct reporting units with an annual budget of approximately $10 billion."[113] Figure 1 depicts the organizational structure of AFIMSC. Serving as the primary service provider are the detachments, "our detachments serve as the face of AFIMSC to the MAJCOMs with which they're collocated. The detachments are robustly supported by the Primary Subordinate Units and Headquarters, which serve as the execution and integration network driving agile combat support delivery."[114]

Pulling together 150 capabilities was not a small task for the Air Force. "AFIMSC encompasses civil engineering, financial management and financial services, installation contracting, security forces and services activity, which includes recreation, lodging, child care, fitness and other support."[115] AFIMSC headquarters is a 350 person staff located at Joint Base San

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112. Kimberly Underwood, Air Force Installation and Mission Support Center Spreads its Wings, *Signal*, 19 September, 2018, https://www.afcea.org/content/air-force-installation-and-mission-support-center-spreads-its-wings, (accessed 8 May 2019)

113. Brief History of the Air Force Installation and Mission Support Center, *Air Force Website*, 18 January, 2017, https://www.afimsc.af.mil/About-Us/Fact-Sheets/Display/Article/1053010/ brief-history-of-the-air-force-installation-and-mission-support-center/, (accessed 8 May, 2019)

114. Major General Bradley D. Spacy, Stakeholder Report 2017, Air Force IMSC, www.afimsc.af.mil, (accessed 9 May, 2019)

115. Major General Spacy, Stakeholder Report 2017

Antonio – Lackland.[116] Prior to declaring AFIMSC Initially Operational Capable (IOC) on 1 October, 2015, the Air Force put a great deal of effort toward process re-engineering. Teams from across the Air Force conducted 34 Business Process Re-engineering (BPR) events, redesigned 284 processes and developed 532 improvement recommendations. Throughout the IOC phase, the focus remained on process re-engineering. In its 2017 Stakeholder Report, Air Force Installation and Mission Support Center Commander Maj. Gen. Bradley Spacy noted that "by the end of FY16, we had collaborated across every functional community, conducted 52 BPR events that leveraged the perspectives of more than 1,000 Air Force subject matter experts, and standardized 357 processes."[117] The completion of the process improvement and reengineering efforts allowed the Air Force to do more with less. It realized an over 50% reduction in Major Command (MAJCOM) Functional Managers from 98 to 46 and an 85% reduction in Functional Area Managers from 154 to 23. In a 2017 interview, the AFIMSC Commander Major General Brad Spacy stated that the efficiencies gained from this effort are real, 600 billets have already been eliminated as part of the transition and 400 more will be cut by 2021.[118] To ensure consistency across Installation and Mission Support service delivery, AFIMSC uses Air Force Common Output Level Standards (AFCOLS). These standards are reviewed annually and adjusted as necessary; the annual standards are then utilized semiannually to measure performance.[119]

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116. Major General Spacy, Stakeholder Report 2017
117. Major General Spacy, Stakeholder Report 2017
118. Jared Serbu, New Air Force command gives leaders 'enterprise view' of mission support functions, Federal News Network, 4 October, 2017, https://federalnews-network.com/on-dod/2017/10/new-air-force-command-gives-leaders-enterprise-view-of-mission-support-functions/ (accessed 8 May 2019)
119. Major General Spacy, Stakeholder Report 2017

Army

The U.S. Army was the first of the services to establish an organization responsible for management of their installations. The Installation Management Command website describes it this way:

> The U.S. Army Installation Management Command is one of the many success stories of Army transformation. In an effort to standardize its garrisons, the Army created the Installation Management Agency in October 2002. Using an enterprise approach, IMA removed the burden of base support from 15 major commands. This brought uniformity to the facilities and services of 184 installations, worldwide - and by 2006, this was accomplished with $4.5 Billion less than in 2003. After proven success, the Army transformed the agency into the Installation Management Command.[120]

Installation Management Command increased in size and scope in 2006 when it was joined by the U.S. Army Environmental Command as a subordinate command. That same year, the Family and Morale, Welfare and Recreation Command (FMWRC) was established with the stand-up of IMCOM. In 2011 FMWRC became the IMCOM G9 which provided greater integration.[121] Another modification to IMCOM was the transition from geographically aligned regions to CONUS based directorates that align with Major Army Commands, like the Air Force. The Training, Readiness and Sustainment Directorates align with TRADOC, FORSCOM and

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120. *Installation Management Command website*, https://home.army.mil/ imcom/ index.php/about/history, (accessed 10 May, 2019)
121. *Installation Management Command website*

AMC respectively.

Currently, IMCOM has approximately 50,000 employees spread across the installations,[122] including its headquarters at Joint Base San Antonio-Fort Sam Houston. In its most recent transition, IMCOM became a major subordinate command of Army Material Command, "The transition establishes unity of command and effort on installations, improves the readiness of Soldiers and formations, and strengthen the well-being of Soldiers, civilians and Families."[123] Throughout its history, IMCOM has sought to gain efficiencies as its budget reduced. For example, in 2011, "The Army vice chief of staff, Gen. Peter W. Chiarelli, said that the Installation Management Command (IMCOM) is 'setting the standard' when it comes to reducing inefficiencies."[124] General Chiarelli cited achievements such as the reduction of region offices from seven to six, which will further be reduced to four. And, "When the command moved its headquarters from Crystal City, Va., to San Antonio, [LTG] Lynch reduced contractor positions from 543 to 0, to save the command manpower costs."[125]

IMCOM utilizes a system similar to the aforementioned Air Force Common Output Level Standards to measure performance to standards. The IMCOM system is Common Levels of Support (CLS). CLS

122. Susan Merkner, IMCOM welcomes new CG Becker, IMCOM Website, 6 September, 2018, https://www.army.mil/article/210765/imcom_welcomes_new_cg_becker, (accessed 10 May 2019)

123. Susan Merkner, IMCOM Transitions to Army Materiel Command, IMCOM Homepage, 8 March, 2019, https://www.army.mil/article/218302/imcom_transitions_to_army_materiel_command, (accessed 11 May 2019).

124. AUSA Staff, IMCOM SETS THE STANDARD FOR REDUCING INEFFECIENCIES, 1 June, 2011, Association of the United States Army, https://www.ausa.org/articles/ imcom-sets-standard-reducing-inefficiencies, accessed 11 May, 2019)

125. AUSA Staff, IMCOM SETS THE STANDARD FOR REDUCING INEFFECIENCIES

measures performance for a variety of installation services and associates funds with the various levels of service.[126] Like the Air Force's COLS, CLS metrics are reviewed annually to ensure they are still relevant and value added.

Marine Corps

In 2012, the Marine Corps established Marine Corps Installation Command (MCICOM), which is headquartered at Marine Corps Base Quantico Virginia. As with the Air Force and Army, this organization was established to garner efficiencies and provide predictability to service members and their families. MCICOM is responsible for 24 installations and has approximately 30,000 installation management personnel worldwide.[127] Because of the Marine Corps' structure, MCICOM's effort to align with major commands also resulted in geographical alignment. MCICOM's regions are East, West, and Pacific, which happens to align with the supported major commands; 1st, 2nd, and 3rd Marine Expeditionary Forces. Like the Air Force and Army, the Marine Corps is seeking consistency and efficiency from their Installation Command, "MCICOM creates uniformity among installation missions, tasks, processes, procedures, structure, service levels, and funding allocation. A single installation higher headquarters drives a consistent application of resources – people, money, and services – resulting in efficiencies and cost reductions across the enterprise."[128]

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126. Measuring Service Performance at Army Installations, *Armed Forces Comptroller – Winter 2009*, http://www.omagdigital.com/article/Measuring+Service+Performance+ at+Army+Installations/442017/0/article.html, (accessed 11 May 2019)

127. MCICOM Staff, MCICOM And Its Importance to Every Marine, *Marine Corps Association and Foundation website*, 12 July 2013, https://mca-marines.org/gazette/mcicom-and-its-importance-to-every-marine/, (accessed 12 May 2019)

128. MCICOM Staff, MCICOM And Its Importance to Every Marine

Like the Air Force, MCICOM uses Common Output Level Support (COLS) to, "achieve consistent programing and budgetary decisions by aligning the PPBE process with COLS metrics."[129]

Navy

Commander, Navy Installations Command (CNIC) was established in 2003 and is headquartered in the Washington Navy Yard. The command was established, "in recognition that greater efficiencies would be realized by having one command responsible for the shore. Commander, Navy Installations, as it was then called, brought together all the shore-related activities under one streamlined command."[130] CNIC spans across 11 Regions to 70 Installations.

The command has not only allowed the warfighter to focus on their primary mission, but the command has become leaner, reduced spending, and became a more efficient organization while delivering better service.[131] CNIC also utilizes COLS and describes these standards as, "a cornerstone of CNIC's ability to program, budget, and execute, in essence to manage the Navy's shore enterprise, in a consistent and logical manner. They are used for describing the Navy's delivery of Shore and Support services. The Navy funds APF Programs to achieve a specific COLS level." Like

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129. Marine Corps Installation Command Order 3000.1, Installation Protection, 29 June, 2015, https://www.mcicom.marines.mil/Portals/57/G1%20Docs/MCICOM%20DIRECTIVES/Orders/MCICOMO%203000.1%20-%20INSTALLATION%20PROTECTION.pdf?ver=2017-04-06-083048-440, (accessed 12 May 2019)

130. Bill French, CNIC – Supporting the Fleet, Fighter, Family for 10 Years, *Navy Live*, 18 November, 2013, https://navylive.dodlive.mil/2013/11/18/cnic-supporting-the-fleet-fighter-family-for-10-years/, (accessed 9 May, 2019)

131. French, CNIC – Supporting the Fleet, Fighter, Family for 10 Years

the Army, the Navy measures performance against the standards quarterly.[132]

Future Challenges

As installations across the Department of Defense move toward 2035 and beyond, they will all face some of the same challenges. This is due in part to their similar situations. The majority of military installations are secured areas with aging infrastructure that are trying to provide services and support to a modern force. They balance providing for service members and their families with readiness platforms that prepare forces for combat. Below is a list of future challenges that installations across DoD will face. Each of these future challenges are not only acknowledged by DoD, but they are making efforts to mitigate each of them. This ability to manage future installation challenges strengthens the argument for future military installations to be centrally managed at the Department level. These future challenges along with a description of the DoD efforts to mitigate are below:

Encroachment

The Department of Defense has a congressionally approved program known as Readiness and Environmental Protection Integration (REPI) program. This program is, "a key tool for combating encroachment that can limit or restrict military training, testing, and operations"[133] Each year REPI provides a report to congress. The 2019 report included a list of accomplishments from 2002, when the program was enacted by congress until 2018. The report indicated 1,922

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132. COLS definition, APF Financial Readiness, https://www.ffrtraining.com/APF_Financial_ Management/1-respond-to-pom-data-call/11153.html, (accessed 13 May 2019)

133. Readiness and Environmental Protection Integration Program, DoD Website, https://www.repi.mil (accessed 24 May 2019)

transactions resulting in 586,665 acres protected across installations from all branches of service.[134] The REPI program is planning for force modernization and the challenges associated with future technology, "The National Defense Strategy urges that 'we cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment.' The REPI program's strategic planning process prioritizes the Department's key test and training capabilities."[135]

Climate Change

A Report on Effects of a Changing Climate to the Department of Defense was published in January 2019. The report took a long-term look at how climate change will impact installations and how these impacts might be mitigated by future installations. The report considered installation vulnerabilities over the next twenty years in the categories of; recurrent flooding, drought, desertification, wildfires and thawing permafrost. There were 79 installations considered across all services, recurrent flooding, drought, and wildfires are the primary concerns. The report concluded that,

"Climate and environmental resilience efforts span all levels and lines of effort, and are not framed as a separate program. Additionally, resources for assessing and responding to climate impacts are provided within existing DoD missions, funds, and capabilities and subsumed under existing risk management processes."[136]

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134. Readiness and Environmental Protection Integration Program, DoD Website

135. Readiness and Environmental Protection Integration Program 2019, 13th Annual Report to Congress, March 2019, https://www.repi.mil/Portals/44/2019%20General%20Fact___%20Sheets/2019_REPI_Report_to_Congress_FINAL_5FEB.pdf?ver=2019-03-05-095918-767, (accessed 24 May 2019)

136. Readiness and Environmental Protection Integration Program 2019, 13th Annual Report to Congress

Availability of Clean Water

One of DoD's environmental research programs is Environmental Security Technology Certification Program (ESTCP). The program promotes the transfer of innovations that have successfully established proof of concept to field or production use. The goal is to identify and demonstrate the most promising innovative and cost-effective technologies and methods that address DoD's high-priority environmental requirements.[137] Since their establishment in 1995, ESTCP has been concerned with the future availability of clean water on military installations, specifically, scarcity and contamination. Their website describes it this way:

> The availability, cost, and quality of water supplies are critical concerns for military installations and military operations within the United States and around the world. Many U.S. military installations are concentrated in regions where drought stress is prevalent. Of equal concern is the increasing interdependence of water and energy supplies, in which water is required to produce energy and energy is required to provide water.[138]

Energy

The Office of the Assistant Secretary of Defense for Energy (ODASD(Energy)) supports initiatives across four primary areas; Energy Resilience, Energy Risk, Energy Performance, Cyber Secure Facilities. These areas take into consideration that the homeland is no longer a sanctuary and that every domain

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137. SERDP and ESTCP, DoD's Environmental Research Programs, https://www.serdp-estcp.org, (accessed 24 May, 2019)

138. SERDP and ESTCP, DoD's Environmental Research Programs

is contested.[139] With their focus on future installations, ODASD Energy sees the challenges associated with the four primary area as:

> **-Energy Resilience:** Enhancing the military capability, readiness, and resilience of our installations and forces through assured access to resilient and cyber secure fuel and power.
> **-Energy Risk:** Identifying, assessing, and integrating energy-related analyses and risks into Department decision-making associated with requirements, deliberate planning, wargames and exercises, installation master planning, Energy Resilience and Conservation Investment Program (ERCIP), and investments in forces and installations.
> **-Energy Performance:** Ensuring energy efficiency and lower costs at DoD installations through reliable, efficient use of power and alternative financing mechanisms.
> **-Cyber Secure Facilities:** Reducing the cyber risks to facility related control systems to ensure reliable power for critical missions.[140]

Infrastructure

Installation infrastructure is an area in need of a great deal of funding in the future. The need continues to grow due to a twofold problem. First there is a lack of construction funding. Due to the Budget Control Act, adjusted for inflation, combined spending on military construction and family housing dropped from

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139. Deputy Assistant Secretary of Defense for Energy, Office of the Assistant Secretary of Defense for Sustainment Website, https://www.acq.osd.mil/log/ENR/index.html, (accessed 24 May 2019)
140. Office of the Assistant Secretary of Defense for Sustainment Website

$14.6 billion in 2012 to $10.5 billion in each of the next two years before plummeting to an annual average of $8.2 billion from 2015 to 2018.[141] The second part of the problem is the neglect to existing facilities. "In 2018 testimony to Congress, Pentagon chief infrastructure officer Lucian Niemeyer warned that the department is running a tab of $116 billion in deferred Facilities Sustainment, Restoration and Modernization funding."[142] Infrastructure is an area that would benefit greatly from the resources saved by consolidating installation management at the Department level.

Connectivity

In August 2016, The DoD Chief Information Officer published, *DoD IT Environment, Way Forward to Tomorrow's Strategic Landscape*. This publication describes the current IT environment as "complex and wide-ranging," with too many organization-specific networks and systems. It goes on to say, "The unnecessary complexity of this network and computing environment limits visibility and impedes the capability to securely share information and globally execute operations with mission partners." The DoD is working toward a future centralized IT environment that, "envisions an environment in which any mission can be successfully executed in a threat-ridden cyber environment." This plan demonstrates DoD's intent to replace current service specific systems and manage a shared system that better meets readiness requirements.[143]

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141. Rick Berger, All the Ways the US Military's Infrastructure Crisis Is Getting Worse, *Defense One*, https://www.defenseone.com/ideas/2019/03/us-militarys-infrastructure-crisis-only-getting-worse/155858/, (accessed 25 May 2019)

142. Berger, All the Ways the US Military's Infrastructure Crisis Is Getting Worse.

143. Way Forward to Tomorrow's Strategic Landscape, *DoD IT Environment*, August 2016, https://dodcio.defense.gov/Portals/0/Documents/JIE/DoD%20

Environmental

The office of the Assistant Secretary of Defense for Environment is the department level organization charged with the challenges associated with the environment. According to their website this organization is, "responsible for DoD's policies and programs related to compliance with environmental laws; management of natural and cultural resources; cleanup of contaminated sites; …green/sustainable buildings; installation emergency management; international environmental compliance and cleanup efforts; strategic sustainability planning; and planning to address emerging contaminants." This office also oversees the Installation Restoration Program. This program works at the installation level to do things like creating a wetland buffer at U.S. Army Garrison Aberdeen Proving Ground or providing assistance in mitigating contaminated areas on multiple installations.[144]

Having a central agency to provide leadership and guidance on these overarching challenges at the strategic level could help to avoid harm to future military operations, and avoid higher future costs. This would result in long term savings, increased readiness and improved quality of life.

Conclusion

All of the service reorganized existing capabilities to create an organization focused on installation management. Through this, they were able to reduce

IT%20Environment%20Way%20Forward%20-%20DISTRO%20(Aug%202016). pdf, (accessed 25 May 2019)

144. Deputy Assistant Secretary of Defense for Environment, *Office of the Assistant Secretary of Defense for Sustainment Website,* https://www.acq.osd.mil/log/ENV/index.html, (accessed 24 May 2019)

personnel and costs. Not all services data is available, but, as seen in this paper, they were able to complete over 400 business improvement processes, reduce size by over 1500 positions, and save in excess of $4.5 billion. The reorganizations also provided an opportunity to look at their processes and make improvements. The word cloud below (Figure 1) is the mission and vision statements of all service's installation management commands. There are certainly commonalities in how they see themselves. There are some minor structural differences, but, in general they are organized by regions and installations, and the installations perform many of the same services. They also measure their performance in a similar manner, with all setting common levels, then measuring performance and making resourcing decisions based on the outcomes. If all the services can reorganize to create an installation command with such positive outcomes, there is an argument to be made that it can also be done at the Department of Defense level with similar results. Certainly, there are differences between the services; however, when it comes to installation management there are also many similarities.

Figure 1. Mission and Vision Statement Word Cloud[145]

Mr. Ronny J. James is a Department of the Army Civilian, since 2005 he has been involved in installation management at the installation and regional levels. He has specific installation experience as a Region Installation Support Team member, Deputy to a Garrison Commander, and Lead Strategic Planner. Additionally, he has worked base closure and realignment efforts in Europe, Korea and CONUS.

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145. Created by the author

Robotic Systems Communications Networks: Essential To The Army's Future Robotic Force

Mr. Paul Chlebo, Department of the Army Civilian

"Autonomous robots must support future battles because the speed of engagements can far exceed the reaction time of humans… the decision-making process requires greater speed, information, and intelligence to make decisions at increasingly rapid rates."

— U.S. Army Training and Doctrine Command (TRADOC) G-2[146]

Given industry and academia predictions of the complexity of robot systems and the data transfer required to perform tasks, there is a need for dedicated forms of robotic system communications networks to enable autonomy in a variety of harsh, isolated, and otherwise contested environments.[147] Such communications capability must enable information sharing between robots and between supervisory robots and their higher level Army decision support systems.

The Department of Defense and the Department of the Army acknowledge rapid advances in technology leading to autonomous robot systems that result in changes to the character of warfare.[148] In 2018,

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146. U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare* (Fort Eustis, VA: U.S. Army Training and Doctrine Command, July 2017), 15. https://community.apan.org/wg/tradoc-g2/mad-scientist/m/visualizing-multi-domain-battle-2030-2050/200203 (accessed April 10, 2019).

147. NASA Jet Propulsion Lab, "Robot Armada Might Scale New Worlds," in *The Reference Shelf-Robotics* (New York: The H.W. Wilson Company, 2010), ed. Kenneth Partridge, 95-96.

148. Jim Mattis, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: U.S. Department of Defense, 2018), 3. https://dod.defense.gov/Portals/1/Documents/

former Secretary of Defense Jim Mattis contemplated future battlefields filled with unprecedented complexity and considered a future with greater integration of more autonomous robotic systems powered by artificial intelligence.[149] Similarly, TRADOC and other Army leaders predict autonomous robots on the battlefield. A communications network tailored for robotic systems is essential to this future.

How extensive will robotic systems be in the year 2035? Today, there is a lack of clarity about the type and quantity of autonomous robot integration within the Army's formations in 2035 and beyond. However, there is the certainty that greater forms of autonomous capabilities must support the Army during combat operations and myriad other multi-domain battlefield tasks. Eventually, as TRADOC predicts, "autonomous robots must support future battles because the speed of engagements can far exceed the reaction time of humans."[150]

This paper describes key assumptions to enable robotic system communications network capability; a future operational environment consisting of autonomous robots; and, robotic system communications network concepts.

Key Assumptions

The following assumptions guide the Army's employment of robotic systems that require dedicated communications network capabilities described in this paper:

pubs/2018-National-Defense-Strategy-Summary.pdf (accessed March 10, 2019); U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare*, 15.

149. *Summary of the 2018 National Defense Strategy and The Operational Environment*.

150. U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare*, 15.

- Global ethics and legal policies will mature to enable trusted autonomous robotic systems to operate on the future battlefield.[151]

- Humankind will rely on at least basic AI to augment human decision making in the economic and military spheres by 2030 to 2050.[152]

- Robotic systems will evolve to a complexity beyond the ability of human control requiring the assistance of artificial intelligence to manage them.[153]

Future Operational Environment

Consider the definition of robots by Carnegie Mellon University to better relate to the future operating environment: robots are "any machine that gathers information about its environment (senses) and uses that information (thinks) to follow instructions to do work (acts)."[154]

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151. Jean-Baptiste Jeangène Vilmer, "Terminator Ethics: Should We Ban "Killer Robots," *Carnegie Council, Ethics & International Affairs (*March 2015). https://www.ethicsandinternationalaffairs.org/2015/terminator-ethics-ban-killer-robots/ (accessed May 6, 2019). [With respect to International Humanitarian Law (IHL), one should instead require that the systems pass what George Lucas calls the "Arkin test"—an adaptation of the famous Turing test in artificial intelligence in which the behavior of a machine could be indistinguishable from that of a human in a given context. A robot satisfies the legal and moral requirements—and can consequently be deployed—when it can be demonstrated that it can respect the laws of war as well as or better than a human in similar circumstances.]

152. Benjamin Jensen and John T. Watts, *The Character of Warfare 2030 to 2050: Technological Change, the International System, and the State* (Washington, DC: U.S. Army, November 22, 2017), 19-20. https://armywarcollege.blackboard.com/webapps/blackboard/execute/content/file?cmd=view&content_id=_210233_1&course_id=_3993_1 (accessed April 6, 2019).

153. U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare,* 15.

154. Kenneth Partridge, ed., T*he Reference Shelf-Robotics* (New York: The H.W. Wilson Company, 2010), vii; Carnegie Science Center Home Page, http://www.carnegiesciencecenter.org/exhibits/roboworld-robots/ (accessed May 6, 2019).

The integration of robots and its increasing capabilities is proliferating at varying rates around the globe. Nations share artificial intelligence (AI) and robotic technologies and simultaneously compete for dominance in these realms to empower future robotic systems for both economic and military advantage. There is a race to develop and deploy robotic capabilities.[155]

Quite possibly, the coming age of integrated autonomous robot systems may produce both broader integration of robots into an increasing quantity of detailed, multi-domain tasks, and second-order effects leading to transformed international relationships and revised international security agreements.

Three recent military perspectives describe a future operating environment consisting of greater quantities of autonomous robots. Each perspective can benefit from a stand-alone, separate robotic systems communication capability dedicated to autonomous missions.

First, the U.S. Army Research Laboratory perspective is that in the battlespace of 2050, robot *soldiers* will operate in teams or swarms in the same way human soldiers act in teams today. These future robots operate under direct human supervision or autonomously to support a variety of tasks such as independent attack forces, as a portion of collective defense, or as sensors.[156]

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155. Corey Charlton, "Game of Drones: Inside the killer robot 'arms race' where the world's five leading superpowers are secretly preparing for an all-out futuristic war," *The Sun,* August 26, 2016, https://www.thesun.co.uk/news/1667063/ drones-inside-the-killer-robot-arms-race-where-the-worlds-leading-superpowers-are-preparing-for-a-futuristic-war-in-cyberspace/ (accessed May 11, 2019).

156. Alexander Kott, et al, *Visualizing the Tactical Ground Battlefield in the Year 2050: Workshop Report number ARL-SR-0327* (Adelphi, MD: U.S. Army

A second joint warfighting perspective from the former Director for Joint Force Development, Vice Admiral Kevin D. Scott, predicts an "evolution of autonomous robotic systems… and the emergence of robots working together… taking on complex actions, autonomous decisions, delivering lethal force, providing intelligence, surveillance and, reconnaissance (ISR) coverage, and speeding response times over wider areas of the globe."[157]

Third, TRADOC predicts that Multi-Domain Operations in a Future Operational Environment contains vast formations of unmanned, robotic, and autonomous systems that depend on massive amounts of data and rapid, assured communications across the spectrum of strategic and tactical battle areas.[158] TRADOC further amplifies this prediction by stating that "autonomous robots must support future battles because the speed of engagements can far exceed the reaction time of humans. The commanders' decision-making process requires greater speed, information, and intelligence to make decisions at increasingly rapid rates."[159] The information requirements of autonomous robots are likely to exceed the capacity of current Army networks and they can benefit from their own form of autonomous mission command. This would permit robots to perform tasks without human intervention.

Research Laboratory, June 2015), 17. https://www.hsdl.org/?view&did=768193 (accessed 10 April 2019).

157. U.S. Joint Chiefs of Staff, *Joint Operating Environment 2035 (JOE 2035), Version 1.0* (Washington, DC: U.S. Joint Chiefs of Staff, July 14, 2016), 17. https://www.airuniversity.af.mil/Portals/10/CMSA/documents/Required_Reading/Joint%20Operating%20Environment%202035%20The%20Joint%20Force%20in%20a%20Contested%20and%20Disordered%20World.pdf

158. U.S. Army Training and Doctrine Command, "The U.S. Army in Multi-Domain Operations 2028," *TRADOC Pamphlet 525-3-1* (Fort Eustis, Virginia: U.S. Army Training and Doctrine Command, December 6, 2018), Foreword. https://www.tradoc.army.mil/Portals/14/Documents/MDO/TP525-3-1_30Nov2018.pdf (accessed April 6, 2019).

159. U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare*, 15.

The importance of robotic system communications networks is that they enable change to the future character of warfare. Inspired by Timothy Griffin of the U.S. Army War College, the nation or actors that allow AI supported mission command amongst robot teams "gains a strong advantage over those nations and non-state actors who insist on man-in-the-loop for lethal action."[160]

The Army is preparing for the benefits of integrating autonomous robotic capability based upon these predictions. There are no limits to the types of dull, dirty, and dangerous tasks robotic systems will support on the multi-domain battlefield.

The coming changes to the character of warfare caused by robotics will create an urgent need for the Army to accelerate the development of robotic system concepts, capabilities, and force structure to remain relevant to the future fight. A robotic systems communications network is part of the equation.

Robotic System Communications Network Concepts

Consideration of academic studies of robotic communications offers the Army innovative options to apply to future conflicts. Descriptions of four industry and academic robotic communications concepts challenge Army research and development experts to develop future capabilities that improve robotic mobility in a combat environment and provide continuity of operations for robots. These concepts are 1) gossip

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160. Timothy Kevin Griffin, *Robotics and Artificial Intelligence Come of Age: Military Implications* (Carlisle Barracks, PA: U.S. Army War College, April 2015), Strategy Research Project, 13. https://apps.armywarcollege.army.mil/modules/Publication-Search/publishedFiles/Griffin_Timothy_Mr_2015.pdf (accessed 15 April 2019).

coverage; 2) link prediction; 3) cloud robotics; and, 4) robot communications optimization.

The first concept proposes autonomous mobility within assigned sectors. This concept appeared in the *Society for Industrial and Applied Mathematics Journal on Control and Optimization*.[161] The authors proposed the design of coordination algorithms leading to the optimal placement of roving robots in an area of interest. Once deployed to accomplish their tasks, AI can enable robots to perform autonomous support of their specified tasks without human intervention.

The authors' so-called '*Gossip Coverage*' algorithm, by way of peer to peer communications between robots, will enable autonomous self-adjustments of robots within their geographic environment based upon the boundaries of their programming and knowledge base. In this manner, *Gossip Coverage* enables robots to optimally adjust their support to missions based upon environmental changes without human intervention.[162] This concept fulfills earlier NASA Jet Propulsion Lab predictions that "robots will command and control themselves …Responding to their environment without human interaction to explore and embrace the unknown."[163] These algorithms can enable teams of autonomous robots to occupy their assigned areas and provide area security, route security, ISR, logistics support, and serve as relays for command and control communications.

161. Francesco Bullo, Ruggero Carli, and Paolo Frasca, "Gossip Coverage Control for Robotic Networks: Dynamical Systems on the Space of Partitions," *SIAM Journal on Control and Optimization* 50, no. 1 (2012), 419-29. https://search.proquest.com/docview/928478558?accountid=4444 (accessed 11 April 2019).

162. Bullo, et al, "Gossip Coverage Control for Robotic Networks".

163. NASA Jet Propulsion Lab, "Robot Armada Might Scale New Worlds," 95-96.

A second concept addresses the challenges of connectivity for robotic network communications while deployed. Neither autonomous nor non-autonomous robots can function without reliable communications. To bridge communications gaps, a commercial company, Tata Consultancy Services Limited, filed several patent applications related to robotic communications. One filed in 2018 was a documents systems and methods of communication link prediction between networks of robots.[164]

Army experts should explore the Tata Consultancy capability that enables mobile robots to automatically establish communications with a cloud network when it is available. Tata Consultancy's capability also enables robots isolated from the cloud network to form robot-to-robot relay systems between themselves and continue supporting assigned tasks. These isolated robots will continue to communicate locally until a cloud communications connection is reestablished. Such robotic communications relay concepts, aided by Tata Consultancy's technological link predictions, can enable the success of both intra- and inter-robot communications networks when geographic conditions or enemy jamming efforts disrupt communications.

A third concept is a dedicated 'Cloud Robotics' capability proposed by Gyula Mester in his 2015 *Cloud Robotics Model* contained within the *Interdisciplinary Description of Complex Systems*.[165] Mester describes a *Cloud Robotics Model* consisting of both

164. "Tata Consultancy Services Ltd Files Patent Application for Method and System for Communication Link Prediction in a Distributed Robotic Networks," *Indian Patents News* (August 09, 2018). https://search.proquest.com/docview/2085572438?accountid=4444.

165. Gyula Mester, "Cloud Robotics Model," *Interdisciplinary Description of Complex Systems 13, no. 1* (Hungary: University of Szeged, Department of Informatics, January 2015), 2. https://search.proquest.com/docview/2070090236?accountid=4444 (accessed 10 April 2019).

Cloud Robotics and a Robotics School. "Cloud robotics is the use of cloud computing to share resources and learning among robots through the internet. A robotics school is a collection of data pools, resource pools and services for robots with advanced intelligence."[166]

Incorporation of such a cloud robotics model may enable more efficient communications capability amongst autonomous robot teams during periods of excellent communications conditions. Simultaneously, such cloud robotics and robotics school capabilities can serve as a continuity of operation (COOP) resource for Army robotic capabilities operating in communications degraded environments. Once connectivity is reestablished, the robotic teams and cloud robotics model update each other and continue their missions.

A fourth robotics communications concept is inspired by the work of Byung-Cheoi Min in his *Optimizing Self-Organizing, Large-Scale, Mobile Robotic Broadband Networks* which considers the employment of autonomous networked robots to restore destroyed communications infrastructure.[167] Such restoral capabilities are necessary to restore traditional general support battlefield communications networks. However, designing this capability to self-deploy as a separate communications network serving as a primary means of communications for small or large teams of autonomous robots is an innovation that requires consideration.

Three options can employ separate communications networks. They can be embedded in the robots themselves; within small drones carried by

166. Mester, "Cloud Robotics Model".
167. Byung-Cheol Min, *Optimizing Self-Organizing, Large-Scale, Mobile Robotic Broadband Networks* (Purdue University: 2014), 70. https://search.pro-quest.com/docview/1615795247?accountid=4444 (accessed 12 April 2019).

robots themselves that self-deploy to low altitude traffic patterns; and within larger unmanned aerial platforms at higher altitudes to provide general support to all Army robots across a wider area. The use of this separate, persistent robot communications network concept can offload high volumes of intra-robot communications data exchange which preserves traditional Army communications network for other human-oriented priorities.

It is clear that the inclusion of increasing quantities of AI empowered robotic systems will outpace a staff's ability to manage operations at AI speeds.[168] Therefore, Army robotic systems need some form of communications network capable of supporting the growth in both quantity and complexity of robot information requirements.

Aided by AI and trusted communications networks, separate inter-robotic (between humans and robots) and intra-robotic (between robots) communications systems can distribute the complexity of these command and control tasks in a manner that enables both robot autonomy as well as human "on the loop" supervision during operations.

Conclusion

Artificial intelligence and robotics will bring change to the character of warfare and the future operating environment which create new requirements for Army investments. These new requirements create the urgent need for the Army to accelerate the development of robotic system concepts, capabilities, and force structure to remain relevant to the future fight.

168. Benjamin Jensen and John T. Watts, *Office of the Chief of Staff of the Army's Strategic Studies Group, Cohort IV (2015-2016) Character of War 2030-2050*, 60.

Robotic systems communications are part of this infrastructure because autonomous robots can far exceed the reaction time of humans.[169] Leaders know success on the battlefield requires command and control communications. Likewise, autonomous robots of the future require their command and control capability, too. The Army must design robotic systems communications networks to ensure success on the future battlefield.

Mr. Paul Chlebo, Jr, is a 1984 graduate of Norwich University, earning a Bachelor of Science in mechanical engineering. In 1988 he earned a Master of Science in telecommunications management from Golden Gate University. Mr. Chlebo served as an active Army Officer and currently serves as a Department of the Army civil servant. Mr. Chlebo reports to Headquarters, Communications Electronics Command at Aberdeen Proving Grounds following graduation from the U.S. Army War College.

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169. U.S. Army Training and Doctrine Command G-2, *The Operational Environment and the Changing Character of Future Warfare*, 15.

Part III

Future Ideas

Creating Joint Multi-Domain Operations Headquarters

LTC Tim O'Sullivan, U.S. Army

The return to great power competition with Russia and China places U.S. military supremacy at risk. Both countries have the capabilities to contest in all domains and plan to defeat the U.S. through multiple layers of standoff.[170] The U.S. Army's concept of Multi-Doman Operations (MDO) addresses these challenges by having the Joint Force work together to compete, penetrate, dis-integrate, and exploit our adversaries.[171] However, the Army lacks the organic capacity in the sea, air, space, and cyber domains to accomplish this task alone. The Department of Defense (DoD) must establish permanent Joint Multi-Doman Operations Headquarters (JMDO-HQ) to provide the synergy and speed of action across the joint functions to defeat near-peer competitors. This paper describes the need to establish JMDO-HQs, how to organize them using the joint functions, and a path for implementation.

The Need to Establish Permanent JMDO-HQ

The U.S. struggled through Korea, Vietnam, and the Grenada invasion to fully integrate the capabilities of the Joint Force.[172] Blurred lines of authority and ineffective decision making led to tens of thousands of Americans dying against third-rate powers.[173] These events led the U.S. Congress to direct reforms

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170. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028 TRADOC Pamphlet 525-3-1* (Washington, DC: U.S. Army Training and Doctrine Command, December 6, 2018), vii.

171. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028*, vii.

172. James R. Locher III, *Victory on the Potomac: The Goldwater-Nichols Act Unifies the Pentagon* (Texas A&M University: College Station, TX, 2002), 4.

173. Locher III, *Victory on the Potomac*.

in the Goldwater-Nichols Act of 1986 that established joint warfighting commands.[174] In subsequent conflicts fought in Panama, Kuwait, Serbia, Afghanistan, and Iraq the Joint Force performed well. In each case, a joint headquarters employed trained units from the military services. Organized along service lines, a joint task force (JTF) normally consists of a land, air, maritime, and special operations component.[175] The military services develop capabilities focused on their primary domain. Joint force commanders "synchronize a series of federated solutions, developed somewhat in isolation to deal with the problems posed in a specific domain into a joint solution."[176] Absent a pacing threat after the Cold War, the Joint Force evolved "for operations in relatively uncontested environments that allow for sequential campaigns based predicable approaches that assume air and naval supremacy."[177]

In future conflicts, Russian and China will exploit the seams in the Joint Force. They will prevent the U.S. from gaining access to the area of operations, isolate forces in each domain, and fix American forces to prevent maneuver.[178] The current model of standing up a JTF after a crisis begins and structuring the operational forces, based on service specific domains, places U.S. victory at risk.

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174. Locher III, *Victory on the Potomac*, 412.

175. The Joint Staff, *Doctrine for the Armed Forces of the United States: Joint Publication 1 Incorporating Change 1* (Washington, DC: The Joint Staff, January 12, 2017), IV-3.

176. David G. Perkins and James M. Holmes, "Multidomain Battle Converging Concepts Toward a Joint Solution," *Joint Forces Quarterly* (Issue 88, 1st Quarter 2018), 54, https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-88/jfq-88_54-57_Perkins-Holmes.pdf?ver=2018-01-09-102340-943 (accessed May 17, 2019).

177. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028*, vii.

178. Perkins, "Multidomain Battle Converging Concepts Toward a Joint Solution," 55.

The U.S. Army in Multi-Doman Operations in 2028 addresses these challenges by describing how the U.S. "will militarily compete, penetrate, dis-integrate, and exploit our adversaries."[179] The Army established a Multi-Domain Task Force (MDTF) in the Indo-Pacific Command and is planning one for Europe.[180] In 2018, the Army's MDTF sank a ship in the Pacific Ocean using ground-based rocket artillery by working with the U.S. Navy and Japanese Defense Forces.[181] Additionally, in January 2019, the Army activated a new battalion at Joint Base Lewis McChord to conduct MDO with organic: intelligence, information, cyber, electronic warfare, and space (I2CEWS) capabilities.[182] To conduct large scale combat operations, the Army is planning to bring back threat-focused field armies to provide "credible deterrence, execute the competition below armed conflict against near-peer threats, and enable the rapid transition to win in large-scale ground combat operations."[183] The MDTF and inter-service cooperation are moving in the right direction, but require formal integration and joint force structure to turn the concept into reality.

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179. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028*, v.

180. Sean Kimmons, "Second Phase of Multi-Doman Task Force pilot Headed to Europe" Washington, DC: Army News Service, October 11, 2018) https://www.army.mil/article/212342/second_phase_of_multi_domain_task_force_pilot_headed_to_europe (accessed May 2, 2019).

181. Kimmons, "Second Phase of Multi-Doman Task Force pilot Headed to Europe".

182. Calbe Minor, "New space, cyber battalion activates at JBLM" Army webpage (January 16, 2019) https://www.army.mil/article/216236/new_space_cyber_battalion_activates_at_jblm (accessed May 2, 2019).

183. Department of the Army, *The U.S. Army Concept for Multi-Domain Combined Arms Operations at Echelons Above Brigade 2025-2045 TRADOC Pamphlet 525-3-8* (Washington, DC: Headquarters Department of the Army, December 21, 2018), iv.

Organizing by Joint Functions

To enable MDO, the Department of Defense must develop and build permanent JMDO-HQ. MDO strives to achieve "convergence" through "rapid and continuous integration of capabilities in all domains."[184] Convergence requires a trained and experienced headquarters based on the seven joint functions: command and control; intelligence; movement and maneuver; fires; protection; sustainment; and information.[185] Unlike an ad hoc JTF, the JMDO-HQ is a standing organization that uses joint function centers to integrate U.S. military, multinational, interagency and partner capabilities against a specific threat. It competes with the adversary to deter and can rapidly expand in the event of armed conflict.
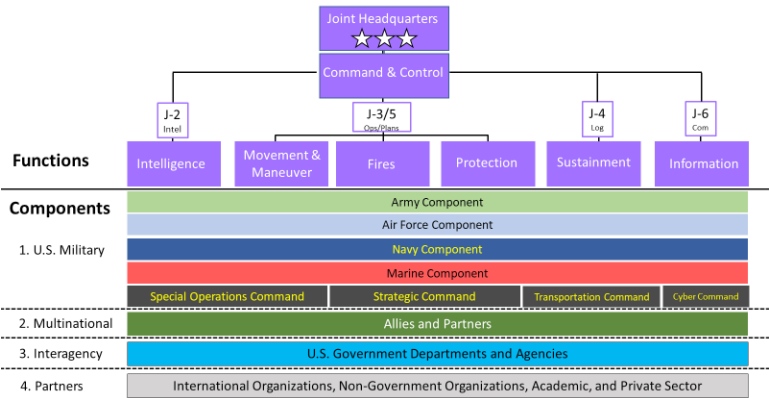

Figure 1 – Notional example of a Joint Multi-Domain Headquarters organization[186]

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184. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028*, vii.

185. The Joint Staff, *Joint Task Force Headquarters: Joint Publication 3-33* (Washington, DC: The Joint Staff J7 Joint Force Development, January 31, 2018), I-5.

186. Created by the author

The figure above shows the basic organization of the JMDO-HQ. The model retains the standard J-code structure to provide "a common reference point for broad functional experience, staff oversight, and accountability."[187] Each joint function center includes the U.S. military components of the Army, Air Force, Navy, Marine, and the appropriate functional combatant command. This organization differs from the traditional domain focused structure with a land, air, and sea components each led by a service. It requires bringing staff together to reconcile different perspectives. For example, the Army uses a "battlefield framework that is oriented on forces and geography," while the Air Force framework is "oriented on function and time."[188] Only a permanent structure can work through the challenges of integrating the different frameworks to better support the commander across all domains.

The other components: multinational, interagency, and partners also play a vital role. Multinational forces consisting of allies and partners will join the applicable centers based on their contributions. The U.S. Government interagency partners provide access to diplomatic, informational, economic, financial, intelligence, and legal elements of national power.[189] Finally, partner organizations that consist of international organizations, non-government organizations, academic, and private sector entities are included to "share information, identify risks, perform vulnerability assessments, assist in planning and provide support

187. The Joint Staff, *Joint Task Force Headquarters: Joint Publication 3-33*, II-12.

188. Perkins, "Multidomain Battle Converging Concepts Toward a Joint Solution," 57.

189. John P. McDonnell, "National Strategic Planning: Linking DIME-FIL/PMESII to Theory of Victory" (Norfolk, VA: Joint Forces Staff College, Joint Advanced Warfighting School, December 6, 2009), 4, https://apps.dtic.mil/dtic/tr/fulltext/u2/a530210.pdf (accessed May 22, 2019).

as appropriate."[190] Each joint function center has a leader and staff consisting of the appropriated skilled members from the services, multinational forces, the interagency, and other partners with the expertise to integrate functions. While far more challenging to establish, this structure improves the commander's ability to employ all assets in multi-domains simultaneously.

Command and Control

The Command and Control function is the "exercise of the authority and direction over assigned and attached forces to accomplish the mission."[191] The JMDO-HQ would have a joint operations area (JOA) assigned where the adversary most threatens U.S. interests. Globally integrated campaigning permits the JOA to cross the geographic boundaries of Combatant Commands.[192] The JMDO-HQ will have assigned operational control of forces to employ forces in MDO. A three-star general or flag officer commands the JMDO-HQ to provide the necessary level of experience and rank to interface with the senior leaders from the multinational forces. In the competition phase, headquarters supports theater campaign objects focused on the adversary, sets the JOA, further develops MDO concepts, and builds relationships with partners. If armed conflict breaks out, the commander's grade could increase based on the number of U.S. and coalition forces that would join the operation.

Intelligence

The intelligence function supports the understanding of the operational environment, adversary

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190. The Joint Staff, *Joint Task Force Headquarters*, I-8.

191. The Joint Staff, *Joint Operations, Joint Publication 3-0, Incorporating Change 1* (Washington, DC: The Joint Staff, October 22, 2018), xiii.

192. The Joint Staff, *Joint Concept for Integrated Campaigning* (Washington, DC: The Joint Staff, March 16, 2018), v.

capabilities, centers of gravity, vulnerabilities, networks and potential actions.[193] In depth and up-close study of potential opponents is necessary to understand their capabilities, activities, motivations, and intentions. The JMDO-HQ intelligence center serves as a direct link to the vast U.S. intelligence community and other part-ners. The center focuses its efforts on the designated adversary. Against near-peer competitors, the air and missile defense intelligence preparation of the battle-field to address threats from ballistic missiles, aircraft, unmanned aerial systems, and cruise missiles is very important.[194] A forward element that narrowly focuses collection efforts on one adversary will promote greater intelligence sharing amongst partner nations in the region. The intelligence center supports all the other joint functions through analysis that informs the com-mander's decisions and activities.

Movement and Maneuver

Movement and Maneuver is the disposition of joint forces to conduct operations by securing posi-tional advantages to achieve operational and strategic objectives.[195] Movement and maneuver center consists of ground forces, along with maritime and air forces, that can move forces within the JOA. The size and scope of this center is based on the adversary. Against North Korea and Russia, ground forces play a lead-ing role in both competition and armed conflict. While against China, the ground forces play a supporting role to maritime and air forces. This center will work to synergize the actions across the domains. Movement and maneuver forces provide a visible presence. The

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193. The Joint Staff, *Joint Operations*, xiv.
194. Department of the Army, *Air and Missile Defense Intelligence Prepara-tion of the Battlefield ATP 3-01.16* (Washington, DC: Headquarters Department of the Army, March 31, 2016), iv.
195. The Joint Staff, *Joint Operations*, xiv.

mobile nature of the Joint Force provides the JMDO-HQ commander a wide range of options along the competition continuum from building partner capacity to large scale combat operations.

Fires

The Fires function uses "available weapons and other systems to create a specific effect on a target."[196] MDO seeks to thwart adversaries by synchronizing lethal and non-lethal capabilities across ground, air, sea, space, and cyber to create multiple dilemmas for the enemy.[197] The fires center will be most challenging due to the complexity, multitude of capabilities, speed of action, and entrenched service interests. In current practice, the maritime, air, land, and special operations components all maintain their own fires elements. The fires center seeks to combine roles of the air component commander, maritime component, and the area air defense commander during the competition phase. Developing an interconnected joint fires center is superior to the current practice of relying on battlefield coordination detachments and liaisons.[198] The fires center will consolidate fires elements in joint doctrine such as the joint fires element, dynamic targeting cell, time-sensitive coordination, and forces fires coordination center.[199] During the competition phase, it focuses on non-lethal fires and exercises to perfect integration across all domains. In the event of large-scale war, the

196. The Joint Staff, *Joint Operations*, xiv.

197. Christopher Wendland, "Multi-Domain task force takes on near-pear operations" *Fires* (U.S. Army Fires Center of Excellence: Fort Sill, OK, May-June 2018), 37, https://sill-www.army.mil/firesbulletin/archives/2018/may-jun/may-jun.pdf (accessed May 2, 2019)

198. Department of the Army, *The Battlefield Coordination Detachment: ATP 3-09.13,* (Washington, DC: Headquarters Department of the Army, July 24, 2015), 1-2.

199. Air Land Sea Application Center, *Dynamic Targeting, Multi-Service Tactics, Techniques and Procedures for Dynamic Targeting: ATP 3-60.1, MCRP 3-16D, NTTP 3-60.1, AFTTP 3-2.3* (Langley, VA: September 10, 2015), 16.

fires function would expand into a more traditional structure to manage the number of assets being employed.

Protection

The Protection function focuses on preserving the force's fighting potential in four ways: active defense, passive defense, reducing the risk of friendly fire, and emergency management.[200] Near-peer investments in electronic warfare (EW) enables them to deny or disrupt communications and global positioning systems, locate friendly forces, and interfere with radio-controlled artillery fuses.[201] Nuclear, biological, and chemical defenses are also important with Russia viewing tactical nuclear strikes or threatening them as a legitimate way to fulfill "national objectives that would otherwise not be accomplished."[202] Protection from air and missile defense requires close coordination between sensors and shooters on the ground, in the air, and on sea domains. The protection center must focus on ensuring the force can withstand attacks, maintain freedom of action, and the ability to sustain the force.

Sustainment

Sustainment is "the provisions of logistics and personnel services to maintain operations through mission accomplishment."[203] The sustainment center will identify potential risks in terms of access, capabilities, and developing alternatives and mitigating

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200. The Joint Staff, *Joint Operations*, xiv.
201. Charles K. Bartles, "Recommendations for Intelligence Staffs Concerning Russian New Generation Warfare," *Military Intelligence Professional Bulletin*, (PB 34-17-4, October – December 2017, U.S. Army Intelligence Center of Excellence: Fort Huachuca, AZ), 15, https://www.armyupress.army.mil/Portals/7/Hot%20Spots/Documents/Russia/Bartles-russian.pdf (accessed May 18, 2019).
202. Bartles, "Recommendations for Intelligence Staffs, 13.
203. The Joint Staff, *Joint Operations*, xv.

measures.[204] Contested deployments and the ability for enemies to attack logistics infrastructure requires working with allies and partners to find methods to disperse classes of supply throughout the area of operations. Large scale combat operations will be lethal and require replacing battle losses at a scale not seen since the Korean War. The sustainment center must not only supply and maintain the force, but also enable the replacement of losses and large-scale deployments.

Information

The information function "encompasses the management and application of information and its deliberate integration with the other joint functions to change or maintain perceptions, attitudes and other elements that drive desired behaviors and support automated decision making."[205] America's adversaries seek to separate our allies and partners by stoking points of friction and portraying the "U.S. as a weak or irresolute partner."[206] The information center works this issue daily to provide a compelling counter-narrative reinforced by actions. Additionally, the information center oversees a network that is robust, resilient, and secure to operate across all functions. Preventing the enemy from disrupting or gaining access to the network is critical because Russian and China will continue to contest in the information domain.

Implementation

Creating permanent JMDO-HQ requires adjustments to the combatant commands and their service component commands to provide the force structure for

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204. Department of the Army, *Theater Army Operations: ATP 3-93,* (Washington, DC: Headquarters Department of the Army, November 26, 2014), 4-1.

205. The Joint Staff, *Joint Operations*, xiii.

206. Department of the Army, *The U.S. Army in Multi-Doman Operations in 2028*, viii.

a permanent headquarters. The Secretary of Defense or a Combatant Commander can establish a joint task force focused on "a specific limited objective and does not require overall centralized control of logistics."[207] The SECDEF should establish two JMDO-HQs focused on Russia and China to conduct globally integrated operations.

For the initial establishment, a service component commander would stand-up the JMDO-HQ. The U.S. Army Europe would take the lead against Russia and the Navy's Pacific Fleet against China. The service components will have one year to plan how to best split the headquarters to operate as a JMDO-HQ. To assist in the stand-up, the Joint Enabling Capabilities Command (JECC) would provide expertise in "plans, operations, logistics, knowledge sharing, intelligence, communications, and public affairs capabilities."[208] The Joint Staff J-7's Joint Training Division would also provide assistance on separating the JMDO-HQ from theater wide operations, developing a coalition and interagency mindset, and requirements for sourcing enduring missions.[209]

At the end of the first year, the JMDO-HQ will conduct several exercises against the specified threat. Initially these events will be simulation based to assist in the development of the staff. Next, real world exercises with operational forces will incorporate all the components. Assessed by external organizations, these exercises will provide honest feedback on what works, what does not, and what the documented JMDO-HQ should look like. After action reviews will inform the

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207. The Joint Staff, *Doctrine for the Armed Forces of the United States,* xix.
208. The Joint Staff, *Joint Task Force Headquarters*, II-4.
209. The Joint Staff, "Forming a Joint Task Force HQ" (Suffolk, VA: Joint Staff J7 Joint Training, September 2015), 1, https://www.jcs.mil/Portals/36/Documents/Doctrine/fp/forming_jtf_hq_fp.pdf (accessed May 21, 2019).

joint manning, training, and equipping requirements to formally document the organization.[210]

The third year DoD will document the JMDO-HQ in force structure with a Joint Manning Document. The majority of the manpower should come from positions currently in the service component commands and assigned forces. The functional alignment that integrates the component staffs coupled with improved technology should minimize new personnel requirements. A goal in building the JMDO-HQ is one that is networked, multinational from the start, integrated with the interagency, and nontraditional partners."[211]

Conclusion

The JMDO-HQ provides the required functions to employ the U.S. military, multinational forces, the interagency, and work with partner capabilities to holistically complete with adversaries across all domains. It will play a vital role in deterring adversaries through focused activities, continuously planning, and enabling a rapid expansion. The challenging task of developing a new joint headquarter structure is necessary to "shift from a model of interdependence to one of integration."[212] The JMDO-HQ operationalizes the National Defense Strategy by providing a headquarters for the Joint Force to compete, deter, and win to protect the security of the nation.[213]

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210. The Joint Staff, "Forming a Joint Task Force HQ", 10.
211. The Joint Staff, "Forming a Joint Task Force HQ", 3.
212. Perkins, "Multidomain Battle Converging Concepts Toward a Joint Solution," 57.
213. Jim Mattis, *Summary of the 2018 National Defense Strategy of the United States of the America*, (Washington, DC: U.S. Department of Defense, 2018), 11.

Lieutenant Colonel Timothy R. O'Sullivan is a 1997 graduate of the U.S. Military Academy with a bachelor's degree in mechanical engineering. Additionally, he earned a master's degree in policy management from Georgetown University. LTC O'Sullivan is a force management officer with 22 years of service and deployments to Kosovo, Iraq, and Afghanistan. His last assignment was on the Army Staff and will next serve at the Mission Command Center of Excellence at Fort Leavenworth.

Changing Army Culture in Multi-Domain Operations and the Future Operating Environment

COL Mary Drayton, U.S. Army

"Seventeen consecutive years of irregular war, extended periods of budget uncertainty and an increasingly complex security environment have eroded our competitive edge. Our adversaries meanwhile have taken advantage of this to better their positions."

Honorable Mark T. Esper, Secretary of the Army[214]

In order for the United States Army to maintain its competitive edge in the future operating environment where every domain; air, space, land, cyber, and sea is where state and non-state actors threaten United States' interests, the U.S. Army must invest in the talent management of the civilian and military workforce starting with primary and secondary education; and partner with the private sector and Defense Industrial Base in research and development opportunities to increase machine learning and artificial intelligence options for incorporation into U.S. Army Warfighting functions, and (3) update doctrine and policies dating back to the Gulf War.

In 2018, the Secretary of the Army addressed the audience at the annual Association of the U.S. Army stressing the need for an "Army Renaissance." Renaissance, defined as a "revival or renewed interest

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214. Rick Maze, "Army Renaissance, Esper Expresses Sense of Urgency, Warning "We Must Act Now,'" (The Magazine of the Association of the United States Army, Vol. 69, No.1, January 2019) p. 30

in something",[215] means the Army must be willing to let go of the past and seek innovative solutions to address the challenges of the 21st century. The recent activation of the Army Futures Command is the beginning of this renaissance and a beacon of light in a system trapped in the dark ages of the late 1970s, early 1980s. The combination of cross functional teams, revision of policies, and partnership with research and development organizations and Congress, demonstrates hope for the "Army Renaissance". The U.S. Army must capitalize on the wins of the Army Futures Command and apply them to the entire organization. This will require a significant change in the Army culture.

Talent Management of the Army Workforce

In a 2011 World Economic Forum report on talent risk, Jean Charest, Premier of Québec, Canada said, "No country, no organization can remain competitive unless talent – the engine force of economies – is there to ensure success of organizations in turbulent times, handle the political, social agenda and boost research and innovations."[216] There has been a lot of discussion of the talent management of the Army workforce to include both Department of the Army civilians and military service members. The Army Talent Management Task Force focuses on matching the right candidates with the right skill sets and expertise to the right job to ensure efficiencies within our Army. However, the Task Force's efforts focus is on the current Army workforce. There is a need to attract young men and women with the characteristics required to operate and fight in the 21st Century strategic environment described

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215.   Dictionary.com, https://www.google.com/search?q=define+renaissance&ie=UTF-8&oe=UTF-8&hl=en-us&client=safari, accessed 16 May 2019.

216. World Economic Forum, Global Talent Risk—Seven Responses (Switzerland: World Economic Forum, 2011), http:www3.weforum.org/docs/PS_WEF_GlobalTalentRisk_Report_2011.pdf (accessed June 11,2018) pg. 5

as "a non-continuous, non-linear battlefield, with little higher command supervision and maximum decentralization."[217] The Army must have leaders who not only exhibit the capabilities, but also understand Mission Command and can operate in the multi-domain environment to achieve mission success. "Mission command is the exercise of authority and direction by the commander using mission orders to enable disciplined initiative within the commander's intent to empower agile and adaptive leaders in the conduct of unified land operations (ADP 6-0)."[218] It is critical for leaders to develop critical, creative, and systems thinking skills in order to exercise mission command. The search for individuals who exhibit such skills is not unique to the Department of Defense; the private and public sector compete for the same exceptional individuals. In order to be successful in remaining the global power in the next 20-30 years, the United States will need to pursue not only a whole of government approach, but a whole of nation approach.

There is a need for a dedicated focus on the future force and that starts with primary and secondary education, grades K-12. Waiting to develop leaders in college is too late in light of today's rapid technological advances that are readily available to our near-peer competitors. Lieutenant General (retired) Rhett Hernandez, West Point Cyber Chair at the Army Cyber Institute at West Point states, "we need to think about how to increase thought leadership…we need to develop strong partners in the commercial sector, industry, academia and government."[219] The Army

217. Tom Stoelker, "Preparing Tomorrow's Cyber Warriors: How West Point is Leading the Way," (West Point Magazine, Sheridan, NH, Summer 2018), p.6
218. Army Doctrine Reference Publication 6-0, Mission Command (Headquarters, Department of the Army, May 2012), p https://fas.org/irp/doddir/army/adrp6_0.pdf (accessed 16 May 2019)
219. Army Doctrine Reference Publication 6-0, Mission Command, 10.

must work alongside partners inside and outside the Department of the Defense in order to stay ahead of its adversaries. Federal level investment in the United States educational system is a critical component of the whole of government and national approach to ensuring the United States has the competitive edge. Working with Congress to invest in educational programs with potential scholarships opportunities into private schools with emphasis on science and technology while establishing a mentorship program with military service members serving in technically complex branches like cyber, space, etc. will benefit both the private and public sector. The mentorship program promotes relationships between the service members and potential candidates for the service and provides exposure awareness about the military. The United States Army is currently comprised of approximately 1.1 million men and women to include National Guard and Reserve components. This represents less than two percent of the United States population limiting the amount of exposure to the general population of the United States. Recruiting young men and women into the military is a challenge not only because of the small force numbers in comparison to the population, but youth in the United States fail to meet the qualification standards required to enter into military service. By starting early during elementary and middle school to develop programs where the military and private sector dedicate time and resources to educate the youth on programs, military service and career opportunities, the pool of highly qualified candidates will increase. The Department of Defense cannot deter and defend against adversaries on its own, especially in the multi-domain environment with multiple state and non-state actors. The Department of Defense must partner with private industry to create an all-encompassing strategy that ensures success for the nation.

Partnering Opportunities

The homeland is no longer considered a sanctuary whereby cyber-attacks have no physical constraints. Adversaries continue to exploit gaps within the U.S. government. If the United States adversaries can attack banking systems, elections, social media, then they can pose a significant threat to the interests of the American people, while simultaneously invoking fear. A look at Clausewitzian Trinity of people, the government, and the military demonstrates there is delicate balance required to maintain global peace. The interrelation of the three components creates tensions, therefore, creating barriers. In a resource-constrained environment, removal of these barriers in order to leverage the resources used by the private sector to counter attacks in the cyber domain is key to progress. It is in the best interests of both the military and private sector to protect, in this particular instance, cyber capabilities. Any attack in the cyber domain can severely impact operations across all other domains.

The military can learn a lot from the defense industrial base. The military has a number of Training With Industry (TWI) opportunities for field grade officers and enlisted soldiers. However, it may be beneficial to have industry integrate with operational units and to have company grade officers, who exhibit exceptional skills-creative thinking, science, and technology background, innovative thinking, etc. compete for TWI assignments. This would incentivize junior officers to remain in military service for a longer duration.

The implementation of junior officers and enlisted soldiers participating within TWI and allowing the private sector employees into our operational units would be a shift in how the military operates. However, the military must change quickly to adapt to the environment. The military takes a big risk in being reactive and is known to have "a long history of failing to quickly integrate novel innovations and technology breakthroughs funded by its research and development (R&D) programmers, such as DARPA (Defense Advanced Research Projects Agency), which get picked up by the private sector instead."[220] The United States Government should be proactive and invest in more research and development through a burden-sharing program with private industry and also review private sector policy, procurement processes, and operating procedures to find areas that may be applicable to the Department of Defense. Investing in R&D will allow for more viable options for employment in the multi-domain environment. Many of the procurement policies and regulations are seen as archaic and burdensome, slowing down the process to place much needed capabilities in the hands of the warfighter. The United States Army must change to maintain its superiority in the multi-domain operations environment.

Update Doctrine and Policies

The security environment faces rapid technological change, challenges from adversaries in every operating domain, and the impact on current readiness from the longest continuous stretch of armed conflict in our nation's history in Iraq and Afghanistan[221] where the

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220. Michael Brown and Stephen Rodriguez, "World War AI': The First Shot Will Be Simulated" The Magazine of the Association of the United States Army, April 2019

221. James Mattis, Summary of the *National Defense Strategy of the United States of America* (Washington, DC, January 2018)

Department of Defense must change its strategy to a more proactive approach towards deterrence. In order to change the strategy, the doctrine and policies must remain updated in a timely manner. More resources are required as it pertains to changing doctrine to keep up with the evolving security environment. As part of the Joint Force, the Army conducts Multi-Domain Operations to prevail in competition and, when necessary, penetrate and dis-integrate enemy anti-access and area denial systems, exploit the resultant freedom of maneuver to achieve strategic objectives (win), and force a return to competition on favorable terms.[222] This competition impacts not only DoD, but the entire nation. One of the scenarios which easily shows the importance of the whole of nation approach is an attack on U.S. banking systems, or even pharmaceutical, gas, or water companies, that could potentially threaten our livelihood. The U.S. military has the role of deterring our adversaries in lethal, combative realms, but utilization of the diplomacy, information and economics will ensure our success.

Challenges

There is an increased potential for gray zone tactics in the future operating environment. These tactics focus on the people and eroding their trust and confidence by attacking governments. Once the trust of the people is diminished there is a domino effect that impacts the government and the military. The United States cannot react and must prevent adversaries prior to their exploiting the U.S. vulnerabilities.

Culture is always a challenge and it takes a significant amount of time and energy to do so. For

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222. The U.S. Army in Multi-Domain Operations 2028, TRADOC Pamphlet 525-3-1, 6 December 2018, p. vii

instance, the Army War College teaches critical, creative, and innovative thinking as part of its curriculum. However, to incorporate systems thinking at the 20-year mark in an individual's career is an area of great concern especially with the implementation of Mission Command. With Mission Command, the argument could be that junior leaders must have the ability to think creatively, innovatively, and critically to operate in the future operating environment with just the commander's intent. This would mean there would be a change to the professional military education and the definition of the Army profession and what ranks bear the moniker.

Conclusion

Despite the changing character of war there are some constants that transcend time, one of them being people. The interests of the people drive political objectives and cause nations to fight wars to protect those interests. People are the cornerstone to change; they are the most expensive investment in any organization and require the most attention. The talent management of the Department of the Defense begins prior to the swearing in of the new private or second lieutenant. The talent management for the service members begins at school age. The talent management referred to in this paper is not confined to that of the DoD, but for the entire nation. Talent management can apply to the three D's: defense, diplomacy, and development, but it also applies to our private sector. The importance of protecting the interests of the American people falls on the shoulders of the entire nation. Each has a role in providing the tools and resources required to develop highly qualified and trained men and women who can successfully perform inside and outside of government. This is what will allow the United States to remain the global power for the next two decades.

Relationships between the Department of Defense and Private industry must strengthen to ensure a competitive edge. It is a challenge as the private industry incentives are primarily profits and Department of Defense is focused on protecting the taxpayer's dollars. However, there are common interests for both sides. Those interests go back to the Constitution of our Nation-life, liberty and the pursuit of happiness. Starting with the interests of the American people, the Department of Defense and Private industry can negotiate and develop a strategy to focus on the youth, invest in advance technology, and share best business practices.

Finally, the current doctrine requires revision to incorporate changes within the environment. Each service -- Army, Navy, Air Force and Marines -- define Multi-Domain Operations (MDO) differently. However, the United States fights its wars joint, meaning it is important that each service define MDO the same and develop doctrine to synchronize efforts accordingly in the future operating environment.

Colonel Mary O. B. Drayton is a 1996 graduate of the United States Military Academy and was commissioned as a second lieutenant in the Chemical Corps. Additionally, she earned a master's degree in business administration from Regis University. COL Drayton became a member of the Army Acquisition Corps in 2005. She has held a variety of Acquisition positions to include Deputy Assistant Secretary of the Army (Procurement) Executive Officer and recently as Battalion Commander and Director of Contracting at the Mission and Installation Contracting Command-Fort Riley, Kansas.

The US Military Must Improve Medical AI Capability To Counter Pending Threat

LTC Chance Comstock, U.S. Army Reserve

Artificial intelligence (AI) is known as the fourth industrial revolution, where machines will start performing many tasks once completed by human beings.[223] Machine learning is a part of AI and demonstrates AI is not just performing repetitious data manipulation errands, but is becoming more intuitive and developing knowledge.[224] This process is very different from machines of the past that were only able to aggregate and manipulate large quantities of data. AI will change how the global industry leaders and international governments execute their internal and external operations in the upcoming future. AI will transform business culture by radically evolving automated business operations, training, and logistics management information technology (IT) systems. Governmental departments, private industries, and military medical services will be drastically affected by the implementation of AI. Military medical leaders should decide how to manage and implement AI services to support complex healthcare delivery systems. If providing the best healthcare to future soldiers is important, then US medical military leaders must utilize bold and creative solutions to integrate and effectively use AI throughout the healthcare enterprise to positively affect medical processes to deploy strong military forces countering the impending threat.

This paper will investigate from the macro level down to the ground floor through cultural and

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223. Artificial Intelligence: The Fourth Industrial Revolution. Information Age. October 03, 2018. https://www.information-age.com/artificial-intelligence-fourth-industrial-revolution-123475170/ (accessed April 16, 2019).

224. Artificial Intelligence: The Fourth Industrial Revolution.

technological lenses to address why AI should be used to affect medical processes. It will look at how culture and AI technology are transforming relationships between US companies and the government, how the government is shaping and influencing the AI issue, the required technical infrastructure and interagency communication to support AI, AI deep learning, military field medicine, and why AI is vital to military medical mobilization processes.

One cultural divide in the implementation of AI is the DoD's relationship with technology giant Google. Project Maven is a DoD program that uses AI and drones to identify people, buildings, cars, etc. in combat zones.[225] Google has recently decided not to renew its contract with the DoD supporting Project Maven due to consternation from the Google workforce. Google employees are concerned about using Google technology to align with the DoD and assisting with war-time tasks.

Interestingly, while some Google employees are worried about their relations with the DoD, they do not seem to have the same concern with China. Google has been assisting China with a search engine called "dragonfly" that makes it easier for the Chinese government to monitor its citizens.[226] Google leadership is trying to appease its employees, and keep the lucrative

225. Tony Romm and Drew Harwell. Google CEO Quietly Met with Military Leaders at the Pentagon, Seeking to Smooth Tensions over Drone AI. The Washington Post. October 05, 2018. https://www.washingtonpost.com/technology/2018/10/05/google-ceo-met-with-military-leaders-pentagon-seeking-smooth-tensions-over-drone-ai/?utm_term=.1d8cb576e9c4 (accessed April 24, 2019).

226. Ray Fava, Google Assisting Oppressive Chinese Government with Censored Search Engine. Conservative Christian News. September 17, 2018. https://noqreport.com/2018/09/17/google-assisting-oppressive-chinese-government-censored-search-engine/ (accessed May 06, 2019).

DoD as a customer.[227] As Google comes to grips with its role of providing AI to the DoD, some critics also think the administration is not doing enough to support research and development and the rollout of AI at the federal government level.

China is the global leader for AI, and observers note China's intent to surpass the U.S. in technological prowess by 2030.[228] U.S. critics and near-peer competitors have driven the President of the United States to issue an executive order calling for an American AI initiative.[229] The goal of this executive order is bringing more attention and influence from a U.S. whole of government approach to AI research and development.[230] Observers note the U.S. spends around one billion dollars annually, while China is contributing approximately 150 billion dollars over the next decade to remain the global leader in AI research and development.[231]

The DoD has taken the lead in the U.S. government to address the AI issue. While many U.S. governmental departments are stating public support for AI, the DoD has an actual AI strategy going forward.[232] The purpose of the 2018 DoD AI strategy is to "articulate the Department's approach and methodology for accelerating the adoption of AI-enabled capabilities to strengthen the military, increase the effectiveness

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227. Tony Romm and Drew Harwell, Google CEO Quietly Met with Military Leaders at the Pentagon, Seeking to Smooth Tensions over Drone AI. The Washington Post. October 05, 2018. https://www.washingtonpost.com/technology/2018/10/05/google-ceo-met-with-military-leaders-pentagon-seeking-smooth-tensions-over-drone-ai/?utm_term=.1d8cb576e9c4 (accessed April 24, 2019).

228. Darrell M. West, Assessing Trump's Artificial Intelligence Executive Order. Brookings. February 13, 2019. https://www.brookings.edu/blog/techtank/2019/02/12/assessing-trumps-artificial-intelligence-executive-order/ (accessed April 24, 2019).

229. West, Assessing Trump's Artificial Intelligence Executive Order.

230. West, Assessing Trump's Artificial Intelligence Executive Order.

231. West, Assessing Trump's Artificial Intelligence Executive Order.

232. West, Assessing Trump's Artificial Intelligence Executive Order.

and efficiency of operations, and enhance the security of the Nation."[233] The U.S. government must build AI support infrastructure before it can implement useful AI. Part of this process includes massive data storage platforms to lay the foundation for AI.

While relationships and cultural norms are essential to understanding AI, data storage addresses the required infrastructure to support AI. Data is considered AI fuel. The storage of mass quantities of data "challenges IT systems like no other application has."[234] Storing large amounts of information is an area in which the DoD can improve.

Data storage and data management must be improved in the DoD since the DoD has not managed its data well.[235] An option for the DoD to consider is granting access to multiple organizations that can view stovepipe and silo IT systems. These organizations will piece together data from different IT systems to form a comprehensive picture. Stovepiped systems stem from a lack of IT systems interoperability. The lack of interoperable DoD systems affects data storage and the ability to retrieve useful data from IT systems. DoD's lack of interoperable IT systems will adversely affect AI implementation. To fully maximize its potential and utilize AI effectively, the DoD will need to keep better data integrity by storing data from organizations across the enterprise in accessible, interoperable data repositories. In addition to increased data storage platforms,

233. 2018 DoD Artificial Intelligence Strategy. 2018. https://media.defense.gov/2019/Feb/12/2002088964/-1/-1/1/DOD-AI-STRATEGY-FACT-SHEET.PDF (accessed April 26, 2019).

234. Dwight Davis, AI Systems Push Data To Its Limits. CIO. January 28, 2019. https://www.cio.com/article/3331994/ai-systems-push-data-to-its-limits.html (accessed April 23, 2019).

235. Solving the Defense Department's Data Problems. Governmentciomedia.com. https://governmentciomedia.com/solving-defense-departments-data-problems (accessed April 16, 2019).

communication between governmental agencies is essential. Communication between government agencies is vital and recently has affected the implementation of interoperable IT systems. A recent communication strain between DoD leaders and Veterans Administration (VA) officials led to friction about who is responsible for what and this feud is slowing down the rollout of interoperability processes.[236] The VA and DoD example shows a lack of alignment between government officials.[237] The goal between DoD and VA should produce a standard electronic health record that soldiers take with them to the VA after they leave the military service. Since AI requires big data, interoperable IT systems are vital to fill this requirement.

One form of AI that will assist strategic military leaders administering healthcare is deep learning. Deep learning is a subset of AI and represents the next phase of machine learning.[238] Deep learning stems from machine learning and has enhanced algorithms that enable machines to make decisions without human supervision.[239] Deep learning is the opposite of many present DoD information technology systems which can only perform single repetitious tasks that they were programmed to implement.

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236. EHR Interoperability for VA and DoD, Who's Responsible? Lawmakers, Officials Can't Agree. Healthcare IT News. September 17, 2018. https://www.healthcareitnews.com/news/ehr-interoperability-va-and-dod-who's-responsible-lawmakers-officials-cant-agree (accessed April 23, 2019).

237. EHR Interoperability for VA and DoD.

238. Bernard Marr, 10 Amazing Examples of How Deep Learning AI Is Used in Practice? Forbes. December 12, 2018. https://www.forbes.com/sites/bernardmarr/2018/08/20/10-amazing-examples-of-how-deep-learning-ai-is-used-in-practice/#4761d3f2f98a (accessed April 16, 2019).

239. Bernard Marr, What Is Deep Learning AI? A Simple Guide With 8 Practical Examples. Forbes. December 12, 2018. https://www.forbes.com/sites/bernardmarr/2018/10/01/what-is-deep-learning-ai-a-simple-guide-with-8-practical-examples/#3ccf81a98d4b (accessed April 16, 2019).

Deep learning refers to "a powerful set of techniques for learning with artificial neural networks (ANN)" that provides machines the capability to learn.[240] ANNs are information networks modeled after the mammalian brain and are extremely fast due to their single focus.[241] Large data sets empower deep learning and are a requirement for ANNs to function effectively.[242] A current example that utilizes deep learning is a self-driving automobile.[243] The deep learning model should be used to assist in healthcare and will positively affect military patient care.

Deep learning will assist physicians with diagnosing diseases and support healthcare administrators by estimating trends. Deep learning will collect large data sets and analyze intricate details forecasting a patient's chance for developing a disease with more precision than humanly possible. Deep learning works well with x-rays or magnetic resonance imaging (MRI). Convolutional neural networks (CNN) are uniquely suited to read x-rays and MRIs and are surpassing humans at diagnosing melanomas and cancer.[244] CNNs have outperformed humans' diagnoses by at

240. Enrique Fernandez-Blanco, Daniel Rivero, Marcos Gestal, Carlos Fernandez-Lozano, Norberto Ezquerra, Cristian R. Munteanu, Julian Dorado, A Hybrid Evolutionary System for Automated Artificial Neural Networks Generation and Simplification in Biomedical Applications. ArXiv.org . April 09, 2019. https://arxiv.org/abs/1904.04754v1 (accessed April 16, 2019).

241. Fernandez-Blanco, et al, A Hybrid Evolutionary System for Automated Artificial Neural Networks.

242. Fernandez-Blanco, et al, A Hybrid Evolutionary System for Automated Artificial Neural Networks

243. Patricia Kellogg, Deep Learning with Deep Imagination Is the Roadmap to AI Chips. News Guards. August 07, 2018. https://www.newsguards.com/2018/08/03/deep-learning-deep-imagination-roadmap-ai-chips/ (accessed April 16, 2019).

244. Jennifer Bresnick, "What Is Deep Learning and How Will It Change Healthcare?" Health IT Analytics. February 27, 2019. https://healthitanalytics.com/features/what-is-deep-learning-and-how-will-it-change-healthcare (accessed April 23, 2019).

least seven percent.[245] The CNN tool will aid medical professionals in how they diagnose and treat patients. Deep learning will also estimate medical trends.

Deep learning will assist healthcare providers and healthcare executives since it will analyze millions of records while projecting the most likely scenarios for a patient's diseases.[246] Healthcare executives in the military will use this data to estimate population trends. Deep learning is particularly relevant for military medical leaders analyzing soldiers that deployed to an area of operations. Military medical leaders will be able to analyze medical data on all soldiers that deploy to unique, specialized environments. The data will be aggregated and can assist medical providers and scientists in discerning if soldiers became ill from just having lived in a specific area. One example is the Persian Gulf syndrome.

Persian Gulf syndrome is a condition that veterans with service in Southwest Asia have encountered. This syndrome has affected thousands of soldiers with respiratory, chronic fatigue, and gastrointestinal issues. The military health system and VA treat chronic symptoms in veterans that served in Southwest Asia.[247] Deep learning will assist in determining if Persian Gulf syndrome is real, how soldiers contracted it, and ways to treat it. Millions of medical records data combined will present AI an opportunity to forecast disease trends through deep learning.

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245. Bresnick, "What Is Deep Learning and How Will It Change Healthcare?"

246. Laura Dyrda, 9 Key Thoughts on How Machine Learning and Deep Learning Will Affect Healthcare. Becker's Hospital Review. https://www.becker-shospitalreview.com/healthcare-information-technology/9-key-thoughts-on-how-machine-learning-and-deep-learning-will-affect-healthcare.html (accessed April 25, 2019).

247. Persian Gulf Syndrome. The Free Dictionary. https://medical-dictionary.thefreedictionary.com/Persian Gulf syndrome (accessed April 25, 2019).

Military field medicine will be positively affected by AI. Military field medicine takes place in a field environment similar to battlefield conditions. One example for military medical leaders to emulate is the Zipline Company in Rwanda. This company utilizes AI and drones to deliver medicine to outlying areas of their country.[248] This technique will increase the reach of medical services to aid soldiers in remote parts of the world. The U.S and its partners and allies should visualize and try to understand the future operating environment and how AI will affect healthcare on the next battlefield. One example is remote medicine where medical doctors can treat injured soldiers remotely through technology.

Remote medicine includes remote surgical services (RSS). RSS allows doctors or programmed machines the ability to perform limited surgery on patients.[249] RSS will reform how US forces execute health service support changing the character of military field medicine. Once this technology is mature, military medical leaders will conserve human blood and tissue by having machines interact with humans to improve the medical outcomes in wartime scenarios. Implementation of this technology will provide users with a competitive edge over adversaries.

As military medical leaders sift through AI implementation and its multiple uses, they still must focus on the impending threat. The future Joint Operating Environment calls for a return to near-peer competition and

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248. Sameer Maskey, AI For Humanity: Using AI To Make A Positive Impact In Developing Countries. Forbes. August 23, 2018. https://www.forbes.com/sites/forbestechcouncil/2018/08/23/ai-for-humanity-using-ai-to-make-a-positive-impact-in-developing-countries-2/#1f2cba151b08 (accessed May 06, 2019).

249. Glimpses of Future Battlefield Medicine – the Proliferation of Robotic Surgeons and Unmanned Vehicles and Technologies. https://jmvh.org/article/glimpses-of-future-battlefield-medicine-the-proliferation-of-robotic-surgeons-and-unmanned-vehicles-and-technologies/ (accessed May 06, 2019).

contested norms and persistent threat.[250] Military medical leaders will need to provide for effective medical mobilization processes at power projection platforms to effectively assemble and project military forces to counter adversaries. The U.S. mobilization process is vital in the future operating environment.

Near-peer competitors are increasing their military capabilities to disrupt U.S. mobilization activities to stop the U.S. from assembling its forces. If U.S. IT systems do not provide the best real-time data and medical mobilization processes are not productive, then military medical leaders are slowing the mobilization effort and wasting time. The U.S. has not been concerned about the time it takes to deploy soldiers since the belief is there is no contest in the U.S. homeland, and the US can take time to deploy its forces. However, the U.S. will not have time on its side in a future fight against a near-peer competitor and will require all processes (including medical mobilization) running efficiently to get soldiers out the door to meet combatant commander requirements.

Finally, military medical leaders must visualize and understand how AI will affect the future environment. Cultural and technological lenses should be used to understand AI. Understanding how internal and external stakeholders operate, and their culture regarding AI and the U.S. government is paramount. Professional AI military occupations should be added to the U.S. military inventory to assist with a foundation for AI. AI infrastructure should be implemented to build a framework for AI employment. An AI framework will positively impact military medicine and military medical

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250. Joint Chiefs of Staff. The Joint Force in a Contested and Disordered World. July 14, 2016. https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joe_2035_july16.pdf?ver=2017-12-28-162059-917 (accessed May 8, 2019).

processes, making them more valid and efficient. Effective and efficient healthcare services are essential for military medical leaders to perform medical mobilization procedures providing fit soldiers to combatant commanders in an expeditious manner. Efficient time management and medical mobilization processes will be required in the future more than ever to counter near-peer competitors.

Lieutenant Colonel William (Chance) Comstock is a Medical Service Corps officer in the U.S. Army Reserve. LTC Comstock is 1995 graduate of Virginia Commonwealth University (Bachelor of Science), and a 2001 graduate of the California University of Pennsylvania (Master of Arts). He has held various leadership, staff, and technical positions in the U.S. Army Medical Department in field units and fixed facilities.

Nuclear and Thermal Energy Sustains the Army of the Future

Ms. Debora Browy, Department of the Army Civilian

Disruption of energy through cyber-attack is proving to be an effective method of non-conventional warfare and even harder is determining who is responsible for the action. Military Installations in 2035 need hardening against adversary breech through the adoption of improved nuclear and thermal technologies, assuring security for U.S., allies and partners. This paper will first explain the necessity for political and military leaders to understand the risk to installations with dependence on public energy and the need to allow installations the ability to generate and control electrical energy autonomously. Secondly, it will identify energy needs for installations as a comprehensive plan that includes sustainability of all services and one that is not dependent on public or private energy agreements. Thirdly, it will educate leaders and civilians to the current safety and security of nuclear and thermal power generation with the inclusion of Artificial Intelligence (AI) and machine learning in the system.

The Joint Operating Environment (JOE) in 2035 describes the future environment by two primary challenges. The first challenge is "contested norms. This challenge highlights the military problems associated with adversaries disrupting through force the rules, agreements, customs, and standards that define today's international order."[251] This understanding of contested norms means adversaries will attack our vulnerabilities through infrastructure weakness.

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251. John E. DeFoor and Jeff Becker, "Joint Operating Environment 2035-The Joint Force in a Contested and Disordered World", The National Interest, https://nationalinterest.org/blog/the-buzz/joint-operating-environment-2035-%E2%80%93-the-joint-force-contested-17165. (accessed April 12, 2019)

Historically, wars were prescribed plans of action using trained fighters whose position was to defend territory or political positions, who fought hand to hand or by mechanized means, bloody and deadly. More recent engagements involve non- uniformed groups through unconventional means, strategic processes or through proxy wars, where a dominant state influences another through coercion. One example is Venezuela, whose political position and economy was disrupted when the power grid shut down affecting every person in the region and causing civil unrest, with the U.S. accused for the action.

The second challenge to the JOE is "persistent disorder, focusing on adversaries exploiting the inability of societies and states to provide functioning, stable, or legitimate governance."[252] This second challenge became evident in March 2019 with the interruption of electrical power in Venezuela that caused chaos and hardship, affecting the day to day lives of citizens and crippling the political party in power from caring for Venezuela citizens.

Combined, these challenges outline an environment lacking stability or command and control, displaying intense political violence and revolt, exposing U.S. vulnerabilities of installation infrastructure. This type of warfare can be internal or external episodic warfare, with or without military engagement but short of traditional armed conflict. These non-traditional attacks by adversaries and Violent Extremist Organizations (VEO'S) effect Global Integration and international partnerships by disrupting security and economic stability. To counter these potential operational interruptions, Army Installations will require hardening against all forms of adversary attack.

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252. DeFoor and Becker, "Joint Operating Environment 2035

Installations need independence from states and to be autonomous with energy resources and new technology. If energy demands do not meet the growing global infrastructure needs, then the house of cards collapses impacting mankind on a grand scale. State regulations and laws control energy distribution and counties provide and maintain the structure and security for local power distribution. One example is in Arizona and California where the Hoover Dam Project has scalable electricity output, increasing or decreasing the flow of water as needed, but is a security risk due to open accessibility and, if disrupted, the ability to impact numerous installations throughout California, Nevada, Arizona and Washington State. Hydro-electric power generation also has environmental concerns due to water being stored behind a dam structure and only released when power is needed, which "creates artificial flow patterns in the downstream river that may be very different from the flow patterns a river would naturally experience."[253] This type of energy is adequate for increasing demands, but can be devastating to the environment. If a breech occurs or plant life dies in flooded areas releasing methane gas into the environment thus contributing to Green House Gases (GHG).

Hydroelectric energy has proven to be a clean source of renewable energy. However, its dependency on continuous water levels and security affects the environment for miles in either direction of upstream or downstream flow. One thought is that in 2035 Army installations could relocate near hydro-dams in the U.S., providing security that protects against malicious activity and could install a secondary micro-grid that is independent from the Bulk Electrical System (BES) as

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253. Union of Concerned Scientist, "How Hydro-Electric Energy Works" https://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/how-hydroelectric-energy.html. (accessed April 16, 2019)

a redundant source of power and controls for uninterrupted energy in the event of an attack to the main grid.

Installations 2035 will have a greater need for uninterrupted power to support the development and operation of robotics, AI, and big data that supports new technologies. These tools will consume greater amounts of energy and are not sustainable if power surges or interruptions occur.

Nuclear energy is not a new concept and has been around for more than five decades. Economically developed countries utilize nuclear energy as a percentage of generated power to offset the dependence on fossil fuels. Currently, "there are about 225 research reactors operating in over 50 countries," with more under construction.[254] Nuclear energy is scalable either up or down as requirements change and, with inclusion of machine learning, will be much safer for use.

The U.S. Military uses nuclear power to effectively and efficiently power submarines and aircraft carriers. Russia has built ice breaker ships and propels them with nuclear power successfully.[255] This paper will identify some of the myths about nuclear power, discuss nuclear accidents that have occurred, their causes and propose a future strategic plan that increases availability of nuclear energy, thermal energy.

The Three Mile Island (TMI) incident that occurred on March 28, 1979 was the result of 'human error' combined with a mechanical failure that occurred in a water valve. According to the report by the U.S.NRC, "Other instruments available to plant staff

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254. DeFoor and Becker, "Joint Operating Environment 2035

255. David Hambling, *Popular Mechanics* "Russia Built a Big Bad Nuclear Ice-Breaker to Win the Arctic", (Jun 23, 2016), https://www.popularmechanics.com/military/navy-ships/a21484/russia-nuclear-powered-icebreaker/. (accessed May 8, 2019)

provided inadequate or misleading information."[256] The attendant read the gauges for water levels in the cooling tower rising and shut off the water. In the absence of computer or machine learning technology, he was unable to see a water valve was stuck open. Safety measures of secondary containment vaults prevented any nuclear material from escaping. "The Department of Energy, the Commonwealth of Pennsylvania, and several independent groups also conducted studies. The approximately 2 million people around TMI-2 during the accident are estimated to have received an average radiation dose of only about 1 millirem above the usual background dose. To put this into context, exposure from a chest X-ray is about 6 millirem…."[257]

This was not the case with Chernobyl where the safety requirement of a secondary containment was ignored allowing the nuclear material to escape into the environment, making the incident significant and catastrophic. Russia did not evacuate or monitor their plant around the clock as required. Another accident was the Fukishima incident in Japan, resulting from a 9.0 earthquake March 11, 2011 followed by a Tsunami that flooded the control and back-up generator rooms with sea water. The most damaging aspect was Japan's inability to supply enough cooling water to keep reactor fuel rods from melting down. All backup generators at the Fukushima Daiichi were under water. The design of the nuclear plant was based on the worst recorded tsunamis in history and failed to be adequate. Fukushima was home to multiple nuclear reactors, owned and operated by several companies, each responsible for the maintenance and safety associated with their

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256. U.S.NRC, Backgrounder on the Three Mile Island Accident, https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html. (accessed May 1, 2019)

257. U.S.NRC, Backgrounder on the Three Mile Island Accident.

individual plants. "In May 2013, the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) reported, following a detailed study by 80 international experts. It concluded that 'Radiation exposure following the nuclear accident at Fukushima Daiichi did not cause any immediate health effects.'"[258]   Corrected punctuation assuming there is a quote within a quote because there is only one endnote number, i.e. [8], and missing quotation marks

Energy Research Laboratories (ERL) has made significant progress to the development of 'very Smaller Modular Reactors' (vSMR) that are scalable and can support installations. SMRs are scalable and can supply enough energy to maintain normal daily operations for any base, but can also run entire cities, if required.

Army bases throughout the U.S. are ideal for nuclear power generation and have large expanses of land combined with security guards and fences, providing stand-off security both for and from the public. Installations provide enough land mass and security to protect power generation of multiple types in most cases. Not every installation is suitable for vSMR technology, but all are appropriate for thermal plants, and will require micro-grids and controls to manage energy production. One base in El Paso, Texas uses 90% of its land as training area with several base camps in New Mexico. This would require an inter-state agreement for utilization of energy. In addition, Fort Hood covers "a total of 340-square miles and supports multiple units, a corps headquarters and a robust mobilization

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258. World Nuclear Association, "Fukushima Daiichi Accident", *(Updated October 2018)*, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx. (accessed May 2, 2019

mission."[259] Another base that is not in close to public population or utilities is Fort Irwin CA., with over 1,000 sq. miles of training area and 37 miles from its closest town. These installations would be ideal pilot projects for standalone power generation and micro-grid technology. If nuclear is not sustainable due to lacking a water source for cooling towers, then thermal energy production with natural gas as the fuel source recommended. Natural gas has had a spike in production within the US and is a source of clean energy, supported by lobbyist in Washington D.C.

Renewable energy of solar or wind require large amounts of land to generate the same amount of energy as nuclear or thermal and are dependent on resources of sustainable wind and sunlight. This technology is in at Fort Bliss, Fort Hood, and Fort Benning, GA. It is possible to store renewable energy in battery cells on site, but this too creates environmental issues for installations. A fourth source of energy is ThermalOne base that has been successful with thermal energy production in Hawaii and has micro-grid technology and controls with the ability to stand alone in power generation. This was necessary due to the vulnerability from natural disasters of hurricanes and tsunamis in the region. New technology in Hawaii is the first use of "A small but operational ocean thermal energy conversion (OTEC) plant was inaugurated in Hawaii last week, making it the first in the world. The opening of the 100-kilowatt facility marked the first time a closed-cycle OTEC plant will be connected to the U.S. grid."[260] This is a first of

259. Military Bases.US, "Ft Hood", http://www.militarybases.us/army/fort-hood/. (accessed May 1, 2019)

260. Malavyka Vyawahare, "ClimateWire", *Hawaii First To Harness Deep Ocean Temperatures for Power*, August 27, 2015, https://www.scientificamerican.com/article/hawaii-first-to-harness-deep-ocean-temperatures-for-power/. (accessed May 5, 2019)

its kind with potential to support bases independently through their own grid and controls. This is a promising source of clean energy.

While each type of sustainable energy has its unique aspects and requirements to be effective, the intent is to equip installations with sustainable energy and controls to remain in place regardless of man-made attack or natural disaster to the grid.

Nuclear power satisfies mandated reductions to GHG believed to cause global warming and climate change. Nuclear energy power generation has improved over time with the inclusion of Artificial Intelligence (AI) to provide monitoring and decisions about safety based on data received in a continuous loop of information including identifying problems before they occur ahead of the scheduled maintenance cycle. Incidents of Three Mile Island and Chernobyl were caused through man-made errors and would not have occurred if controlled by computers, or AI. The incident at Three Mile Island resulted in the loss of the core reactor, but secondary containment was in place and prevented any nuclear radiation from escaping to the atmosphere. There were zero deaths or injuries associated with Three Mile Island.

A combination of renewable energy combined with micro-grid systems and controls allows Army installations to remain the security force for the U.S. relocation of operational or training bases, allows the security and space required for nuclear and thermal power generation, and promotes confidence of the American people. Inter-service agreements can allow installations to generate and provide power to local hospitals and emergency services as needed.

Reliable clean energy such as nuclear or thermal energy, combined with micro-grid technology and controls on Installations, ensures uninterrupted power and assured security. Energy produced on installations can support communities during outages or malicious activity for continuity of emergency services or even daily operations.

Legislative leaders cannot promote self-interest when it comes to the security of the U.S. but must think in terms of sustainable applications of energy. Nuclear energy is an efficient and effective energy, scalable and controllable as this paper demonstrated. Thermal energy has dependence on NG that is bountiful today. Lessons learned from past incidents provide better safety and security and built into new systems such as vSMR. Public awareness of nuclear power as a safe energy is paramount to its success. Inclusion of new technologies, such as AI or Machine Learning, enhance production and monitor safe usage of energy. Procedures for all aspects of emergencies are in software programs for effectiveness.

Ms. Debora E. Browy, Department of the Army Civilian, is a graduate of Northern Arizona University where she earned a bachelor's degree in Science and Public Service. She served in the U.S. Army with Corp of Engineers, Combat Heavy Brigade, Army Material Command, Army Tank and Automotive Command, and Army Test and Evaluation Command. Ms. Browy has been an Army Logistician and Manager since 2008. Following graduation from the Army War College, she will serve the Army G-3/5/7 at the Pentagon.

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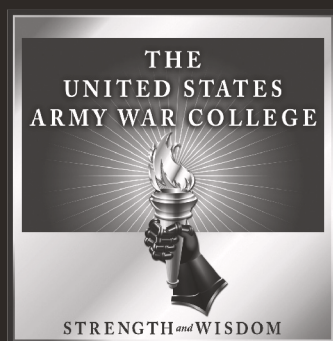
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