STRATEGY RESEARCH PROJECT

COUNTERMOBILITY FOR THE ARMY AFTER NEXT: AN OBSTACLE TO MANEUVER ASCENDANCY?

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USAWC CLASS OF 1998

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An Obstacle to Maneuver Ascendancy?

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ABSTRACT

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TITLE: Countermobility for the Army After Next: An Obstacle to Maneuver Ascendancy?

FORMAT: Strategy Research Project

DATE: 31 Mar 1998 PAGES: 41 CLASSIFICATION: Unclassified

The Army After Next (AAN) effort seeks to provide the Army of 2020 with the physical speed and agility to complement the mental agility inherited from Force XXI. AAN developers have concluded, "mobility, characterized predominantly by speed of maneuver, proved to be the most important factor contributing to battlefield success." With any concerted efforts to build a future force of knowledge and speed, countermobility will remain a significant operational capability that we must address and that we will need to integrate for successful operations of the Army After Next. This paper examines AAN operations and addresses why countermobility will be significant and how this battlefield function should be addressed integrally with the technological, physical, and doctrinal developments that will forge the Army's ability to rapidly maneuver and to strike with precision.

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AN ASYMMETRIC RESPONSE TO MANEUVER

On 28 March 1997 a mechanized brigade combat team rolled west across the desert of the U.S. Army's National Training Center at Fort Irwin, California. The brigade's mission was to attack and destroy an enemy motorized rifle battalion which defended key terrain in the southern corridor, setting conditions for a future enemy offensive. What made this particular day special was that this brigade was the brigade of the future, Task Force XXI. The context for the battle was the Army's Advanced Warfighting Experiment (AWE) for digitization and other future capabilities.

During the day and night prior, the Brigade capitalized on its sophisticated intelligence capabilities to discern exactly where the enemy was preparing its array of tactical obstacles. Through digitized terrain analysis the Brigade's leaders gained appreciation of the important tactical characteristics of the terrain. Yet on that morning, the Brigade's attack faltered as they approached and then, with difficulty, breached the obstacle. As the obstacles were finally reduced, the enemy employed remotely delivered scatterable mines, using multiple rocket launcher assets, to reinforce the breached obstacles in depth and deal a defeating blow to the brigade's offensive momentum. The obstacles the Brigade had encountered, exactly where anticipated, were in some locations nothing more than wire fence obstacles, in other locations surface laid anti-tank mines.[1]

This episode from the AWE underscores a trend that has been seen at our combat training centers for years--that an enemy's direct attack of our capability to maneuver significantly impacts the battle and that we continue to have difficulty in successfully overcoming maneuver countermeasures.[2] Digitization alone may affect but not solve this problem. The brigade level warfighting experiment gave no indications that we were on the threshold of anything more than incremental improvement in overcoming such maneuver countermeasures through Force XXI restructuring.

Looking to the years past 2010 and even past bringing Force XXI to fruition, the Army After Next effort "seeks to provide the Army of 2020 with the physical speed and agility to complement the mental agility inherited from Force XXI."[3] As pioneers of the AAN effort have begun to explore the characteristics and likely requirements of future battle, they have concluded, "mobility, characterized predominantly by speed of maneuver, proved to be the most important factor contributing to battlefield success."[4] AAN is headed toward a substantial development and fielding effort to generate significant improvements in mobility for the

Army's future force. At the same time however, we recognize that "any serious military threat between now and the 2025 period will very likely involve asymmetric forces designed specifically to threaten U.S. superiority in areas requiring long development and deployment lead times."[5] Is countermobility an area in which adversaries will focus and negate potential U.S. maneuver superiority?

With any concerted efforts to build a future force of knowledge and speed, countermobility will remain a significant operational capability that we must address and that we will need to integrate for successful operations of the Army After Next. This paper will examine AAN operations and address why countermobility will be significant to those operations and how this battlefield function should be addressed integrally with the technological, physical, and doctrinal developments that will forge the Army's ability to rapidly maneuver and to strike with precision.

To conduct this analysis, I will first examine the concept of countermobility as a component of our doctrine, then look at the current directions for how AAN operations will be conducted, focusing on how we intend to regain maneuver dominance. With this basis, I will examine the potential impacts that countermobility may play in AAN operations, extending current countermobility capabilities and considering enhanced capabilities that appear to be feasible within collateral development times. Lastly, I will draw conclusions with regard to the significance of countermobility on our future operations, force structure, and development efforts.

COUNTERMOBILITY AS A DOCTRINAL CONCEPT

In 1985, the Army published a field manual entitled *Countermobility*. Although not yet rescinded, the manual is outdated and largely ignored with current and better doctrine articulated in other publications. The draft of the Army's newest Field Manual 100-5, *Operations*, only uses the term "countermobility" once, but close reading of current doctrine reveals that the concept is still valid. Our recent capstone doctrine has simplified and reduced terminology by including the concept of countermobility within a broader context of mobility operations, expanding the latter to encompass "restricting enemy mobility."[6] Still, the 1993 version of FM 100-5 stipulates the purpose of countermobility operations being to "limit the maneuver of enemy forces and enhance the effectiveness of fires."[7] And, the Army's most recent doctrinal effort, FM 100-5 (draft), includes the concept of countermobility within the operating system of mobility and survivability.[8] While not specifically linked in the manual, countermobility directly supports the doctrine's postulated core functions of shaping and striking.

The fundamental concept for the role and purpose of countermobility was reinforced with the publication of Field Manual 90-7, *Combined Arms Obstacle Operations*, in September 1994. This manual addresses the employment of reinforcing tactical obstacles, differentiated from natural obstacles, which are used "to attack the enemy maneuver (and) to multiply the effects and capabilities of firepower."[9] These tactical obstacles are comprised of minefields as well as other than mine obstacles. In terms of impacting the dynamics of combat power, countermobility efforts contribute to decision in engagements and battles by degrading the enemy's maneuver, thereby contributing to more favorable conditions for engagement with fires.[10] Marine Corps doctrine similarly defines countermobility as "those actions that impede movement of the opposing forces," and explains that such effort "can enhance the effectiveness of friendly fires and can cause the enemy losses in personnel, equipment, and time."[11]

Countermobility is accomplished by either physically or psychologically affecting the enemy force so that its ability to maneuver is impeded even more than the difficulties posed by the existing media of the battlespace. Techniques and procedures for countermobility efforts currently (and historically) fall into three classes of efforts--(1) physical alteration of existing battlespace to cause greater difficulty for movement, e.g., digging of an anti-tank ditch, blowing or digging of a road crater, digging a pit along an infantry approach, demolition of a bridge; (2) construction of barriers to impede movement, e.g., log obstacles, abatis, dragon's teeth, boulders, walls, wire obstacles; and (3) mine warfare. The first two categories render additional physical impediment to maneuver, with the last rendering psychological impediment to maneuver. Mine warfare combines the factors of lethality and uncertainty to cause minefields to be effective obstacles as they psychologically impact on maneuver of forces in their proximity.

While "the art of successfully using obstacles against enemy attack is as old as warfare," the concept and role of countermobility in our current doctrine follows a direct lineage to the start of this century and the First World War.[12] Furthermore, the evolution of countermobility in doctrine is linked directly to the cyclic development of technology and warfare as explained in *Knowledge and Speed*, the 1997 annual report on the AAN effort.[13] Countermobility and mobility are dynamics within an action-reaction-counter-reaction cycle. Just as the potential for "second cycle warfare," manifested during World War II, could be seen emerging back in World War I, the development of countermobility closely followed the efforts to maneuver. Within a year of the debut of tank warfare at Cambrai in 1917, the Germans employed crude anti-tank mines in response.[14] With development of mechanized warfare between the wars, military force during World War II encountered first generation anti-tank mines employed in vast quantities, as well as new concepts for other anti-vehicular obstacles such as dragon's teeth, anti-tank ditches, and demolition obstacles. Even the earliest efforts at a scatterable mine capability were seen by early World War II.[15]

Technological developments within the physical arena of countermobility have been minimal since World War II. The development of barbed wire into rapidly emplaceable concertina was a significant development that provides a rapidly emplaceable physical obstacle effective against dismounted maneuver. Other progress in this area has been focused toward improved machinery for digging and technological improvements in explosives technology. However, old concepts such as tank ditches and boulder roadblocks still pose threats to ground vehicle mobility.

Mine warfare, however, has substantially developed in ways contributing to both the components of lethality and uncertainty that make minefields effective obstacles. Since World War II, changes in sensor technology have made mine actions much more complex, and advances in warhead technology have made mines more lethal. Various improvements in delivery and emplacement techniques have yielded mining systems that are both rapidly and remotely emplaceable.

Disturbing to proponents of maneuver is the fact that capabilities and techniques to respond to the mine threat have lagged behind the pace of mine development. Mechanical reduction capabilities such as plows, rollers, and flails, the same techniques used during World War II, are still commonly fielded to today's forces. In fact, the Army is still in the development process for a modernized counter-mine capability by mechanical reduction, the Grizzly breacher vehicle.[16] While incorporating tank-comparable mobility and state-of-the-art technology for controlling a full-width plow blade, this vehicle is actually an effort to field an effective countermeasure to what C.E.E. Sloan has delineated as first and second generation mine threats while a third is already emerging.[17] In short, technology has been and still is advancing the mine threat faster than capabilities to counter mines. The Army's technology master plan for last year assessed that:

> Mine improvements will likely continue at a rapid pace. Inexpensive, land mines can destroy multi-million dollar weapon systems. The future outlook is even more ominous, with the evolution of new smart mines. Micro-electronics will soon take mines to new levels of lethality. The countermine shortfall is particularly worrisome because it strikes at the heart of the Army's doctrine of rapid movement and surprise to win quick decisive victories."[18]

Doctrinal concepts have followed the technological developments for countermobility, specifically the mine warfare component of countermobility. While in 1985, FM 5-102 addressed employment of *scatterable* mines, a refined capability by the 1980's, FM 90-7 ten years later addressed a concept in which the capability could be employed--the *situational* obstacle. Situational obstacles are differentiated from *directed* or *reserve* obstacles in that minefields can be planned, but executed only upon discrete criteria, or situational factors of enemy and/or friendly forces. The enabling factors for situational obstacles are that scatterable mines are rapidly emplaceable and, by some delivery systems, remotely emplaceable. The potential for an obstacle on the battlefield can be held by a commander until the situation develops as to when the obstacle will be needed and where (at least among a discrete set of employments) it will best support the commander's concept for operations. The concept of situational obstacles addresses use of countermobility capability in a more advantageous manner against the enemy, and further considers minimizing potential restraints on friendly maneuver by our own obstacles. The concept also addresses the temporal aspect of countermobility effects inherent to the self-destruct characteristics of scatterable mines.

Current developments such as wide area munition (WAM) and intelligent minefield (IMF) may be considered examples of Sloan's concept of third generation mines. He specified examples such as off-route mines like the U.S. M24 or M66 systems and the ERAM (extended range anti-armor munition).[19] WAM and IMF are significantly more advanced, showing the technological progress over the decade since Sloan's writing. Doctrinal concepts for such third generation systems are still being developed. Similar to doctrine for situational obstacles lagging the technological developments of second generation mines, the Army's experimental force and those working with it use a new term of "dynamic" obstacles to describe the countermobility potential of Force XXI.

But, a specific definition or distinction of operational concepts is yet to be articulated.

THE DIRECTION OF AAN--A QUEST FOR ENHANCED MANEUVER

The base premise for the Army After Next effort is that the Army, as the nation's core land combat force, must develop the forces capable of dominant maneuver as well as precision engagement. The Army After Next must be able to:

> "conduct battle rapidly and to end it cleanly at the moment when the paralytic effect of firepower is greatest...(forcing) psychological collapse--the breaking of an enemy's will to resist--(which) results when an opponent finds himself challenged and blocked wherever he turns."[20]

The underlying assumptions are that "the object of war is not to kill the enemy so much as it is to break his will to resist," that decisive victory in war must be achieved by forces on the ground, and that firepower alone is limited in effect.[21]

While precision capabilities have enhanced destructiveness of firepower, enemy forces have always and will always take measures to maximize their protection and survivability and continue to fight. Firepower alone cannot be counted on to defeat the will of an enemy nation or force. Firepower alone cannot guarantee establishment of military conditions needed to support national strategic objectives. The capability to maneuver is essential for decisive victory.

The Army After Next effort is seeking avenues by which the Army can attain physical agility to capitalize on mental agility. Enhanced situational awareness, a capability that the Army will gain in moving toward the digitized Army XXI, will allow commanders to maneuver forces more rapidly and effectively. In moving toward AAN, the Army also will develop the physical ability in terms of organization, equipment, leaders, and soldiers, for future land combat units to move with speed that will allow exploiting enhanced and superior situational awareness.

In AAN war games conducted during 1997, forces were envisioned with the capability of conducting "an air-ground tactical method of maneuver that combined lighter surface fighting vehicles with advanced airframes capable of transporting them at speeds as great as 200 kilometers per hour over distances in excess of 1500 kilometers...terrain came to serve a protective and concealing function without restricting mobility." The speed for operational maneuver will necessitate the Army's shift "upward from its traditional two-dimensional spatial orientation of land forces into the vertical or third dimension."[22]

The specific capabilities of this future force have been detailed in forces assumed for war games. AAN has stipulated objective criteria to which developers have already developed technologically constrained concept designs. *Knowledge and Speed*'s air-ground concept has been conceptually embodied in a mix of ground vehicles transported in or under advanced airframes giving a capability for rapid operational and tactical maneuver. The force also has a family of aerial vehicles, all unmanned and operating at different altitudes and varying durations on-station, for purposes of reconnaissance and surveillance, air defense, fire support (precision engagement), and C4I support.

The ground vehicle concept is for a family of advanced fighting vehicles (AFV), fifteen-ton wheeled vehicles with light armored protection, capable of 90-mph road speeds and 50-mph cross country speeds and a 1000-mile range. AFVs are configured in two versions of fighting vehicles and other versions for C2, information management, fire support, reconnaissance, utility transport, and maintenance. All have a different array of crew, weaponry, and support capabilities. The AFV is supplemented by the advanced robotic engagement system (ARES) which is a 3-4 ton vehicle controlled by the AFV out to a range of 200 meters. The AFV incorporates robotic mine sensor/clearer capability and one version is equipped with an earth-moving blade. Additionally, the force had capability to emplace "advanced brilliant mines

(ABM)" either by direct (vehicle or hand) or remote (artillery) means.

The advanced airframe (AAF), a fixed wing tilt rotor craft with a 2000 km range and speed up to 560 kph, provides transport for the AFV (one or two per airframe) and the ARES (up to four per airframe). More than just a lift airframe, the AAF with its weaponry and ability to take on an attack pod is also an airframe for attack.[23]

The Mobility Integrated Idea Teams worked through the summer of 1997 and developed technologically feasible concepts to meet these envisioned operational characteristics with base case vehicles for the AFV and AAF. The team for the base case ground vehicle came back with pertinent mobility characteristics of a less than 15 ton wheeled vehicle capable of 40 mph cross country and 75 mph road speed (100 mph burst) with a range of 600 miles. The team for a base case airframe examined concept feasibility for rotary wing and tilt-rotor airframes capable of transporting the 15-ton ground vehicle to a mission radius of 1000 km.

Linked to the technological capabilities enabling air-ground mobility at significantly higher speeds and ranges, the AAN effort has produced operational concepts or patterns for how these mobility capabilities will be employed. Out of the Winter

War Games of 1997 came concepts for conduct of dispersed tactical operations, enabled by enhanced mobility and knowledge. Effects will be massed as opposed to forces. Prior to the AAN 97 Winter Games, similar concepts for future warfighting were already envisioned within the discussions of the OSD/DCSOPS sponsored *Dominating Maneuver Workshop IV*, held in Spring, 1996. One example envisioned at this workshop, the "swarm" concept, includes small and dispersed units massing briefly and suddenly in synchronized and decisive combat action against the enemy. The concept included three forces with distinct roles, "pick a path (Eagle), make a path (Tiger), and exploit a path (Cobra)." Elements of a "swarm" force would execute key tasks to include emplacement of "dynamic" obstacles and breaching.[24] While the "swarm" concept may be the extreme for dispersion of force, the general trend through the body of all concepts examined at that workshop, and the trend within AAN thought, has been toward dispersed operations. Dispersion and speed of movement are seen as essential for force protection and retention of the force's potential to "pulse" against the enemy with precision and simultaneity.

THE SIGNIFICANCE OF COUNTERMOBILITY FOR AAN--WHY AND HOW

> "Future land units will exploit terrain by maneuvering for tactical advantage within the folds and

undulations of the earth's surface without suffering the restrictions imposed on mobility by contact with the ground."[25]

Statements such as that above might be taken to imply that technological advancements will allow the Army's future forces to maneuver without concern for natural obstacles or for efforts of an adversary to shape the existing battlespace in order to fight on more favorable terms. However, as noted in the previous section, efforts to conceptually design a force structure for the Army After Next have included consideration of both a countermobility capability within that force and a counter-countermobility capability, or mobility capability, for overcoming obstacle efforts of the enemy.[26] The fact that countermobility capabilities are included in hypothetical force constructs for AAN war games may be *prima facie* evidence of continued significance of countermobility for future operations. But let's examine in more detail the implications of the specific directions the Army is pursuing for technologically advanced mobility and consider potential simultaneous advancements in countermobility. Beyond advances in technology, emerging maneuver concepts have characteristics that will offer continued but different opportunities for response with countermobility measures. I will focus first on how countermobility could impact our AAN effort to regain maneuver ascendancy and secondly look at ways in which countermobility will serve as a continued important combat multiplier for how the AAN force will fight.

AAN's air-ground mobility concept still presents potentially lucrative opportunity to an adversary to employ countermobility against the AFV and AAF in combination and/or separately. The AFV is a 15 ton wheeled vehicle. There is nothing in the vehicle's concept that would give it any kind of significantly greater capability versus today's array of physical obstacles than current fighting vehicles. Hence, there is no reason for any confidence that enemy forces would not have capability to degrade the maneuver of AFV equipped forces, perhaps yielding future situations such as those described in the first pages of this paper. Increased speed of the vehicle would cause the most high technology proximity fused mines such as off-route mines or WAM to have less probability of effective engagement. Increased speed may also diminish time available for obstacle execution. But, increased speed will have no impact on lethality of lower-technology first and second-generation mines.

The AFV concept envisions an integral remote mine sensor and robotic clearing apparatus as capabilities for overcoming mine obstacles. And, in fact, the Army and the Defense Department are currently embarked on several advance technology demonstrations

(ATDs) that have been incorporated into the Joint Countermine Advanced Concepts Technology Demonstration (ACTD). These efforts are promising in that they pursue the general area of technologies needed to enable a future force to overcome mine obstacles. But, as the research and development effort is pursued, there are three challenges that will have to be successfully overcome to enable true physical agility to the Army After Next:

> -Mine detection and neutralization systems will not only have to be effective but also durable and lightweight.
> -Capable systems will have to be employable at speeds that will not degrade battle force maneuver unacceptably for the design operational concept
> -Energy sources of feasible weight, power, and longevity will have to be available for any directed energy technologies, particularly for use in mine neutralization.

By virtue of being wheeled, the AFV will be more susceptible than a tracked vehicle to effects of non-lethal obstacles such as craters, ditches, and rubble. Adding a blade to a 15-ton wheeled vehicle will give it little capability for clearing emplaced, excavated, or blasted obstacles. The laws of physics dictate that a substantial amount of work (force x distance) is needed to clear such obstacles back to trafficable conditions. Explosives technologies have and will offer techniques for reduction of physical obstacles but concerns remain. These issues include timeliness of employment, signature of employment, and reliability of results. Alternatively, materials technologies may offer potential for filling or building up obstructed terrain to become passable. But, no technology development effort in this direction is past infancy at best.

In summary for the ground piece of the air-ground maneuver concept, potential adversaries will have capabilities of yesterday and today to emplace obstacles in the path of an AFV force. If they should have the opportunity, then countermobility will have significant impact. While physical obstacle technology has not changed greatly since World War II, this is now a focus of new research.[27] The ground element of this air-ground force may maneuver rapidly between obstacles but, at an obstacle, maneuver may be delayed or stopped unless significant advancements are forthcoming in the arena of mobility support. As noted earlier, this would require more than just keeping pace with mine advancements but an effort to first catch-up, then keep-up.

The advanced airframe (AAF) would give AAN battle forces the capability to move over the ground and any emplaced obstacles. Other concepts have been considered, such as within the technology workshops of the AAN Winter War Games, for over-the-ground vehicles as future fighting platforms of the "land" force, relieving the Army of "suffering" for the ground-bound mobility of the AFV.[28] However, while such maneuver would take a considerable technological development, obstacle and mine responses to counter the maneuver capability are just as technologically feasible.

Precursors of such countermeasures have already appeared. The idea of using terrain for its protective effects while maneuvering over it to avoid its restrictions does little to change the relevance of intelligence preparation of the battlefield to include terrain analysis of mobility corridors and time-space relationships. Having templated how an opposing force may maneuver, even over the ground, situational obstacle capabilities effective against such an over-ground force are within near term feasibility for potential adversaries. Anti-helicopter mines have already been developed in the United States and Europe. Under Army contract, both Textron Defense Systems and Ferranti Components Division of the United Kingdom have developed concept models for anti-helicopter mines that function with similar sensor arrangements and projected warhead capabilities as the U.S. WAM (wide-area munition).[29] The British and Germans have also developed an anti-helicopter mine dubbed HELKIR.[30] These types of ground systems, effective against low flying combatants, exemplify the potential of countermobility. Such technology will enable lethal obstacles that attack *over-ground* maneuver and enhance fires effects, in this case direct fires and fires of air defense weapons that can engage as platforms move to higher altitudes to avoid the mine threat. In terms of FM 90-7 obstacle effects, such mines would offer a capability to "turn" over-ground maneuver in the vertical dimension. With advancements to employ such mines rapidly and remotely, the concept of situational obstacles would render a capability very effective against over-ground maneuver.

The mobility solution of moving into the third dimension may well stimulate other innovations that could counter maneuver as rapidly as gains could be realized. Aerial obstacles have been attempted in the past. Over fifty years ago the British produced the "Short and Long Aerial Mine."[31] The devices suspended heavy steel cables from parachutes, intending to disrupt German flying formations during the Battle of Britain. Whether these devices constituted an aerial mine (lethal obstacle) or an obstacle (physical barrier impeding mobility), the idea of using physical impediments in the airspace to counter air mobility is not new or beyond feasibility. British Wallop Industries built a 1980's update on such a device called a "Skysnare," which uses a kite balloon pulling a Kevlar cable obstruction up to an altitude of 300 meters, well above common coordinating altitude for Army aircraft and well above the nap-of-the-earth flight altitudes envisioned within the AAN air-ground maneuver concept.[32]

Aerostats, employed for military purposes since the Civil War, also offer renewed potential utility in this arena. Use of aerostats has recently reemerged for air defense early warning purposes by serving as long station-time platforms for airborne sensors.[33] With development of smaller and more lethal munitions, using such a platform for aerial mines would be feasible. Alternatively, such long duration platforms could also provide a basis for non-lethal attacks on air maneuver to include particulate release which would degrade or damage air-breathing engines upon ingestion or, electromagnetic pulse that would attack avionics, target acquisition, communication, and weapons control systems on tomorrow's future fighting vehicles.[34] Obstacles of this nature could be effective even if static in terms of position. In considering all of these examples, it is apparent that there is a range of promising technological reactions that adversaries may take to U.S. actions pursuing maneuver ascendancy.

Stepping back from the specific issue of ground or air mobility for fighting vehicles, the operational concepts for future dominant maneuver by land forces should cause concern for countermobility responses. While dispersion and smaller units linked by enhanced situational awareness would appear to yield a warfighting pattern that would be less vulnerable to obstacle operations, increased capacity for situational obstacles on the part of our adversaries would still be a distinct threat. For example, if the enemy could discern the patterns of a "swarm" operation, employment of a capability for situational obstacles at the location that the "Tiger" team finds a "path" would hold significant potential for interference with the "Cobra" team's exploitation maneuver.

Should AAN operations move beyond AAF/AFV air-ground maneuver and shift further into over-ground maneuver, the countermobility experience of the Navy may take on new relevance for the Army. The Army's current concepts with regards to countermobility are centered on obstacles and anti-vehicular mine employment against a mechanized force, concepts dating back primarily to World War II. However, the Navy, with its maneuver through the comparatively featureless medium of the world's oceans, has been struggling with a concept of mine warfare for at least a hundred more years. Disregarding restrictions such as straits, naval mining is effective in areas where naval forces need to project to impact battle space around land-based objectives, targets, or ports. Mines are effective sea obstacles at the periphery of the featureless medium. Employment of future maneuver countermeasures in the airspace may be similar. Obstacles would still be effective where the medium for maneuver becomes constrained--again, at the periphery of the medium--above the ground on which targets and objectives are located. Viewed within the construct of current Army doctrine for countermobility, such employment of future obstacles or mines fits the concept of protective obstacles, helping to counter the maneuver of assaulting forces in order to retain a position, protect the force, and continue mission support.

With consideration of service approaches to countermine and mobility support, it is interesting to note that there is a widely held perspective in both services that disregards or diminishes the capability to attack our maneuver. The Navy has traditionally neglected mine warfare and has recently been playing catch-up with their countermine capability.[35] Similarly, a tendency to overlook such capabilities also exists within the Army. *Knowledge and Speed* reflects such thought, giving concern to natural obstacles but not to reinforcing obstacles. *Breaking* *the Phalanx*, a recent proposal for new combined arms formations at lower echelon of command includes engineer mobility structure within the combined arms battalion but fails to address staff integration at the group level. Colonel MacGregor portrays heavy combat group operations as largely immune to obstacles except for when they "pick their way through."[36] A 1994 report commissioned by Undersecretary of Defense for Policy minimizes the utility of landmines by conducting set piece tactical defense simulations. Although the capacity of mine obstacles to thwart attacks and counterattacks is clearly noted, the ramifications of this finding for an offensively focused Army are not examined within a context of superior application of the dynamics of combat power.[37]

The significance of countermobility in AAN operations lies not only in the fact that future obstacles or mines may degrade force mobility, causing decisive delays in maneuver, but also because the survivability of the force is dependent on its ability to move rapidly. Force protection is risked by giving up traditional forms of protection such as armor plating, in order to gain in the complementary dynamic of combat power, maneuver. Once slowed the force is very vulnerable. By the air-ground concept of *Knowledge and Speed*, if the force has to "bypass" obstacles by moving out of the protective folds of terrain, folds that also identify potential axes of advance to the opposing commander who has analyzed his battlespace, the force becomes more vulnerable. Countermobility efforts will be an understandably attractive area of focus for a force preparing to do combat with the Army After Next.

The capability of ***our*** forces to execute countermobility will also be a significant combat multiplier for success in battle. While we seek to increase significantly the mobility of the force, the measure of how fast is fast enough must be gauged relative to an adversary's capability to maneuver and to engage with fires. Our integration of countermobility will continue to offer battlefield effects to gain this relative increase, not just compared to our capabilities today but relative to an enemy's capability tomorrow. With the speed of movement and offensive focus envisioned for AAN operations, the AAN battle force would be well served to have a truly "dynamic" obstacle capability.

Although the concept of "dynamic" obstacles has not yet been defined formally, the Army appears to be headed toward an extension of the concept of situational obstacles to a capability not only for near-instantaneous emplacement, but also for command activation/inactivation so that the lethality of a minefield becomes controllable. The capabilities of the previously cited "advanced brilliant mines" are not detailed in the AAN report, but the term itself implies an extension of the Intelligent Minefield (IMF) concept, an effort started in FY93 as an ATD programmed through FY00.[38] This enhancement in control of minefield lethality will indeed offer obstacle capabilities that will be "dynamic" on the battlefield in terms of space and time. In support of precision engagement, the capability to employ higher capability situational or even dynamic obstacles would still enhance fires through traditional effects of slowing or temporarily halting moving forces. Such capabilities could turn moving forces into alternate mobility corridors (perhaps vertically), and set up precision engagements in locations of greater tactical or even operational advantage.

While *preparation* is a characteristic of defensive operations by Army doctrine, the increase of information capabilities should enable the AAN battle force to be more capable of preparation prior to offensive operations. Enabled by its intimate knowledge of the terrain of the National Training Center, the OPFOR regiment routinely shapes the battlefield with employment of persistent chemicals, scatterable mines, and preparatory forces. Knowledge capabilities such as those to be gained through Force XXI development should enable very refined analysis of the battlespace for tactical effects of the terrain. Commanders and staffs could analyze weapons effects and integrate obstacle effects--prepare the battlefield--even for the offense. While such capability would require significant advancements over currently fielded systems, these would certainly seem to be technologically feasible prior to the 2020 time frame.

Such obstacle employment would fit the FM 90-7 doctrinal concept of obstacle employment to fix an enemy for attack or strike by precision fires or to disrupt as part of a security operation. However, AAN concepts also contain seeming requirements for countermobility employment for purposes of protection. Dependent on rapid movement for protection of the force, AAN operations will include inherent requirements for the force to slow or halt, even if by the commander's own choosing. In these instances, the capability to execute countermobility against enemy forces that may assault the battle force position would still be important. Additionally, protective obstacle capabilities will be needed for any support assets, even if located very remotely from area of battle force operations, for fixed position activities.

CONCLUSIONS AND IMPLICATIONS

By this examination of AAN directions along with trends of countermobility capabilities and concepts, it is apparent that countermobility will continue to be a significant factor in the future. Our Army must be able to overcome an adversary's employment of such techniques against us in order to achieve the desired ascendancy of maneuver. With this significance, there are several implications for our efforts in moving toward the Army After Next.

First, the Army must pursue continued research and development in the arena of mobility/countermobility hand in hand with efforts to develop a force with physical agility. Lagging mobility support capabilities identified earlier cannot be ignored if we are to attain the desired mobility enhancements. As the force's capability to maneuver will still be subject to attack, capability to execute breach operations will still be required, though that breach will differ from that attempted on 29 March by Task Force XXI. Rapid obstacle reduction will be an essential fundamental of such breaching operations, enabled by precursor abilities to acquire and analyze the obstacle.

In order to equip such a highly mobile force with obstacle reduction capability, we will obviously have to move beyond the dependence on the heavy mechanical reduction implements that we currently have and are scheduled to be fielding through the first decade of the next century.[39] Efforts such as the Joint

Countermine Advanced Concepts Technology Demonstration (ACTD) are moving in the right direction. The capabilities sought with Vehicular Mounted Mine Detector (VMMD), Off-Route Smart Mine Clearer (ORSMC), and Mine Hunter/Killer are operational capabilities needed now to support such a concept as AAN in the future. Developmental efforts for mobility support must continue to have sufficient priority and resource commitment to actually field the envisioned capabilities. Comparison of funding for Army Advanced Technology Demonstrations (ATDs) during fiscal year's 1998 and 1999 shows mobility/countermobility related ATDs are targeted for about 14% of the Army's program for each year.[40] However, a glaring observation of any visit to the National Training Center today is the continued use of M60 and even M48 tank chassis by engineer units as a combat vehicle platform for mobility support. When research, development and procurement funding is rolled together for fiscal years 1997 through 2006, only 0.6% is targeted for engineer systems.[41] Furthermore, an area in which technological development is lacking is in new capabilities to overcome non-lethal obstacles. Funding of counterobstacle capabilities must be integral with enhanced mobility efforts and all other developments needed to gain physical agility.

Second, the Army should continue to develop the concept of "maneuver support" as an operating system or functional area that transcends current branch structure. Just as right organization and doctrine are needed to exploit technological breakthroughs and bring about revolutions in military affairs, all the factors of doctrine, training, leader development, organization, modernization, and soldiers (DTLOMS) must be integrated if the Army is to capitalize on the products of our ATDs and ACTDs. The growing complexity of threats to maneuver will dictate that the Army After Next have forces and leaders dedicated to maneuver support, understanding the complexities of the threat, and fully appreciating the capabilities and employment of an array of capabilities that will be necessary to minimize an adversary's effectiveness in degrading our maneuver. The Navy is headed in a similar direction with its Mine Warfare Command and surface and aviation force structure focused on countermine actions.

The requirement for a combat support function of maneuver support would suggest that our current force structures and doctrines for combat engineer functions, chemical reconnaissance, smoke generation, and battlefield circulation control may need to be relooked and refined to a more responsive support concept and force structure. MacGregor's question concerning how to comprise and command combined arms formations is very much at issue here.

We have made mistakes in this arena before by trying to build mobility capabilities directly into our armored forces. However, the effectiveness of these capabilities was limited by the finite span of attention of those concerned with closing with and killing the enemy. Structuring armored vehicle launched bridges and mine plows and rollers into the tank battalions are both examples of capabilities not utilized to full effectiveness due to poor organization. And, if the potentials of third dimension maneuver and countermobility are realized, our maneuver support forces will have to be structured to overcome these threats in all dimensions.

Lastly, our AAN will require countermobility capabilities fitted to our operational concepts and effective against an array of enemy capabilities. The U.S. has been a technological leader in mine warfare and with current ATDs such as Intelligent Minefield should continue to be for sometime. However, in moving to the Army After Next, there are some concerns for our countermobility development efforts. First, the U.S. capabilities for remote emplacement are lagging. As addressed earlier, remote emplacement, with rapidity of emplacement, is an underpinning of the concept of situational obstacles. Rotary and fixed wing air platforms are vulnerable during minefield emplacement. And, with mission planning and preparation times, these systems are less rapid than they may seem at first glance. The U.S. should seriously examine rocket emplacement capability, a direction that countries of the former Soviet block have extensively developed.[42]

The second concern would be that our countermobility capability becomes overly simple, losing the factor of uncertainty that enables minefields to be effective obstacles. Investment in one or two very capable systems such as WAM and Volcano can carry a disadvantage of simplifying an adversary's countermine efforts. While scatterable mines offer a significant capability in that they are rapidly emplaceable and very lethal, there are potential drawbacks in the fact that they are also surface laid and, therefore, more easily acquired and vulnerable to countermeasures. Putting all of our countermobility capability into one or two high technology systems at the cost of a greater palette of capabilities, may not serve the Army well over the full spectrum of operations that we will conduct. Perhaps the significant contribution that new technology contributes is greater diversity and complexity in the range of capabilities as well as the new capability itself.

Also, in developing our future capabilities for countermobility, we should not lose sight of the potential for low technology countermeasures to high technology munitions, to include mines. Even today as we invest significant amounts of money into high technology munitions such as WAM, we must not forget potential simple responses to such high-tech munitions, such as being incapacitated by dismounted infantry. The complementary overlaps of combined arms and high/low technology mixes will continue to be important for full spectrum dominance.

Word Count: 6656

ENDNOTES

[1] Accounts of events during Brigade AWE are personal observations of the author.

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[5] Ibid, 4.

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[7] Department of the Army, Operations, Field Manual 100-5 (Washington, D.C.: U.S. Department of the Army, 1993), 2-14.

[8] Field Manual 100-5(Draft), 6-1.

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[10] Department of the Army, Operations, Field Manual 100-5 (Washington, D.C.: U.S. Department of the Army, 1986), 2-9 to 2-12.

[11] U.S. Marine Corps, Division Operations, Fleet Marine Force Manual 6-1 (Washington, D.C.: U.S. Department of the Navy, 12 Jul 1995), 7-12,-13.

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[13] Knowledge and Speed, A1-A3.

[14] Sloan, C.E.E., Mine Warfare on Land (London: Brassey's Defence Publishers, 1986), 1.

[15] Harry N. Hambric and William C. Schneck, "The Vehicular Mine Threat" (Fort Belvior, VA: Night Vision Electronic Sensor Directorate, 30 Dec 1994), 15.

[16] MAJ Harry Greene, "The Grizzly and the Wolverine: Alternatives to an Orchestrated Ballet of Farm Implements," Engineer, U.S. Army Professional Bulletin No. 5-96-3, Aug 1996.

[17] Sloan, p24-25, 126-127.

[18] Department of the Army, Army Science and Technology Master Plan, Fiscal Year 1997 (Washington, D.C.: U.S. Department of the Army, 21 Mar 1997), III-M-3.

[19] Sloan, 127.

[20] Knowledge and Speed, 5.

[21] Ibid, A-3

[22] Ibid, 13 & 18.

[23] "US Forces for Planning," as accessed from ARTAC, http://artac1.mil. Accessed 17 October 1997.

[24] Science Applications International Corporation, Dominating Maneuver Workshop IV Summary Report (Carlisle Barracks, PA: US Department of Defense, Office of the Secretary of Defense and US Army War College, Center for Strategic Leadership, 1996), 10.

[25] Knowledge and Speed, 18.

[26] Mobility support by its pure doctrinal definition per FM 100-5 includes actions to overcome existing obstacles to maneuver, whether they be natural or cultural, as well as obstacles emplaced by they enemy pursuant to combat intentions. Mobility discussions within this paper will be confined to those

necessary to overcome opposing force countermobility efforts, hence, countermobility as the base concept for discussion.

[27] Michael Raphael, "Stop that Tank, but Don't Destroy It," Philadelphia Inquirer, 22 Nov 1997.

[28] Knowledge and Speed, 18.

[29] Christoper F. Foss, Jane's Military Vehicles and Ground Support Equipment, 1995 (London: Jane's Publishing, Inc., 1995), 240.

[30] David R. Alexander, "Antihelicopter Mines: The Emerging Threat to Helicopter Operations," U.S. Army Aviation Digest, May/June 1993, 37.

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[35] See Arthur A. Adkins and David P. Burnette, "Solving the Mine Countermeasures Problem: A Matter of Focus and Priority," (Newport, RI: U.S. Naval War College, May 1996).

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