Strategy Research Project

US Terrain Shaping Munitions and Area Denial Capability

by

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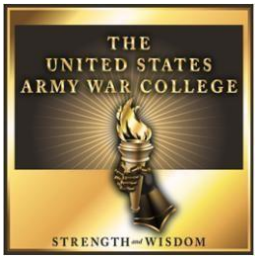

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Abstract

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The US finds itself in an increasingly unstable and unpredictable world with a shrinking military. Smaller JTFs will have to form on short notice from multiple bases to cover the joint functions. We cannot allow the enemy to control key terrain and use their countermobility systems to pin down and destroy our forces. During the recent wars in Iraq and Afghanistan, we ceded the countermobility fight to the enemy and lost the initiative. Engineers focused on building protective structures and finding IEDs. After 10 years of overreliance on remote sensor-fires links and aviation we are ill prepared for the fights ahead. In the process we lost our proactive mindset in using countermobilty to support defensive and offensive operations. Our current systems are nearing the end of their lifecycle and are inadequate for supporting future operations. We must engage with all stakeholders and swift action across DOTMLPF to develop scalable, reliable, affordable, and effective lethal and non-lethal countermobility capabilities in support of the joint commander's intent. The days of legacy landmines are mercifully gone, FASCAM is inadequate, the demands of man-in-the loop systems are tremendous and we must train and equip for the fight ahead.

US Terrain Shaping Munitions and Area Denial Capability

What is the role of lethal countermobility and our ability to "shape the terrain" in future warfare? Lethal counter mobility is part of the assured mobility framework which is a critical enabling process to reduce risk to mission failure and maintain options for the commander.[1] Developing this capability is a classic study in the strategic process of how services deliver capabilities (means) to the joint force commander who employs them (ways) to advance national interests (ends.) The perspectives of many stakeholders ultimately shape the future role of this capability. Realigning our capability development with the projected future operating environment will take vision and strategic leadership. There is a growing role for countermobility in an increasingly complex and unstable world. We must be proactive in getting inside an adversary's decision-making process and reducing the risk from inevitable surprises to US land forces through the use of landpower. Landpower is the ability to gain, sustain, and exploit control over land, resources, and people through the use of threat, force, or occupation.[2] Effective application of landpower requires new levels of integration between mission command, fires, maneuver, and protection capabilities, both lethal and non-lethal.

The future role of countermobility poses three questions: What capability do we need? What capability do we have? How can we close the difference? There has been a great deal of analysis on the challenges posed by anti-access and area-denial (A2AD) systems.[3] We must ask, if these capabilities are so effective even against a hegemonic power like the U.S., then how good is <u>our</u> A2AD capability? Anti-access systems are generally long-range systems that lie outside the scope of the project. Area denial capabilities are usually of shorter range and designed not to keep the enemy out, but to

limit his freedom of action within the operational area. This strategic research project will analyze the demand signals from various internal and external stakeholders to determine the future countermobility capability requirement for assured mobility and friendly area denial. It will then provide a short unclassified view of what capabilities we currently have and finally provide some recommendations on how to align our capability development with our vision of the future requirement. The fate of our service members depend our ability to get countermobility defined, aligned, and resolved before they deploy into harm's way.

What do We Need?: Stakeholder Analysis.

Both internal and external signals are important to consider when determining what capability and capacity will be needed in the future. Internal demand signals can come from lessons learned, experimentation, concepts, doctrine, and unit requests. External signals can come from policy, treaties, congressional oversight, allies, adversaries, and the public. To achieve the right capability, leaders must disentangle the people from the problem; focus on interests instead of positions; and work together to find creative and fair options.[4] Leaders must communicate openly to find common interests beneath the superficial positions and find innovative ways to create mutual agreement on acceptable solutions. In some cases, we may have to accept the best alternative to a negotiated agreement, especially when the intensity of one interest is strong but a competing interest is based on survival of our forces.[5]

Scanning the environment provides us a starting point to determine future requirements. The debate over lethal countermobility has been highly charged for decades, and rightfully so. The debate focuses considerable energy on an apparent friction point between our national interests (security and prosperity) and our national

values (universal rights.) A great deal of misinformation and miscommunication exists on terrain shaping munitions. The word "landmines" generates a reflexive reaction from many on both sides. When prompted, even many well informed people will state that US policy is to abolish them and never use them. This is not the case, however, and as military professionals we must understand the facts.

Much of the confusion centers on the Mine Ban Treaty (MBT), also known as the Ottawa Accords.

> The MBT was initiated by NGOs and then driven by a unique partnership with mid-size states and international agencies during a fifteen-month period to develop political momentum toward prohibiting [anti-personal landmines] APLs, otherwise known as the Ottawa Process. Unlike most multilateral disarmament agreements, it did not have the support of [any] major power such as China, Russia, and the United States.[6]

Celebrities and politicians scrambled to rid the world of landmines and save children from their horrors. Books calling for the ban on landmines rolled off the presses by the millions, many sporting a cover staged with a small child injured or in grave danger from a nearby landmine.

All in all, it was one of the most successful information campaigns in recent history. The problem was that were talking past each other or not talking at all. The crisis of legacy landmines was real. They were maiming thousands of people a year around the world and something had to be done. The International Campaign to Ban Landmines received a Nobel Prize in 1997 for its work on the MBT.[7] What went missing in the discussion, however, was that the US had already developed and fielded a far safer replacement to legacy landmines.

Legacy landmines can remain armed and lethal years or even decades after the conflict is over. Millions remain unmarked and unreported, and they do represent an

unacceptable threat to humanity. These weapons are not in keeping with US values, and abolishing them is the right thing to do. How can there be any question that we need to get rid of legacy landmines from our villages, towns, and farms? There really isn't much opposition, and in fact the US is the largest contributor to humanitarian demining and conventional weapons destruction in the world, providing $2.3B in aid to 90 countries.[8] However, people conflate many things with "landmines," including improvised explosive devices (IEDs), submunitions, bomblets, scatterable munitions, etc., which frequently confuses the discussion. The U.S. designed the Family of Scatterable Munitions (FASCAM) in the 1970s, in part as the solution to the persistent landmine problem. They contain limited electronically controlled self-destruct times, as well as self-destruct safeguards if the electronic self-test failed after launching. Keep in mind that most of these were planned to be on the ground for a short period in which a actual battle is taking place. The likelihood of the child chasing the soccer ball through the razor wire fences and into the munition field during the middle of a tank battle was, to say the least, farfetched, and certainly worlds away from the core problem we needed to solve: 60 million legacy landmines laying around the planet. Critics could not logically differentiate between legacy landmines posing an unseen hazard 40 years after a battle versus FASCAM, which self-destruct in 4 hours. Thus, anti-mine activists failed to take note of this quantum leap forward in solving the original problem.

The US had stopped using legacy landmines (except in Korea) in 1996[9] amendment to make made the distinction between persistent landmines and nonpersistent munitions during ongoing MBT discussions in 2004, but critics rejected the proposed amendment. Ultimately, many smaller countries ratified the treaty, but

most of the major powers refused to sign, including the US, China, and Russia. However, we must continue to engage in this dialogue to reinforce US commitment to ridding the world of legacy landmines. Future countermobility system developers must be mindful of this history. Any proposed solution must be reliable enough to ensure that there is no remaining explosive hazard decades (or even minutes, for that matter) after the battle.

In 2009 the Army advanced beyond FASCAM to third generation Intelligent Munitions Systems (IMS) called Scorpion. Although it contained even more layers of sensors and the ability for an operator to remotely deactivate the system, the specter of unintended casualties continued. The added safety features increased the cost and critics conjured up stories about school buses materializing and racing into the middle of a battle. These magic school buses could apparently drive into a munition field in the seconds it took to disarm the system. The critics' lack of ability to acknowledge most responsible military uses ultimately slowed our alternative landmine development. Congress defunded the IMS-Scorpion systems in 2010, although it had successfully completed all tests. The tiny number of weapons purchased and the minimal training on the system almost guaranteed that the training base would fail and the skills would atrophy.[10] It is clear that we need to manage external communications about this capability in order to prevent it from getting side tracked or bogged down again.

A recent Human Rights watch report included the following excerpt: “No victim-activated munitions are being funded in the procurement or the research and development budgets of the US Armed Services or Defense Department, but two related programs are being funded: the M-7 Spider Networked Munition and the IMS

Scorpion. These once had the potential for victim-activated features (thereby making them anti-personnel mines as defined by the Mine Ban Treaty), but they are now both strictly “man-in-the-loop” or command-detonated and therefore permissible under the treaty.”[11] This is one of the major friction points that previous administrations and military officials have had with the MBT as written. While agreeing to elimination of persistent landmines, the treaty makes no provision for second generation, self-destructing systems. It also leaves no provision for third generation systems with man-in-the-loop to be placed into automatic mode to defend troops against an onslaught of advancing enemy, even if he can visually verify that there are no civilians amongst the attackers.

In September 2014, President Obama once again emphasized our commitment to moving beyond a world of legacy landmines. The US National Security Council spokesman, in a press conference September 2014 stated that the President had approved a new policy:

> The United States is aligning our APL policy outside the Korean Peninsula with the key requirements of the Ottawa Convention, the international treaty prohibiting the use, stockpiling, production, and transfer of APL, which more than 160 countries have joined, including all of our NATO Allies….The United States will:
>
> - not use APL outside the Korean Peninsula;
> - not assist, encourage, or induce anyone outside the Korean Peninsula to engage in activity prohibited by the Ottawa Convention
> - undertake to destroy APL stockpiles not required for the defense of the Republic of Korea...
>
> Even as we take this further step, the unique circumstances on the Korean Peninsula and our commitment to the defense of the Republic of Korea preclude us from changing our anti-personnel landmine policy there at this time.[12]

This announcement was a major US step toward the MBT, and instantly removed every US legacy landmine from operation outside of Korea. However, it also removed from our inventory all of the anti-personnel FASCAM designed to replace the legacy landmines. The US retains only one viable anti-personnel system. The announcement did not affect our limited anti-vehicular capability. The new policy, therefore, increases the urgency to modernize our countermobility systems, while retaining the capability necessary to execute the national security strategy.

Congress has also been actively engaging the issue. There have been numerous reports and hearings on the method to replace landmines and the control and safety of those systems. Congress wants the services to adapt faster and more efficiently, while retaining appropriate controls on both the process and the outcomes of future capability development. It recently engaged on the process of material development within the Department of Defense (DOD). Both Congress and DOD have been vocal about the slow pace and high cost of materiel development. The services have responded that the system developed by Congress for oversight of the Joint Capability Integration and Development (JCIDS)[13] and Research Development Test and Evaluation (RDT&E) is too cumbersome. Congress recently sent a strong message that it wants changes to streamline the process and reduce redundancies. On 18 March 2015 Congress called members of all three services to Capitol Hill to provide testimony to the House Armed Services Committee (HASC) and the Senate Armed Services Committee (SASC) on redundant regulatory burdens that were impeding modernization and increasing developmental costs. The discussion focused on reducing the redundant requirements for a material development decision. The process requires between 60-80

separate documents, depending on the milestone, to develop and acquire a new capability or to modernize a system. The HASC has since introduced legislative changes to reduce the documentation burden, but the signal was clear that they desired faster and more efficient adaptation by DOD.[14]

Congress, and the SASC, in particular have been instrumental in shaping this particular capability. Senator Patrick Leahy, a senior member, was a key figure in securing over $2B in funding for the US global humanitarian demining.[15] The US has not used a persistent landmine since 1991 and has remained committed to leading the world's humanitarian assistance and responsible development to landmine alternatives. Senator Leahy championed man-in-the-loop systems that may have limited US capability but may one day allow the US the accede to the MBT as currently written.

The future of our countermobility systems is clearly dependent on the strategic and operational direction of the joint force and the nation as a whole. The services must consider the geographical combatant commanders as key stakeholders. Each services develops capabilities within their core competencies, but the ultimate consumer of the capabilities is the joint force commander. There are no indicators that there will any major shifts in US interests around the world; however, there are clear indicators that some of the threats we face are emerging in ways we have not foreseen. Chairman of the Joint Staffs, General Martin Dempsey, refers to this shift in his foreword to the Joint Force Capstone concept as a security paradox. "While the world is trending toward greater stability overall, destructive technologies are available to a wider and more disparate range of adversaries. As a result, the world is potentially more dangerous than ever before."[16]

The world does not appear to be trending toward greater stability since the publishing of that document. Despite the US desire to rebalance to the Pacific the tyranny of the urgent may hold US attention elsewhere. Continuing tensions in South Asia, a new wave of violence following the Arab Spring, the specter of a nuclear armed Iran, failing states like Yemen and Syria, and the emergence of ISIL have further destabilized the Middle East. The attacks by Russian-backed forces in the Ukraine, a 30% rise in the Russian defense budget, and numerous terrorist attacks across the European Union (EU) have brought US armored brigades back to Europe.[17] The US cannot take its eye completely off the possibility of a clash with a near-peer competitor just yet. The continued destabilizing effects of poverty, failed states, and the combination of terrorists groups from Al-Qaida, Al Shabaab, and Boko Haram are wreaking havoc on the African continent. It is clear that we are living in interesting times and this is probably the time to increase the flexibility of our options, rather than reduce it. US forces are likely to have to deploy with little notice to address a range of national security issues around the world.

As the joint community determines which capabilities will be needed in the future, it must also incorporate lessons from the past. In the 1940s-1980s, we shaped terrain cheaply and highly effectively, but we achieved the effect through the application of large numbers of Soldiers employing massive numbers of legacy landmines. Such a posture requires an amount of manpower that is simply unrealistic in today's smaller military, not to mention an absolutely unacceptable humanitarian risk.

In the 1990s we developed effective systems to solve the manpower problem through the introduction of FASCAM. However, the system lacked flexibility and

scalability. Commanders could not control when the munitions were active or safe without destroying the munitions. Commanders also had to choose how long the munitions would be active, from few preset choices. They lacked the scalability to allow the commander to determine lethal or nonlethal effects. Finally, the training systems provided little training for the crew and anemic training aids left the joint force with no appreciation of what a massive physical and psychological effect real munitions would have on the enemy. This left us marginally trained and equipped for a conventional fight, and then along came Afghanistan and Iraq.

The wars in Iraq and Afghanistan saw decreased use of protective obstacles around bases, sometimes limited to only concertina wire and dirt-filled Hesco barriers. A few pundits went so far as to say we no longer needed countermobility, since surveillance and fires alone could protect our forces. While the major forward operating bases (FOBs) were surrounded by thousands of tall concrete barriers, small combat outposts on the fringes were left with little more than wire and sandbags as obstacles. Such situations put the sensor-shooter concept to the teat, and it often failed.

Chief Warrant Officer 3 Ross Lewallen, an Apache pilot, recounts what he saw when he arrived at Combat Outpost (COP) Keating near Jalalabad, Afghanistan in October 2009. “Much of Keating was in flames and dozens of insurgents could be seen on the camp's perimeter.”

Chief Warrant Officer 2 Chad Bardwell, who piloted another one of a swarm of Apaches that rushed the base's defense that day recalled, “When we first showed up and put our sensors on Keating, the amount of flames and the smoke…to see that amount of personnel running outside of their wire. It was just kind of shock. " Keating

had come under attack by as many as 350 fighters. The post's defenses included only protective barriers, sensors, and concertina wire. Despite the fires from “swarms” of the most advanced US jets and helicopters, 8 US servicemen lay dead and 24 wounded. The enemy had gained control of key terrain, providing a position of advantage for their fires. The attackers then advanced on the outpost in mass under with supporting fires from key terrain. Sensors had done nothing to warn U.S. personnel that there was a force of hundreds massing on them. The camp was ultimately abandoned and destroyed.[18]

A year earlier COP Kahler near the village of Wanat had been attacked in a similar fashion. The RAND Report on the incident provided the following details:

> On July 13, 2008, by a significantly larger number of Taliban insurgent forces that used stealth, camouflage, communications discipline, and rapid movement over extremely rough mountainous terrain to establish positions close to the COP’s perimeter. The insurgents used coordinated rocket-propelled grenades (RPGs), small arms and heavy machine gun fire, and mortar barrages to inflict heavy casualties on the outpost. Ultimately, nine U.S. soldiers were killed and 27 U.S. and four ANA soldiers were wounded. The COP was soon thereafter abandoned.[19]

How did the 100 insurgents overcome high-tech thermal sensors? They used blankets! Over half of the engagements were reported to have occurred within 50 meters and many less than that. We need to regain our focus on dominating key terrain and not ceding it to the enemy. Having long-range sensors and fires is nice, but we need to shape the terrain we are on and use countermobility systems to deny the enemy key terrain.

The allure and overreliance on sensor-fires is not isolated to the small combat outposts. The US spent billions of dollars trying to create a persistent surveillance network over Iraq and Afghanistan, but the improvised explosive device (IED) remained

the number one killer. The enemy used IEDs as countermobility, area denial, and close combat weapons.[20] The vast majority of these were emplaced along roadways, greatly reducing the wide area security mission down to a long series of linear named areas of interest (NAIs). In future fights, we may not be able to ignore all the space between the roads as cross-country combined arms maneuver rebalances with wide area security. The threat could also increase exponentially as we move from underfunded ad hoc networks to complex hybrid state-funded forces combined with criminal networks.

Summarizing the effects of a protracted counterinsurgency (COIN) focus of the 2000s, I would argue that we failed to adapt our capabilities due to program cancelations, a glacial defense acquisition system, and an over-dependence on sensor-fire capability. The Army ultimately defunded large portions of its anti-vehicular capability and simply accepted more risk.[21] Our leader skills in building engagement areas and in employing lethal countermobility to deny terrain diminished. Unfortunately, the result was that we ceded the capability to the enemy and terrain shaping was done to us, not by us. We spent the remainder of the wars in Iraq and Afghanistan playing catch-up at the cost of 1000s of lives and limbs.[22] We cannot afford another 10 years of loss as we remain engaged in an ever more unstable and unpredictable world. As General Paul Ely declared after the Korean War, “We must review the causes of our failures and our successes to ensure the lessons which we bought so dearly with our dead do not remain locked away in the memories of the survivors.”[23]

These examples remind us of the hazard of failing to incorporate countermobility into our joint operations. History is clear about the tremendous force multiplying effects of obstacles.[24] Obstacles aid the joint force in concentrating enemy forces into a target-

rich environment, slowing and disrupting hostile forces to increase time to acquire and target them; denying the enemy key terrain that provides them positional advantage; protecting friendly forces and facilities; and, perhaps most importantly, imposing psychological effects on enemy forces and their leadership.[25] While terrain-shaping munitions are effective in damaging or destroying enemy systems, as obstacles they are one of the best ways to get inside an enemy's decision-making cycle and attack his ability to execute his plan. The joint force commander needs this advantage to overcome the enemy's will to fight and to achieve our desired objectives and endstate.

The DOD Joint Operational Access Concept[26] lays out, in some depth, the tremendous challenge that anti-access and area-denial systems can pose to land forces. One way to create the localized capability advantages during crisis-specific condition setting, described in the Joint Concept for Entry Operations (JCEO), is to use our own area denial systems to prevent the adversary from getting his systems into place and denying him the best locations to employ them.[27] Munitions with command-detonation capabilities allow friendly forces to hold terrain without having "boots on the ground." Friendly forces can then turn off or self-destruct munitions to allow immediate occupation of key and decisive terrain by friendly forces.

Key to the JCEO is the rapid combination of joint capabilities from across the services that must be combined from all domains (land, air, sea, space, and cyber) to achieve local superiority during entry operations. The US has reduced its forward basing, resulting in fewer forces being directly assigned to combatant commanders. Units stationed in CONUS are predominately on service specific bases. Since units can be allocated for planning for multiple contingencies, the exact team with whom they will

fight depends on which plan they are executing. Sometimes crisis action planning requires that joint task forces be assembled en route to the objective from different bases and staging areas. Near-perfect intelligence was not achievable from our sensors-fire coverage after 10 years of development, relatively static locations, and a cooperative host nation in Iraq. We should not expect to do it on the fly during an opposed entry. Sensor-fires networks and countermobility systems must be integrated and complementary during contingency operations with small joint entry forces. These smaller, more agile teams will have to protect themselves against numerically superior forces. By proactively shaping their environment and defending during a period of inevitable surprises, they can survive until they can change the conditions, seize the initiative, and exploit opportunities.

Our current systems are ill suited to meet the demands of the future joint force fight. US current ground-delivered area denial systems are obsolete, in poor repair, and many are at the end of their useful life with no current program of record to replace them.[28] Air-delivered systems are in much the same condition and service budgets shortfalls are creating growing risk in this long-range capability. Crews are untrained on the systems and leader skills for planning and executing countermobity have atrophied due to poor training systems and prolonged engagement in COIN. Strategic leaders and planners seem almost baffled by the concept of shaping terrain to our advantage, or at least to reduce risk. They are far more comfortable trying to counter an insurgent network's use of IEDs countermobility plan than they are with devising their own. Staffers conflate modern terrain shaping munitions with legacy landmine policy, leaving leaders unsure of what we need, what we have, and how/when we should use them.

Stakeholder positions and lessons learned indicate that we need new countermobility systems to meet the requirements of the joint force on the current and future battlefield. The systems must be integrated into the overall sensor network and must provide the commander with the ability to differentiate targets from civilians or friendly forces. They must be robust enough to provide lethal effects on personnel and vehicular targets and scalable enough for tight quarters of an urban area as well as broad and open terrain. They must be controllable to ensure that the commander remains in the loop and decides when the operator is to screen (merely warn of targets), guard (engage to disrupt), and cover (prevent the passage of intact enemy). Such requirements will take leader engagement, vision, and communication to keep all stakeholders informed and an active part of the guiding coalition.

Closing the Gap

How do we close the gap between our current systems and training to meet these future demands? The JCIDS process frequently employs a framework of doctrine, organizational design, training, materiel, leader development, personnel, and facilities (DOTMLPF) to sub-divide steps to change. Policy is sometimes included although outside the purview of the JCIDS system.

Doctrine

Joint and service doctrine exists for the effects planning, integration, execution, and reporting requirements for terrain shaping munitions; however, the doctrine is incomplete in its discussion of scalable effects. Due to the growing complexity of the battlefield, anti-personnel countermobility systems may require new definitions of nonlethal effects on personnel, such as "dissuade" or "incapacitate," instead of doctrinal formation based effects (fix, turn, block, and disrupt.) As we continue to improve

doctrine for entry operations, we must codify countermobility tasks, especially in high priority missions like WMD elimination, where phases of isolation, exploitation, and destruction may be inconsistent with short duration raids.[29]

Organization

Current Army BCTs do not have authorizations for existing ground delivery systems (Volcano). III Corps has required that the Maneuver Support Center of Excellence and the Department of the Army (DA) modify the basis of issue plan (BOIP) to authorize delivery systems in the BCT.[30] Current BCTs rely on echelon above BCT engineer units for ground emplacement. While this is a normal and expected task organization to form the combined arms team, having a minimal organic capability would be preferable during entry operations. BCTs do have the organic capability to deliver limited artillery delivered munitions (RAAM). The competition for ammunition space and the larger number of rounds required by our current (dated) systems makes this prohibitive to joint force operations. Joint fixed wing aircraft could deliver munitions (Gator), but USAF has proved resistant to the mission in recent discussions, due to limitations in mission profiles and the number of sorties required. DA approved Spider (AP) munitions systems on unit authorization documents but the fielding could be accelerated with additional funding. In order to create a more viable near term capability, DA could modify the basis of issue plan for Intelligent Munition System-Scorpion to match units currently authorized Volcano until a new system is fielded. This would generate the appropriate signal in the training and leader development domains to increase training.[31]

Training

Recent lessons learned from the National Training Center (NTC) indicate that units are not proficient with the employment of the Volcano systems due to limited training with combined arms obstacle integration. Training aids are inadequate and do not provide the fidelity to effectively train the force. The munitions allocated to train on the systems are extremely limited (4 rounds per system per year) and include no live munitions training.[32] Few units had trained with the Scorpion AV system; however, units are making steady improvements in training level with the Spider (AP) system. The Army must increase allocations of munitions for training on Volcano systems and Scorpion. DOD must develop robust and realistic training devices and simulations to improve joint readiness, or this skill set will remain poorly trained. Units could create a master gunner for countermobility systems. Leveraging opportunities to work with Army Test and Evaluation Command and the Program Manager can reveal opportunities to gain experience on the system outside of traditional training venues.

Materiel

Volcano ammunition is nearing the end of its lifecycle and will soon begin phased demilitarization after 25 years of development and service life.[33] AP mixed rounds were already banned by policy last year. However, the demil costs could be avoided for AT rounds by using existing systems for training or through foreign military sales. US units already training Iraqi forces to counter ISIL, for example, could include training and transfer of excess systems made available from force reductions. The system was once considered cost prohibitive for training with live munitions but could now actually be a cost saving measure. Air delivered systems are also nearing the end of their useful life and require replacement. The capability development system must inform a decision to

develop a replacement rotary wing system or shift that mission to rocket, UAV, and fixed wing payloads. The System Training Plan (STRAP) must include robust training aids, devices, simulations, and simulators (TADSS). The proponent and the program manager must fight to protect the training aids in the program budget even at the expense of the number of actual munitions procured. Lessons learned in training will drive the demand signal from the joint force commander in real operations. The services can purchase more munitions if demand in combat exceeds supply but an ineffective training system will ensure the whole program's death from lack of confidence. An effective training system should be developed for Scorpion and future AV systems. Modernization should be approved through the Joint Emergent Operational Need (JEON) process to more rapidly close this capability gap for ongoing crisis in the USCENTCOM area. The Joint Requirements Oversight Council (JROC) recently approved an Initial Capability Document (ICD) within the JCIDS in order to begin addressing the capability gap.[34] Joint force engineers must inform the geographical combantant commanders, and service component commanders of the developments to close this gap in capability. Joint force engineers are instrumental in ensuring the capability remains high on the Integrated Priority List (IPL).

Currently, Defense Advanced Research Projects Agency (DARPA) is conducting technical readiness level assessment and development efforts on some portions of the future capability; however, we need to leverage existing research development test and evaluation (RDT&E) time and cost.[35] The Scorpion system already meets some of the requirements and we can't afford to wait to field a capability until 2026 or later. There is an uncalculated, unmitigated, and growing risk to the joint force today. We can

accelerate a solution for the warfighter by leveraging existing RDT&E data and expertise in accordance with the guidance we receive from Congress. We can focus our RDT&E on capability gaps that don't already have solutions (long haul secure communications, target verification sensors to support man-in-the-loop requirements, training platform, integrated AP/AV control, integration on remote delivery systems and augmented reality heads up display to allow the man-in-the-loop to fight the complex system in contact). If effective sensors are coming into use with other unmanned ground sensor programs, then we could integrate those rather than develop them from scratch. We have solved most parts of the problem, but integration is key. Returning to Milestone A and working every component from fuses, controllers, kill vehicles, etc. wastes precious time and resources.

Personnel

There would be a positive impact of lowering casualties, medical evacuation, and replacements during contingency operations due to improved protection, standoff, target acquisition, and weapons effectiveness if we reengage in proactive countermobility operations. The Combat Engineer Force Design Update (FDU) being analyzed at the Maneuver Support Center of Excellence (MSCoE) could repurpose structure made available through more efficient countermobility systems to close gaps in capabilities elsewhere in the formations.

Facilities

Training locations should be identified on installations using live munitions for training. The superior fusing already incorporated in many of these second generation systems would ensure that dud rates approach zero. Installations with BCTs and echelons above brigade (EAB) training with live munitions have already trained

Explosive Ordnance Disposal (EOD) teams on the installation. Since units would only use AV Volcano systems, there is minimal risk to technicians.

Conclusion

The requirement for terrain shaping munitions is all around us, from combined defense or securing weapons of mass destruction on the Korean peninsula; to denying key terrain in our wide area security of Iraq and Afghanistan with limited boots on the ground; to contingency operations that demand combined arms maneuver to address security issues from hybrid threats in Europe; or to terrorists threats like ISIL and Boko Hararm. All are situations that may require JTFs to control terrain. We must develop new countermobility systems that provide the scalability and control that allow the commander to employ lethal effects within an area when necessary. But these systems must also allow the commander to act with restraint and proportionality while reducing risk to both our forces and civilian personnel. They must be reliable, so that munitions no longer pose a lethal threat when the conflict is over. We need a system that is affordable, and we can do that by ensuring that training is embedded and that munitions can be deployed and recovered if not employed. We must ensure that the system is adaptable across the depth of the battlefield and can be modified as technology improves. Finally, we need this capability soon. Our current capabilities are dwindling and the demand signals are strong in a progressively unstable world. The first thing we can do is to begin the dialog with stakeholders, both to educate ourselves and to build a guiding team with unstoppable momentum. The uncalculated and unmitigated risk to the joint force due to a lack of coherent and viable countermobility capability that currently exists is unacceptable to national security.

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