Integrated Deterrence Strategy of the Advancing Battlefield

March 02, 2017

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Twenty-first century United States (U.S.) deterrence strategy will pivot on its ability to design and integrate new technologically advanced weapons with a changed military doctrine to combat emerging modes of warfare. Since World War II, the U.S. military has dominated all aspects of nuclear and conventional warfare, leading to the development of hybrid or nonlinear warfare, greatly reducing the U.S. ability to wage conventional war. Nonlinear or "hybrid" warfare, will be the warfare of the twenty-first century. Combining conventional weapons with guerrilla and terror tactics, as well as using civilian infrastructure and clothing, gives adversaries a greater advantage. This advantage renders U.S. weapons and tactics less effective due to possible civilian collateral damage and reduced battlefield mobility, in turn equalizing the battlefield significantly. Therefore, for the U.S. military to maintain its dominance on the battlefield, it must adapt a "surgical" doctrine of combat. The ability to find, isolate, disable and destroy the enemy with minimal damage incurred to civilian populations and infrastructure; all while being an "untouchable" force. A revision of this sort needs to be the core focus of the U.S. combat doctrine in the twenty-first century. The advantage to this concept is a reduced presence of U.S. forces which allows local populations to lead semi-normal lives, ideally minimizing U.S. resentment, potentially allowing for reduced friction from the population allowing the U.S. military to focus on tactical objectives. This surgical doctrine can be implemented through the use of emerging technologies to improve U.S. accuracy, speed, mobility, and ability to interpret the battlefield all at a reduced cost. The ability to integrate these technologies with a new doctrine effectively and in a timely manner, will demonstrate the U.S. capability to dominate all modes of warfare; nuclear, conventional, guerrilla, digital, and nonlinear. Doing so may

effectively deter confrontation with the U.S. as advisaries will determine any military action or attack against the U.S. would have little reward at an extreme risk.

Nonlinear Warfare

Nonlinear warfare can be defined as, "wars that incorporate a range of different modes of warfare, including conventional capabilities, irregular tactics and formations, terrorist acts including indiscriminate violence and coercion, and criminal disorder"[1] The advantage of this mode of warfare is that it reduces enemy exposure to a superior force that would otherwise destroy them. At the same time, it also creates social disorder that changes the atmosphere of the battlefield resulting in a complex social dynamic which strains intelligence and turns the U.S. military into more of a police force to maintain order. Following World War II, the U.S.' ability to wage conventional war stood unrivaled. U.S. dominance in the air, land, and sea made it impossible for other conventional militaries to achieve battlefield objectives, much less field their weapons. As John Arquilla and David Ronfeldt state in their book, *Swarming and the Future of Conflict*, "One lesson of Operation Desert Storm is that it is unwise to provoke a full-scale conventional military conflict with the United States and its allies."[2] This statement is in response to the rapid destruction of the Iraqi military and assets in Operation Desert Storm (1990-1991). Desert Storm is a primary example of why nonlinear warfare emerged. The only feasible option to successfully achieve military objectives when facing a stronger force is to

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[1] Frank Huffman, *Conflict in the 21st Century: The Rise of Hybrid Wars*,Arlington, VA: Potomac Institute for Policy Studies, 2007, 8.

[2] Arquilla, John, and Ronfeldt, David, *Swarming and the Future of Conflict*, *In Athena's Camp*. Santa Monica, CA, RAND Corporation, 1997. Accessed February 10, 2017. ProQuest ebrary.

equalize the battlefield as much as possible. This allows less capable forces to have an increased chance at either effectively denying or destroying a stronger force. Nonlinear warfare has proven in many instances to be an effective method to equalize the battlefield. The 2014 Russian intervention in Ukraine provided numerous examples of nonlinear warfare. Reports from Ukraine's front lines describe "separatists" being well armed and well trained.[3] The separatists moved in military style convoys, and used self propelled artillery, but wore no uniforms and vehicles had no identifying markings.[4] Separatist leaders claimed that the equipment was captured from Ukrainian forces, but no such forces ever penetrated deep enough to be where the weapons were in use.[5] In fact U.S., intelligence indicated that Russian artillery crossed the border earlier in the conflict giving well coordinated fire support.[6] Another example that is often referenced as effective nonlinear combat, Greg Grant explains in his 2008 article, "Hybrid Wars," is the case study on the 2006 Lebanon war, which highlights key components of Nonlinear warfare.

> "Hezbollah forces shot down Israeli helicopters, severely damaged a patrol boat with a cruise missile and destroyed heavily armored tanks by firing guided missiles from hidden bunkers. The organization also used aerial drones to gather intelligence, communicated with encrypted cell phones and watched Israeli troop movements with thermal imaging night-vision equipment."[7]

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[3] Kramer, Andrew E., and Michael R. Gordon. "Ukraine Reports Russian Invasion on a New Front." *New York Times*, August 28, 2014.

[4] Ibid

[5] Ibid

[6] Ibid

[7] Grant, Greg. "Hybrid Wars." *Government Executive* 40, 5 (April, 2008): 18-22,24:Proquest.com

Furthermore, Grant states, “IDF (Israeli Defence Force) units did not train for combat above the small unit level, and key elements such as armor and artillery lost much of their major combat capacity.”[8] Lack of preparation and understanding of enemy nonlinear tactics quickly reduced the IDF’s ability to wage war. The IDF therefore took unnecessary casualties and was stopped by an inferior force. According to the Winograd Commission Report, "Israel initiated a long war, which ended without a defined military victory." Furthermore the report stated "a semi-military organization of a few thousand men resisted, for a few weeks, the strongest army in the Middle East, which enjoyed full air superiority and size and technology advantages."[9] This led analysts studying the conflict to ask how such an inferior force could fight so effectively against a vastly superior IDF. Avi Kober of the Department of Political Studies at Bar-Ilan University in Israel writes, "The cult of technology has had a weakening effect on traditional military capabilities such as close combat or combat intelligence." The war, he argues, shows that it is difficult, if not impossible to destroy a sophisticated guerrilla force by fighting on plasma screens.[10] Kober makes the argument that technology is reducing combat effectiveness in some aspects of warfare. However, with technology from a decade ago, the 2006 War with Lebanon would have been difficult to eliminate a guerrilla force. New technology that is emerging today will be a key component in destroying guerrilla and nonlinear forces.

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[8] Ibid

[9] "C1. Winograd Commission, Summary of the Interim Report on the 2006 Lebanon War, Jerusalem, 30 April 2007 (excerpts)." *Journal of Palestine Studies* 36, no. 4 (2007): 208-13.

[10] Huffman, *Conflict in the 21st Century: The Rise of Hybrid Wars.*

Doctrine Change

Warfare has evolved from a very disorganized simple "melee" to the "massing" of troops and resources, who would support each other like the greek phalanx, to the complex strategy driven "maneuver" warfare that is currently practiced today.[11]Of course today the U.S. dominates maneuver warfare in every aspect. The problem that arises from this dominance is that adversaries will not play into U.S. abilities. maneuver warfare tactics are highly effective when facing a uniformed military where strategy and objectives of the enemy are predictable or noticeable and counter strategy could be made to destroy or deny the enemy.[12] During traditional maneuver warfare it is important to note that civilian populations and infrastructure are damaged or destroyed and loss of private property, is not uncommon.[13] This may result in resentment of the invading force, complicating local relations. However, in today's nonlinear battlefield no such military or maneuver strategy exist. This results in the U.S. utilizing massive amounts of resources to fight a conventional war costing billions of dollars a year.[14] According to the U.S. Department of Defense 2016 budget request the U.S. spends about $11 million on missiles and munitions annually.[15] The cost to engage and destroy one piece of enemy equipment or position may cost the

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[11] Arquilla, John, and Ronfeldt, David, *Swarming and the Future of Conflict. p.7-23*

[12] Lind, William S, *Maneuver Warfare Handbook*, New York, Westview Press, 1985. *eBook Collection.*

[13] Bousquet, Antoine, "Chaoplexic Warfare or the Future of Military Organization." *International Affairs Royal Institute of International Affairs* 84, no. 5 (2008): 915-29.

[14] U.S. Congress. Committee on Armed Services. *The current and future roles, missions, and capabilities of U.S. military air power: hearing before the Subcommittee on Airland of the Committee on Armed Services, United States Senate, One Hundred Eleventh Congress, first session, April 30, 2009*. 111th Cong., 1st sess. Cong. Rept. S. HRG. 111–198 . Washington: U.S. G.P.O., 2009. Accessed February 5, 2017.

[15] United States. Department of Defense . Office of the Under Secretary of Defense . *FY 2016 Program Acquisition Cost by Weapon System*. February 2016. Accessed February 4, 2017. http://comptroller.defense.gov/Portals/45/documents/defbudget/fy2016/fy2016_Weapons.pdf.

U.S. thousands of dollars in munitions alone. Cost this high complicate strategy and strain commanders to try to cut the cost of war often reducing combat effectiveness of the U.S. military.[16] Maintaining a forward operating base (FOB) is vital to U.S. military power projection in areas of operation. However, maintaining FOBs can also cost hundreds of thousands of dollars annually. Some of these FOBs carry out few operations in which the cost outweighs the benefit.[17] The current operational cost of the military is one that is reflective of fighting a near-peer adversaries. With the U.S. monopoly on conventional war, adversaries are likely to resort to access denial, nonlinear strategies, or weapons of mass destruction, not a full scale war. A change of focus in U.S. doctrine may allow the DoD to allocate resources to deal with future challenges it may face.

Unit organization

U.S. military doctrine in the 21st century will need to undergo several fundamental changes to meet the threat of nonlinear warfare. Nonlinear warfare brings in a new complexity to the battlefield, as mentioned previously nonlinear forces do not follow "traditional" strategy.[18] Often, the strategy is to harass, induce casualties, and hinder operations.[19] Such forces move within civilian infrastructure, communicate through market grade technology, and utilize the social dynamic of the population to

[16] Gates, Robert Michael. *Duty: memoirs of a Secretary at war*. New York: Alfred A. Knopf, 2014.
[17] Hsia, Timothy, "A Quick Review of Combat Outposts (COPs)." *Small Wars Journal*, 2008. www.smallwarsjournal.com
[18] Frank Huffman, *Conflict in the 21st Century: The Rise of Hybrid Wars.*
[19] Ibid.

achieve objectives.[20] This challenges, but does not incapacitate, the U.S. military in an area of operation (AO). In fact, the U.S. is perhaps the best example in regards to net-centric type command, giving large amounts of autonomy to military forces to complete objectives. With that, the U.S. can still improve how its military operates in combat. Divisions are usually the smallest individual entity that can sustain operations in an AO for an extended period of time. From there, orders are sent down to brigade or regiment, battalion, company, etc. However, given that enemy units no longer follow predictable strategies it may be beneficial for the U.S. to give more autonomy to the company level. Companies are the largest tactical entity that conduct short term operations in very specific locations. This means that companies often will be the entity that are most likely to make contact with enemy forces. By and large, this is not entirely different from the current function of the U.S. military; but allowing companies increased autonomy would allow for a shorter response time in order to adapt to rapidly changing battlefield conditions.[21] Along with greater autonomy, battalions should have assets such as armor, cavalry, and support directly under its control. This would provide greater access to resources that are usually controlled by higher echelons of command that now can be used to support that battalion specifically rather than entire regiments where assets sometimes are unavailable because current missions are taking place. Commander's intent and orders would still be sent from higher echelons to achieve desired objectives for operational purposes.

[20] Ibid
[21] Bousquet, Antoine. "Chaoplexic Warfare or the Future of Military Organization." p. 924

Mobility

As mentioned, the U.S. employs large amounts of resources and personnel creating what's referred to as a target rich environment, essentially giving enemy forces numerous targets to engage. Setting up FOBs or combat outposts (COP) gives the enemy targets to send indirect fires and harass. Knowing locations of U.S. forces also gives the enemy more opportunity to plan when, where, and how to attack U.S. forces in the AO. One possible solution to be assessed to resolve this issue is to change from projecting power via satellite outpost, to a much more fluid application of force. At the same time, reducing these satellite COPs along with consolidating personnel and resources would result in a greater ability to defend those positions. Antoine Bousquet, in a 2008 journal article, talks about an emerging concept of "swarm warfare"[22] This concept is essentially saying that chaos is always a factor for all on the battlefield. This concept of swarm warfare harnesses chaos of the battlefield by "swarming" the enemy from all directions through fire and maneuver; swarming with small land and air based vehicles such as helicopters and ATV's or other emerging technology. This will enable the U.S. to move and shoot faster, making it difficult to fight what appears to be an unorganized mass of forces. The idea is find the enemy, move to engage them from all directions with smaller, more autonomous entities that can adapt to rapidly changing situations, isolate the enemy by cutting off egress routes, silencing/ jamming communications, disabling sensors, optics, and electronics.[23] This

[22] Bousquet, Antoine. "Chaoplexic Warfare or the Future of Military Organization."p. 928
[23] Ibid

may also include civilian infrastructure. Once isolated, use precisions fires from all directions to disable or destroy enemy capabilities from greatest to least threat. For example, heavy weapons like machine guns and mortars pose more of a threat than standard riflemen. Once the enemy has been disabled or destroyed, attacking forces would need to break contact and rapidly disperse again in all directions.[24] This dispersion attempts to mitigate possibility of counter attack or other enemy entities nearby to engage the attacking forces, as the enemy can not attack what is not there. This concept admittedly comes with many variables that need to be accounted for through training and well integrated tactical aspects. By rapidly dispersing, the amount of energy and resources used to purse the dispersing force would likely outweigh the gain. Ideally attacking forces would be able to regroup at a secure outpost or location. Through intelligence and field observation, new targets and objectives should be assessed as quickly as possible and a new attack order given so that continuous pulsating swarms can be organized and dispatched to keep on the offensive and keep the enemy "off balance."

The Warrior

In the U.S. military, the individual's ability to perform is vital to the the operational ability of that individual's unit. The U.S. trains and maintains the greatest war fighters in the world. Frank Hoffman however, acknowledges the need for a new type of warrior.

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[24] Ibid

"...hybrid warriors," highly adaptable troops able to rapidly shift between competing demands on a chaotic battlefield. They must be prepared for bloody, close-quarters firefights, yet also be ready to protect civilian populations caught up in the fighting. That demands more investment in cultural intelligence and language training to root out an elusive enemy hiding among the people." [25]

Nonlinear warfare will be a more complex and engaging mode of warfare. Therefore, greater training and equipment will be needed to equip the new generation of warriors. In regards to training warriors, there will need to be a greater emphasis on cultural awareness training. This could be achieved through academic cooperation. Utilizing universities resources to educate future warriors on a specific culture in an accelerated yet expert manner. Understanding complex social and cultural aspects before U.S. intervention provides a more favorable possibility that good relations can be maintained with the local population by not violating cultural norms, traditions, or taboos. Local populations are more likely to know about enemy movement, capabilities and command structure, thus working with the population on good terms could provide a more simple method of collecting human intelligence.[26] Furthermore, in training, future warriors will need to be able to lead and react to extremely fluid situations. Being able to take information like troop movements their equipment and

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[25] *Hoffman, Conflict in the 21st Century: The Rise of Hybrid Wars.*

[26] Krawchuk, Fred T, "Strategic Communication: An Integral Component of Counterinsurgency Operations." *Connections: The Quarterly Journal* 05, no. 3 (2006): 35-50.

abilities as well as being able to assess one owns abilities and equipment all under the constraints of time will need to be a main focus of training for both non-commissioned officers and commissioned officers. In addition, the warrior of tomorrow is facing never seen before threats from new technology. With digital warfare becoming a main pillar in combat, there is undoubtedly many weaknesses present when dealing with digital/ electronic equipment.[27] By and large digital/ electronic assets need power, loss of power from depletion, disruption, or destruction could result in a loss of an ability on the battlefield. Therefore, future warriors will need to be able to operate without the use of technology that assists or replaces abilities like air power, communications, navigation or weaponry. This helps mitigate the possibility of losing electrical power in an uncertain future of war where electronic and digital assets will be a primary target. Complete dependance on technology could very well become the U.S. achilles heel if it is not aware of the vulnerability of technology. Training future warriors with the ability to operate without these luxuries will prove to be a vital skill. This does not mean that the U.S. should not use technology, rather quite the opposite. The U.S. should embrace technology to achieve its objectives on the battlefield, yet have an effective force in case such capabilities become unavailable. In fact, connecting each individual warrior with real time information regarding the enemy capability, mobility, and location would give the U.S. and unprecedented edge in controlling the chaos of war. Equipping the warrior with technology that that enhances human abilities would provide the U.S. with the ability to reduce personnel in combat situations; ideally

[27] Boot, Max. "The Paradox of Military Technology." Oct 2006. Council on Foreign Relations. Feb 2017.

helping reduce casualties, and yet each individual being a force multiplier. Equipping the warrior will come with many challenges. With the evolution of technology it may be a very rapid process, therefore, beginning to engage in conversation, thought experiments, and controlled tests would pave the way for proper and effective implementation of tomorrow's warrior and their capabilities.

Unit Composition

With electronic warfare rapidly becoming a mainstay in combat it is necessary to evaluate the composition of combat units. The U.S. military today uses electronics to effectively carry out its objectives. However, advisaries may use equipment that may render our electronic equipment less effective. This equipment typically refers jammers or infrared countermeasures (IRCM). As advanced targeting systems and munitions become more affordable and accessible,[28] the U.S. will have to have countermeasures for not just large vehicles like rotary aircraft and naval assets but also for land vehicles like the Joint Lightweight Tactical Vehicle (JLTV). Having these counter measures for all vehicles and assets ideally make the U.S. military difficult to target and effectively engage. Having the ability to jam the advisories radar and communications will isolate the target, again aiding in complicating the adversary's command and control measures. Using IRCMs will make precision weapons that are used against the U.S. less effective. However, it is important to equip all units from

[28] Ibid

battalions/ brigades to the squad, in this manner to ensure there is no gap in abilities allowing maximum flexibility of U.S. forces in all situations.

New Weapons

Through all of warfare, new weapons have changed the battlefield. Often times effective implementation of these weapons came after it was introduced to the battlefield. The tank and airplane in WWI is a primary example of implementation after introduction. Both vehicles were used in small capacities to support very small units which essentially made them big, slow, vulnerable targets.[29] After many fruitless efforts, tactics of these weapons changed to be utilized in support of infantry and infantry in support of these weapons.This in part changed the way operations were ran. By the time WWII unfolded the Germans had mastered mechanized and air warfare. They recognized how air, land, and sea assets could support each other to rapidly overwhelm the battlefield and achieve both attrition of the enemy and key objectives.[30] Understanding these emerging weapons and how they can effectively be implemented before introduced will be vital to maintaining a stable operational capability while making a transition from current weapon platforms to these new weapons. These weapons are not necessarily improvements to old platforms. These are not just improved battle tanks, improved munitions, or battlefield optics. These weapons are introducing completely new technology that will change the way that war is fought. These weapons include, but are not limited to, autonomous robots/ sentries/ drones, high energy weapons such as lasers and electromagnetic pulse weapons (EMP),

[29] Glanfield, John, *The Devil's Chariots: The Birth and Secret Battles of The First Tanks,* Gloucestershire, UK, Sutton Publishing Nov. 30, 2006.
[30] "Blitzkrieg." Encyclopædia Britannica, April 23, 2015. https://www.britannica.com/topic/blitzkrieg.

and finally kinetic weapons. The U.S. should be wary of both these weapons deployed against it as well as implementing them into its own armed forces.

Autonomous Robotics, Drones, Sentry weapons.

Autonomy simply is the ability to function without outside influences, independant.[31] Weapons today are becoming more autonomous leading to legal, operational, and tactical uncertainty. This discussion will only focus on the operational and tactical level ideas. Autonomous weapons as defined by the DoD is as follows:

> "A weapon system that, once activated, can select and engage targets without further intervention by a human operator. This include human-supervised autonomous weapon systems that are designed to allow human operators to override operation of the weapon system but can select and engage targets without further human input after activation. The crux of full autonomy is a capability to identify, target, and attack a person or object without human interface. Although a human operator may retain the ability to take control of the system, it can operate without any control being exercised. A fully autonomous system is never completely human-free. Either the system designer or an operator would at least have to program the system to function pursuant to specified parameters."[32]

[31] Grant, Greg. "Hybrid Wars."
[32] United States Dep't of Defense, Directive 3000.09: Autonomy In Weapon Systems 13-14 (Nov. 21, 2012), http://www.dtic.mil

The benefits of weapons like these have numerous advantages over human beings. Electronic information systems can react faster and more accurately than people. These systems can run continuously with simple recharges and will perform at a consistent level as opposed as tired, injured, or restricted individual. Most importantly they run at a lower cost in both in life and military resources. These weapons will be able to carry out many functions on the battlefield that would give a significant advantage to any force that deploys them. Such functions include, but are not limited to; battlefield surveillance, base security, precision fires, rapid envelopment, troop and material transportation, causality/ POW extract, and general combat support.

Survalience

In a recent "60 minutes" interview the "Perdix", autonomous drones were revealed to the world as functional drones that could monitor the battlefield like never before.[33] Being able to work as a swarm or multiple swarms, these drones were able to take in larges amount of data share it among all other drones and react to this information accordingly. How equipment like the Perdix could shape the battlefield is unlimited. Constant, real time, information being taken and analyzed through digital means has many benefits. First, it takes a very complex task off the shoulders of the warrior, allowing them to give more focus on the mission and the situation before them. Next, such equipment surveilling the battlespace allows the warrior to see where the enemy is and their assets allowing for more informed tactical maneuvers that place the warrior in a superior position. Also, constant monitoring of advisaries movements and actions will provide the U.S. with greater understanding of how well an enemy force is trained which can be used to

[33] News, CBS. "Capturing the swarm." CBS News. January 09, 2017. Accessed February 10, 2017. http://www.cbsnews.com

fine tune training to engage very specific groups. Also, this surveillance of combatant forces may deter them from certain actions, such as placing improvised explosive devices (IED) or engaging U.S. FOBs. Continuous real time surveillance will be one of the most critical aspects of fighting in nonlinear warfare.

Security

Autonomous drones and sentries could be useful to secure perimeters of U.S. bases. These vehicles would be able to run constantly patrolling perimeters and learning about the security situation such as weak points or likely avenues of approach. If ground vehicles such as the U.S.MC's multi utility tactical transport (MUTT) were synchronized with autonomous drones such as the Perdix the two systems could support each other to effectively secure outpost or warriors in the field. Automated targeting systems again would be more accurate and could respond much more rapidly and efficiently than a human operator. These vehicles would also save manpower needs for certain types of patrols, such as recon patrols, ambush patrols, and some security and economy of force patrols. This again allows more of the burden to be distributed to other entities allowing combat leaders to focus on the mission at hand.

General Combat Support

Many autonomous vehicles would be excellent resources in swarm maneuver tactics as they would be able to maneuver very quickly without fatigue and would be able to withstand more damage and not be as susceptible to suppressive fires. Rapid envelopment of enemy forces

is a key concept in modern warfare tactics,[34] it remains true to this day, only enveloping small units rather than entire companies may be more appropriate in nonlinear combat. Autonomous vehicles would be an excellent tool to cut of enemy egress routes as well as secure the AO from outside attack or counterattack. Furthermore, these vehicles would also be useful "on point" or the lead member of a fireteam. Sending the vehicles in first to see what threats are inside of a building or over a hill would keep the warrior aware and safe from surprise attacks. One additional benefit that these weapons could have is "networking fires" essentially they follow a timed algorithm that would suppress targets allowing for warriors to move more freely and rapidly. If synchronized with drones ground robots or sentries would be able to maneuver themselves into tactical positions to either engage or suppress based off the emerging situation. The application of autonomous vehicles is only restricted by the technology available. As technology has shown its development is rapid and unpredictable. Understanding what is available and dependable and how to implement it effectively will be a continuous experience for the U.S., but it will keep its forces ahead of the opponent to control the battlefield.

High Energy Weapons

High energy weapons are weapons that use large amounts of focused or dispersed energy for an array of applications.[35] These weapons can be used to destroy enemy vehicles, weapons, or munitions, for access denial, disable sensors and overwhelm electronics ultimately destroying them.[36] These weapons would be a very affordable resources as high energy would replace

[34] Lind. "*Maneuver Warfare Handbook*." p.89
[35] Beason, Doug. *The E-bomb: how America's new directed energy weapons will change the way future wars will be fought*. Cambridge, MA: Da Capo Press, 2005. p.23
[36] Ibid p.12

munitions that cost money to manufacture, transport, and maintain. [37]Also high energy weapons such as EMPs would be extremely useful in isolating and disabling enemy combatants equipment. These weapons could be mounted on robots or drones, land vehicles, ships, and aircraft.[38] Defense against high energy weapons is very difficult especially because the delivery of the energy is at the speed of light. Currently there is a lot of technical and logistical developments that need to be accounted for before these weapons can effectively be implemented, but it's only a matter of time before these obstacles are overcome meaning thought experiments and discussion of these weapons should be considered.

Security/ Defense

In regards to security, possible applications of weapons, like the U.S. Army's Tactical High Energy Laser (THEL), could be used to intercept enemy munitions such as mortars, rockets and ballistic missiles effectively destroying them before they hit their target.[39] Furthermore, high energy weapons would be able to destroy enemy sensors like the ones found on drones. This is particularly important because if an enemy released something similar to the perdix drones individually destroying each one would be a very difficult task and may take too long allowing the enemy to acquire the information desired. One large release of directed energy may be able to disable large swarms of drones or other types of sensor based equipment. Implementation of these types of weapons for base security would make it very difficult to attack any military installation as direct means of attack would be rapidly and accurately eliminated. High energy

[37] Ibid p.78
[38] Ibid p.107-111
[39]\ "Tactical High Energy Laser (THEL)." Northrop Grumman. Accessed February 10, 2017. http://www.northropgrumman.com

weapons could also accompany convoys and patrols as these platforms could be mounted on vehicles. This would give greater security to elements that experience changing environment and are more vulnerable to an ambush. One additional application for defensive measures better for extremely complex environment where insurgents may hide among civilian populations. A unique capability of high energy weapons is the active denial application. It uses microwaves to direct an intense non violent burning sensation that causes no physical damage to human targets.[40] This type of application maybe be better suited for urban environments where population density is more of a factor in combat operations. If an application such as active denial were able to be compacted into a man portable device, squad size elements would be able to use such technology to help secure temporary positions again allowing them to focus on the mission. High energy weapons would could be very portable affordable and effective means of enhanced security.

Offense

High energy weapons would give the U.S. a great advantage on the battlefield when attacking a target. Since high energy can be extremely focused precision fires would be extremely fast and accurate with little to no collateral damage, something that is desireable in urban combat. High energy weapons again could deliver an incapacitating shot that would not destroy but rather disable something. This could be useful if capturing something in tact is required or stopping a vehicle with a high valued target inside. Also, with using this weapon in conjunction with other abilities would be beneficial such as surprise attacks where speed and

[40] Beason, *The E-bomb. p.114*

stealth are vital, perhaps disabling a mobile platform with fleeing combatants to rapidly close with and destroy. The applications for offensive maneuvers with high energy weapons are vast and ever changing, again proper implementation of these weapons deserves further discussion.

Electromagnetic Pulse Weapons (EMP)

EMP's are the most immediate threat to U.S. military's ability to operate. As stated the U.S. military is very dependent on electronic equipment. EMP's send out a large electromagnetic signal that overwhelms electric circuits and "fries them." EMP's can be detonated at various sizes causing no harm to humans. The size of the signal sent will determine what size and complexity of electronics it will destroy. The reason these are so dangerous is because of the relative ease to make EMP's. Small EMPs can be made with things in a standard household, more advanced ones can be made in a college physics lab. Of the weapons listed in this project, EMP's are the second most realistic weapon to be used on the battlefield, right after drones. There are multiple ways to defend against EMP's, current methods include what's known as "shielding," which is basically putting more metal around a electronics that would be able to dissipate the signal enough so equipment could sustain an EMP.[41] The problem with this is how heavy and immobilizing this type of equipment would be for the warrior. EMP's will need to be one of the most immediate obstacles that the U.S. military will have to overcome in the next few years as nonlinear tactics would greatly benefit from EMP's.

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41 Chapman, S. Jonathan, David P. Hewett, and Lloyd N. Trefethen. "Mathematics of the Faraday Cage." *SIAM Review* 57, no. 3 (2015): 398-417.

Offense

With the threat that EMP's pose on the U.S. military, their implementation into U.S. armed forces rather would give an unprecedented advantage over much of the equipment used in nonlinear warfare. Equipment like market accessible vehicles, cell phones, and computers. Directed EMP's from drones or other platforms would be very useful in disabling potential vehicle borne improvised explosive device (VBIED). Next, EMPs would help with the isolation aspect of the swarm concept. Again directed EMP could disable enemy communications and vehicles including drones. EMP's will have many other applications in an offensive stance that could greatly improve U.S. capability to control every aspect of the battlefield.

Defense

EMP's in a defensive posture would have many useful applications; they would be good for controlling avenues of approach, particularly in urban settings where large amounts of vehicles are present. EMP's would also serve as a good defense for drones or other small electronic devices that may be used to surveil U.S. forces. Again EMP's will have many more applications as they are implemented and situations evolve.

Electromagnetic propulsion weapons/ kinetic weapons

Electromagnetic propulsion weapons, also known as "railguns" or "coilguns" are a new type of weapon that have many unique advantages over traditional gunpowder or solid fuel projectiles. Railguns can fire "dumb" warheads meaning there is no guidance of the round to its target, however, the projectile can be fired at hypersonic speeds. The U.S. Navy's current

Railgun prototype can fire a projectile at three times the speed of a traditional muntion.[42] The projectiles do not require any fuel or even explosive warheads, as the kinetic energy from the projectile would be great enough to destroy targets.[43] One of the greatest advantage of these weapons would be the inability to intercept the projectiles. Intercept munitions and technology could not lock onto something as small as the projectiles while going at hypersonic speeds. Another great advantage is the cost of the projectiles is only a fraction of the price of current "over the horizon" munitions. Implementation of these weapons would improve accuracy, time to target while reducing the overall cost. These weapons still have many logistical limitations at this time such as the amount of power required to fire one projectile, but with the evolution of technology these limitations may not exist in a few short years.

Integration

The integration of these weapons and doctrine change over the coming decades will be a logistical, operational, and tactical challenge. As would be expected this process should be a very methodical procedure that does not bring in the weapons or doctrine change without first doing extensive research into applications of the weapons, deep level thought experiments, extensive training and field test. As discussed, effective implementation should come before introduction of the changes on the battlefield. There could be numerous ways to go about the integration of new tactics and weapons and every method will have its drawbacks and problems. However,

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42 "Electromagnetic Railgun." Electromagnetic Railgun - Office of Naval Research. Accessed February 10, 2017.http://www.onr.navy.mil

43 Ibid

these changes will position the U.S. military for continued superiority on the battlefield for the decades to come. Largely the integration will be based off of the progress of the weapons being developed. Many of the discussed weapons and equipment are in the early prototype stages of their development, the integration of these methods and weapons can be done in stages. These stages could resemble the crawl, walk, run concept. This is to ensure there is a smooth transition without compromising U.S. abilities.

Crawl

Immediate course of action are those which can take effect in a very short time frame. These actions are simple and require little to no additional resources. First and foremost, ensuring that U.S. forces are being well trained in warfighting without the use of technology or other luxuries that U.S. forces have become accustomed too. This includes, but is not limited to, air power, sea power, and undisturbed communications. This will provide every warrior with the ability to function as a completely isolated entity on fluid battlefield where new technologies may restrict the U.S.' current abilities to operate. At the same time, a greater emphasis on creative and quick reaction skills for NCO's and commissioned officers should be a main focus. This step is vital for making smaller units more autonomous on the battlefield. As no one particular situation can be predicted on the battlefield, it may be best to enhance rapid critical thinking and creative problem solving as these skills would be useful in any situation. Next, discussion and thought experiments amongst experienced commanders and inexperienced commanders should begin to take place. Inexperienced commanders can offer an outside perspective that sometimes can help identify trends and patterns or introduce new ideas "outside

the box" all of which will help shape the future. These commanders will slowly analyze problems and solutions on the tactical, operational, and strategic level with the swarm tactic or other ideas put forward in this project. When these discussions take place it's important to remember that these changes would not be immediate and that tools and weapons are not all available yet. Discussion and thought experiments should be vast and critical to ensure that multiple perspectives are considered including those pertaining on how to train and integrate these changes.

Walk

The walk phase will be the slow and gradual physical integration of the new weapons and concepts discussed earlier. It may be best to start by replacing weapons that carry out the functions of old platforms. Such as the railguns replacing large artillery pieces or a greater role of drones in training evolutions. This will allow warriors to have a basic understanding of the purpose of the weapon system and slowly adapt to its capabilities. From here, beginning to bring in equipment that performs new task and allowing warriors to train with such systems to begin to familiarize themselves with the systems. This will be important with robotics and drones as these machines will operate autonomously taking the responsibility from human operators. During this time, integrating defensive high energy weapons would be beneficial, again to allow warriors to understand the equipment and its capabilities. From here, beginning to change the structure of the chain of command would be necessary. Giving battalions more autonomy and resources during training to understand the complexities of nonlinear warfare. It may be beneficial for each battalion, company, platoon, etc to largely develop its own standard operating procedures (SOP)

within themselves so commanders can customize their units to whatever works best for them. Also, the integration of the new digital warfare assets within each platoon should begin to take place. Understanding how these assets will work on the battlefield and how to effectively employ them will be vital to platoon commanders. As nonlinear warfare happens largely in conjunction with digital equipment or infrastructure these assets will be able to disrupt enemy digital activity such detonating IEDs or jamming communications. Tactical changes will then need to start being rehearsed. A bottom up approach when putting these tactics in place will give a strong foundation in understanding the of how swarm maneuvers will work. Beginning at the squad and moving up to platoon, then company will allow leadership at every level to understand what is going on above and below them. Performing live fire swarm maneuvers with the new weapons will come next allowing warriors to see large operations in motion again familiarizing themselves with the nature of the operations. This part of integration will need to be carefully monitored as it will be inherently different to warriors and commanders and confusion will be present. Large amounts of mobility mixed with new weapons systems will create a much more rapid and fluid movements on the battlefield inherently elevating risks in training, proper operational risk management (ORM) will need happen for each evolution. This “walk” phase is very much a familiarization phase understanding and slow steady movements are essential to successfully integrating these new concepts and weapons.

Run

The run phase will be the final step in successful integration as it will bring all aspects discussed together in one cohesive functional ability. The run phase will be a steady change over

unit by unit process. Changing too rapidly may be crippling to U.S. current abilities and could lead to the possibility of being caught in a transition where forces are not completely ready for full operation of new weapons and tactics. Changing units methodically and allowing them to be tested on the battlefield will allow for proper analyzing of those units to find problems or better ways to carry out the operation. This will help reinforce the walk step in understanding the new weapons and tactics. When implementing on the battlefield it will be important to have additional assets ready to support operations as safety of warriors and accomplishing the mission hold a greater importance than proving successful integration. The objective of this new strategy is to shift away from this mode of conventional war to fight nonlinear warfare, but also being able to have "dual purpose" tactics and equipment to face near peer adversaries.

Conclusion

Successful deterrence requires the willpower to carry out a credible threat and the capability to actually perform such an action. The U.S. military today is too susceptible to the emerging mode of nonlinear warfare. Nonlinear warfare uses multiple modes of war such as acts of terror and instigating criminal behavior to create social disorder that acts as camouflage for insurgent fighters. Guerrilla tactics are used to avoid U.S. strengths such as air power and fire superiority, while being able to destroy modern equipment with conventional weapons. Civilian infrastructures are used such as public transportation, power grids, internet, and cellphones to achieve the objective of insurgents. Nonlinear warfare will not destroy the U.S. military, but rather make war too costly in lives and resources to continue to pursue U.S. objectives. This has been demonstrated in Vietnam, Iraq, and Afghanistan. This increases adversaries will to fight the

U.S. as they can effectively stop the U.S. from achieving its objectives. With this in mind the U.S. should look into changing the way it fights war form the costly conventional maneuver warfare strategy to a more swarm warfare that integrates new technology, weapons, and tactics. This reform will make the U.S. military more “surgical” in its combat operations. With new weapons and technology the U.S. will be able to swarm enemy positions isolate, disable, and destroy the enemy with little collateral damage and as little interruption of the population's daily life. U.S. forces will rapidly disperse from the battlefield to a secure position, typically in a FOB or COP type base where again new technology will defend the position in all directions essentially making U.S. forces untouchable. With technology and tactics changing, military doctrine will need to be modified to deal with extremely fluid combat situations. These new weapons and swarm warfare will save the U.S. considerable amounts of lives and resources as it would take less warriors on the battlefield and cheaper ways to engage the enemy. A “crawl, walk, run” type concept will be the methodical integration of these new weapons and tactics. This is to ensure that effective implementation happens before introduction. If the U.S. can effectively implement these changes ideally it would show advisaries that the risk of fighting the U.S. is far greater than the reward as the U.S. can find, isolate and destroy any combatant entity before they can inflict any damage to the U.S. This project is not to give the answers to the emerging mode of warfare but only to add to the discussion of how the U.S. should deal with fighting asymmetrical forces and near peer forces. This change in America's ability to fight war is to mitigate conflict as war should always be a last resort. In the spirit of the great military strategist Sun Tzu, “Supreme excellence consists in breaking the enemy's resistance without fighting.”