Military Review

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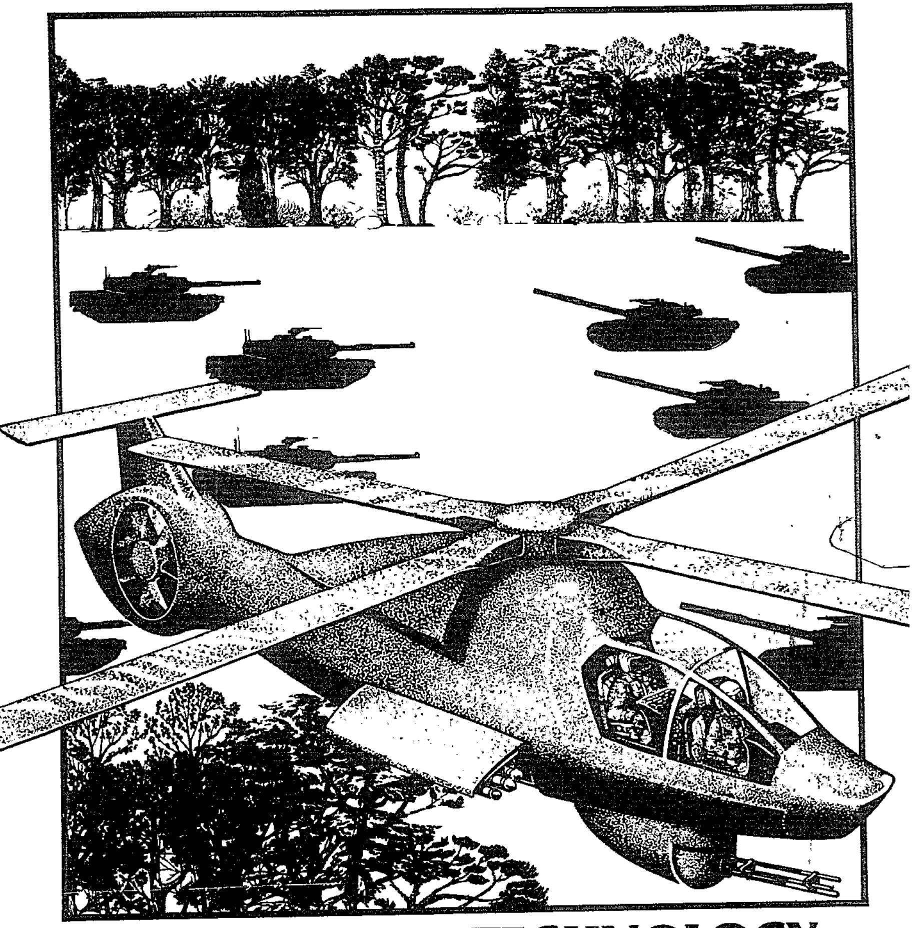

FUTURE WAR/TECHNOLOGY

... see pages 2—49

Military Review

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The **Mission** of MILITARY REVIEW is to provide a forum for the open exchange of ideas on military affairs; to focus on concepts, doctrine and war fighting at the tactical and operational levels of war; and to support the education, training, doctrine development and integration missions of the Combined Arms Center and the Command and General Staff College.

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From the Editor

In this time of unprecedented change in US international relations, members of the Armed Forces face some exceptional challenges. The main challenge is to determine what lies ahead. As we look out toward an ambiguous future, we must find answers to some important questions. What will be the nature of warfare in the future? What will be the major threat to US security? What type of organizations, arms and equipment will be needed for our military forces? What impact will new technology have on war-fighting in the next decade and beyond? In short, where do we need to go and how do we get there?

These are only a few of the perplexing questions facing us as we confront the dual nature of our profession. We must be ready to fight tommorrow morning's war with today's arms and equipment, while concurrently identifying the requirements for future war and charting a reasonable course toward those future requirements. As tough as the first part of our mission is, the second task is even harder. It involves making well-reasoned decisions on such critical issues as force design, weapons development and procurement, development of doctrine and training for leaders and soldiers.

With the above questions in mind, this issue of *Military Review* presents some articles that focus on one aspect of the problem—the technological future of war. Realizing full well that not all future military problems will have a technological solution, the authors, nonetheless, ponder the impact of present and future technology on the profession of arms and remind us that war-fighting doctrine and technology are inseparable. Although focusing on the material aspect of war, the authors emphasize repeatedly the importance of the human element in war.

Two of the articles in this issue are winners in our recent writing contest. Major Robert Strange's "Bright Promise or Broken Dream" won first place. His article discusses reasonable expectations of future war, the impact of high technology weaponry on war-fighting doctrine, sociological limits governing the use of military forces and the future threat to US security. Lieutenant Colonel Clayton Newell's essay titled "The Technological Future of War" took third place. In our focus on future technology, Newell keeps us honest by reminding us that man remains the dominant figure in war, the "lifeblood of the Army." The second place winner was Captain Kevin B. Smith. His essay, "Back to the Trenches," is scheduled for future publication.

Finally, this issue inaugurates a short, new feature titled "CALL Forum." CALL is the acronym for the Center for Army Lessons Learned located here at Fort Leavenworth. It disseminates to the Total Army combat-relevant lessons gleaned from Armywide training exercises, combat training center rotations, historical sources and doctrinal research. Our "CALL Forum" section is designed to add to the dissemination process by highlighting a few relevant lessons learned on one of the battlefield operating systems.

PWC

THE CHANGING

FACE OF WAR
INTO THE FOURTH GENERATION

William S. Lind,
Colonel Keith M. Nightengale, US Army,
Captain John Schmitt, US Marine Corps,
Colonel Joseph W. Sutton, US Army, and
Lieutenant Colonel G. I. Wilson, US Marine Corps Reserve

The authors look at the makeup of war in recent generations and posit that we are on the verge of a new generation. They see this generation as one that may combine very different methods of waging war with significant new technology. The result, they warn, will require the military and the nation to adapt to this changing face of war.

THE PEACETIME soldier's principal task is to prepare effectively for the next war. In order to do so, he must anticipate what the next war will be like. This is a difficult task that gets continuously more difficult. General Franz Uhle-Wettler of the West German army writes:

"At an earlier time, a commander could be certain that a future war would resemble past and present ones. This enabled him to analyze appropriate tactics from past and present. The troop commander of today no longer has this possibility. He knows only that whoever fails to adapt the experiences of the last war will surely lose the next one.[1]

If we look at the development of warfare in the modern era, we see three distinct generations. In the United States, the Army and Marine Corps are now coming to grips with the change to the third generation. This transition is entirely for the good. However, third-generation warfare was conceptually developed by the German offensive in the spring of 1918. It is now 70 years old.[2]

This suggests some interesting questions:

- Is it not about time for a fourth generation to appear?
- If so, what form might it take?

These questions are of central importance. Whoever is first to recognize, understand and implement a generational change can gain a decisive advantage. Conversely, a nation that is slow to adapt to generational change opens itself to catastrophic defeat.

Our purpose here is less to answer these questions, than to pose them. Nonetheless, we will offer some tentative answers. To begin to see what these might be, the questions must be put into historical context.

Three Generations of Warfare

While military development is generally a continuous evolutionary process, the modern era has witnessed three watersheds in which change has been dialectically qualitative. Consequently, modern military development comprises three distinct generations.

First-generation warfare reflects tactics of the era of the smoothbore musket, the tactics of line and column. These tactics were developed partially in response to technological factors—the line maximized firepower, rigid drill was necessary to generate a high rate of fire, and so on—and partially in response to social conditions and ideas, with the columns of the French revolutionary armies reflecting both the élan of the revolution and the low training levels of conscripted troops. Although rendered obsolete by the replacement of the smoothbore by the rifled musket, vestiges of first-generation tactics survive today, especially in a frequently encountered desire for linearity on the battlefield. Operational art in the first generation did not exist as a concept, although it was practiced by individual commanders, most prominently Napoleon Bonaparte.

Third-generation warfare was conceptually developed by the German offensive in the spring of 1918. It is now 70 years old. This suggests some interesting questions: Is it not about time for a fourth generation to appear? If so, what form might it take?

Second-generation warfare was a response to the rifled musket, breechloaders, barbed wire, the machinegun and indirect fire. Tactics were based on fire and movement, and they remained essentially linear. The defense still attempted to prevent all penetrations; and in the attack, a laterally dispersed line advanced by rushes in small groups. Perhaps the principal change from first-generation tactics was heavy reliance on indirect fire. Second-generation tactics were summed up in the French maxim, "the artillery conquers, the infantry occupies." Massed firepower replaced massed manpower. Second-generation tactics remained the basis of US doctrine until the 1980s, and they are still practiced by most US units in the field.

While ideas played a role in the development of second-generation tactics (particularly the idea of lateral dispersion), technology was the principal driver of change. Technology manifested itself both qualitatively, in such things as heavier artillery and bombing aircraft, and quantitatively, in the ability of an industrialized economy to fight a battle of materiel (*Materialschlacht*).

While the basic concepts of third-generation tactics were in place by the end of 1918, the addition of a new technological element, tanks, brought about a major shift at the operational level in World War II. That shift was blitzkrieg. In the blitzkrieg, the basis of the operational art shifted from place (as in B. H. Liddell Hart's indirect approach) to time.

The second generation saw the formal recognition and adoption of the operational art, initially by the Prussian army. Again, ideas and technology both drove the change. The ideas sprang largely from Prussian studies of Napoleon's campaigns. Technological factors included Helmuth von Moltke's realization that modern tactical firepower mandated battles of encirclement and the desire to exploit the capabilities of the railway and the telegraph.

Third-generation warfare was also a response to the increase in battlefield firepower. However, the driving force was primarily ideas. Aware that they could not prevail in a contest of materiel because of their weaker industrial base, the Germans developed radically new tactics in World War I. Based on maneuver rather than attrition, third-generation tactics were the first truly nonlinear tactics. The attack relied on infiltration to bypass and collapse the enemy's combat forces, rather than seeking to close with and destroy them. The defense was in-depth and often invited penetration, which set the enemy up for a counterattack.

While the basic concepts of third-generation tactics were in place by the end of 1918, the addition of a new technological element, tanks, brought about a major shift at the operational level in World War II. That shift was blitzkrieg. In the blitzkrieg, the basis of the operational art shifted from place (as in B. H. Liddell Hart's indirect approach) to time. This shift was explicitly recognized only recently, in the work of Colonel John Boyd, US Air Force, Retired, and his OODA (observing, orienting, deciding and acting) Loop theory.

Thus, we see two major catalysts for change in previous generational shifts: technology and ideas. Therefore, we should ask, what perspective do we gain from these earlier shifts as we look toward a potential fourth generation of warfare?

Elements That Carry Over

Earlier generational shifts, especially the shift from the second to third generation, were marked by growing emphasis on several central ideas. Four of these seem likely to carry over into the fourth generation, and indeed to expand their influence.

The first is mission orders. Each generational change has been marked by greater dispersion on the battlefield. The fourth-generation battlefield is likely to include the whole of the enemy's society. Such dispersion, coupled with what seems likely to be increased importance for actions by very small groups of combatants, will require even the lowest level to operate flexibly on the basis of the commander's intent.

Second is decreasing dependence on centralized logistics. Dispersion, coupled with increased value placed on tempo, will require a high degree of ability to live off the land and the enemy.

Third is more emphasis on maneuver. Mass, of men or firepower, will no longer be an overwhelming factor. In fact, mass may become a disadvantage, as it will be easy to target. Small,

Perhaps the principal change from first-generation tactics was heavy reliance on indirect fire. Second-generation tactics were summed up in the French maxim, "the artillery conquers, the infantry occupies." Massed firepower replaced massed manpower. Second-generation tactics remained the basis of US doctrine until the 1980s, and they are still practiced by most US units in the field.

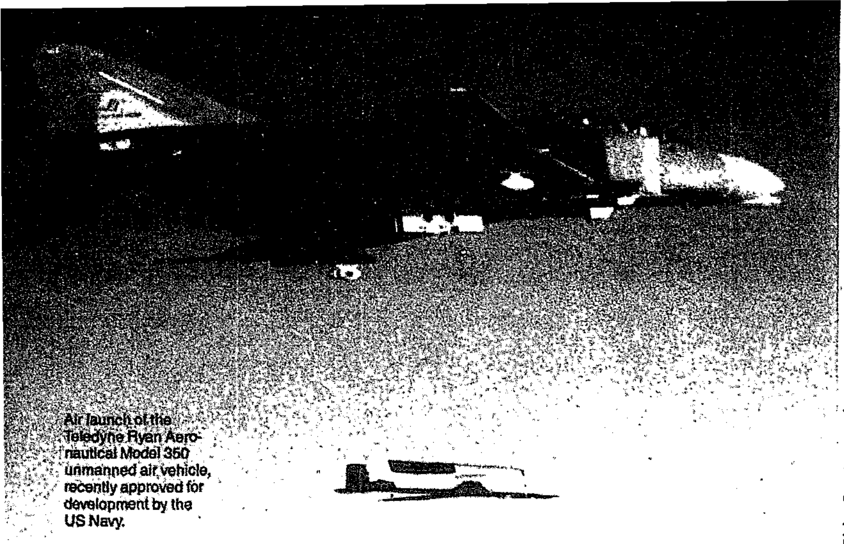
highly maneuverable, agile forces will tend to dominate.

Fourth is a goal of collapsing the enemy internally, rather than physically destroying him. Targets will include such things as the population's support for the war and the enemy's culture. Correct identification of enemy strategic centers of gravity will be highly important.

In broad terms, fourth-generation warfare seems likely to be widely dispersed and largely undefined; the distinction between war and peace will be blurred to the vanishing point. It will be nonlinear, possibly to the point of having no definable battle lines or fronts. The distinction between "civilian" and "military" may disappear. Actions will occur concurrently throughout all participants' depth, including their society as a cultural, not just a physical, entity. Major military facilities such as airfields, fixed communications sites and large headquarters will become rarities because of their vulnerability. The same may be true of civilian equivalents such as seats of government, power plants and industrial sites (including knowledge as well as manufacturing industries). Success will depend heavily on effectiveness in joint operations, as lines between responsibility and mission become very blurred. Again, all these elements are present in third-generation warfare—the fourth generation will merely accentuate them.

A Potential Technology-Driven Fourth Generation

If we combine the above general characteristics of fourth-generation warfare with new



Air launch of the Teledyne Ryan Aeronautical Model 350 unmanned air vehicle, recently approved for development by the US Navy.

Teledyne Ryan Aeronautical

The growth of robotics, remotely piloted vehicles, low probability of intercept communications and artificial intelligence may offer a potential for radically altered tactics. In turn, growing dependence on such technology may open the door to new vulnerabilities, such as the susceptibility to computer "viruses."

technology, we see one possible outline of the new generation. For example, directed energy may permit small elements to destroy targets they could not attack with conventional energy weapons. Directed energy may permit the achievement of electromagnetic pulse effects without a nuclear blast. Research in superconductivity suggests the possibility of storing and using large quantities of energy in very small packages. Technologically, it is possible that a very few soldiers could have the same battlefield effect as a current brigade.

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Small, highly mobile elements, composed of very intelligent soldiers armed with high-technology weapons, may range over wide areas, seeking critical targets. Targets may be more in the civilian, rather than the military, sector. Front-rear terms will be replaced with targeted-untargeted. This may in turn radically alter the way in which military services are organized and structured.

Units will combine reconnaissance and strike functions. Remote, "smart" assets with preprogrammed artificial intelligence may play a key role. Concurrently, the greatest defensive strengths may be the ability to hide from and deceive these assets.

The tactical and strategic levels will blend as the opponent's political infrastructure and civilian society become battlefield targets. It will be critically important to isolate the enemy from one's own homeland, because a small number of people will be able to render great damage in a very short time.

Leaders will have to be masters of both the art of war and technology, a difficult combination as two different mind-sets are involved. Primary challenges facing commanders at all levels will include target selection (which will be a political and cultural, not just a military, decision), the ability to concentrate suddenly from very wide dispersion and selection of subordinates who can manage the challenge of minimal or no supervision in a rapidly changing environment. A major challenge will be handling the tremendous volume and potential overload of information without losing sight of the operational and strategic objectives.

Psychological operations may become the dominant operational and strategic weapon, in the form of media/information intervention. "Logic bombs" and computer viruses, including latent viruses, may be used to disrupt civilian, as well as military, operations. Fourth-generation adversaries will be adept at manipulating the media to alter domestic and world opinion, to the point where skillful use of psychological operations will sometimes preclude the commitment of combat forces. A major target will be the enemy population's support of its government and the war. Television news may become a more powerful operational weapon than armored divisions.

This kind of high-technology fourth-generation warfare may carry in it the seeds of nuclear destruction. Its effectiveness could rapidly eliminate the ability of a nuclear-armed opponent to wage war conventionally. Destruction or disruption of vital industrial capacities, political infrastructure and social fabric, coupled with sudden shifts in the balance of power and concomitant emotions, could easily lead to escalation to nuclear weapons. This risk may deter fourth-generation warfare among nuclear-armed powers just as it deters major conventional warfare among them today.

A major caveat must be placed on the possibility of a technologically driven fourth generation, at least in the US context. Even if the

Soldier operating a Dragon antiarmor weapon system.

The technology itself must be translated into weapons that are effective in actual combat. At present, our research and development and procurement processes have great difficulty making this transition . . . Too many so-called smart weapons serve as examples. In combat, they are easy to counter, fail of their own complexity or make impossible demands on their operators

technological state of the art permits a high-technology fourth generation—and this is not clearly the case—the technology itself must be translated into weapons that are effective in actual combat. At present, our research and development (R&D) and procurement processes have great difficulty making this transition. They often produce weapons that incorporate high technology that is irrelevant in combat or too complex to work in the chaos of combat. Too many so-called smart weapons

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serve as examples. In combat, they are easy to counter, fail of their own complexity or make impossible demands on their operators. The current US R&D and procurement processes may simply not be able to make the transition to a militarily effective fourth generation of weapons.

A Potential Idea-Driven Fourth Generation

Technology was the primary driver of the second generation of warfare; ideas were the prime driver of the third. An idea-based fourth generation is also conceivable.

For about the last 500 years, the West has defined warfare. For a military to be effective, it generally had to follow Western models. Because the West's strength is technology, it may tend to conceive of a fourth generation in technological terms.

However, the West no longer dominates the world. A fourth generation may emerge from non-Western cultural traditions such as found in Islamic or Asiatic societies. The fact that some non-Western areas, such as the Islamic world, are not strong in technology may lead them to develop a fourth generation through ideas rather than technology.

The genesis of an idea-based fourth generation may be visible in terrorism. This is not to say that terrorism is fourth-generation warfare, but rather that elements of it may be signs pointing toward a fourth generation.

Some elements in terrorism appear to reflect the previously noted "carry-overs" from third-generation warfare. The more successful terrorists appear to operate on broad mission orders that carry down to the level of the individual terrorist. The "battlefield" is highly dispersed and includes the whole of the enemy's society. The terrorist lives almost completely off the land and the enemy. Terrorism is very much a matter of maneuver: the terrorist's firepower is small, and where and when he applies it is critical. Terrorism must seek to collapse the enemy from within, as it has little capability (at least currently) to inflict widespread destruction.

Two additional carry-overs must be noted, as they may be useful "signposts" pointing toward the fourth generation. The first is a component of collapsing the enemy. It is a shift in focus from the enemy's front to his rear. First-generation warfare focused tactically and operationally (when operational art was practiced) on the enemy's front—his combat forces. Second-generation warfare remained frontal tactically, but at least in Prussian practice, it focused operationally on the enemy's rear, through the emphasis on encirclement. The third generation shifted the tactical, as well as the operational, focus to the enemy's rear. Terrorism takes this a major step further. It attempts to bypass the enemy's military entirely and strike directly at his homeland—at civilian targets. Ideally, the enemy's military is simply irrelevant to the terrorist.

The second signpost is the way terrorism seeks to use the enemy's own strength against him. This "judo" concept of warfare begins to manifest itself in the second generation, in the campaign and battle of encirclement. The enemy's fortresses, such as Metz and Sedan, became fatal traps. It was pushed further in the third generation, where on the defensive, one side often tries to let the other penetrate, so his own momentum makes him less able to turn and deal with a counterstroke.

Terrorists use a free society's freedom and

A camera crew films operations on the bridge of the USS *Fox*, Persian Gulf, 29 July 1987.

Fourth-generation adversaries will be adept at manipulating the media to alter domestic and world opinion, to the point where skillful use of psychological operations will sometimes preclude the commitment of combat forces. A major target will be the enemy population's support of its government and the war. Television news may become a more powerful operational weapon than armored divisions.

openness, its greatest strengths, against it. They can move freely within our society, while actively working to subvert it. They use our democratic rights not only to penetrate, but also to defend themselves. If we treat them within our laws, they gain many protections; if we simply shoot them down, the television news can easily make them appear to be the victims. Terrorists can effectively wage their form of warfare, while being protected by the society they are attacking. If we are forced to set aside our own system of legal protections to deal with terrorists, they win another sort of victory.

Terrorism also appears to represent a solution to a problem that has been generated by previous generational changes, but not really addressed by any of them. It is the contradiction between the nature of the modern battlefield and the traditional military culture. That culture, embodied in ranks, saluting, uniforms, drill, and the like, is largely a product of first-generation warfare. It is a culture of order. At the time it evolved, it was consistent with the battlefield, which was itself dominated by order. The ideal army was a perfectly oiled machine, and that was what the military culture of order sought to produce.

However, each new generation has brought a major shift toward a battlefield of disorder. The military culture, which has remained a culture of order, has become contradictory to the battlefield. Even in third-generation warfare, the contradiction has not been insoluble. The *Wehrmacht* bridged it effectively, outwardly maintaining the traditional culture of order, while in combat demonstrating the adaptability and fluidity a disorderly battlefield demands. However, other militaries, such as the British, have been less successful at dealing with the contradiction. They have often attempted to carry the culture of order over onto the battlefield, with disastrous results. At Biddulphsberg, in the Boer War, 18 Boers defeated two British Guards battalions that fought as if on parade.[3]

The contradiction between the military culture and the nature of modern war confronts a traditional military service with a dilemma. Terrorists resolve the dilemma by eliminating the culture of order. Terrorists do not have uniforms, drill, saluting or, for the most part, ranks. Potentially, they have, or could develop, a military culture that is consistent with the disorderly nature of modern war. The fact that their

Wide World Photos

Terrorists use a free society's freedom and openness, its greatest strengths, against it. They can move freely within our society, while actively working to subvert it. They use our democratic rights not only to penetrate, but also to defend themselves. If we treat them within our laws, they gain many protections; if we simply shoot them down, the television news can easily make them appear to be the victims.

broader culture may be non-Western may facilitate this development.

Even in equipment, terrorism may point toward signs of a change in generations. Typically, an older generation requires much greater resources to achieve a given end than does its successor. Today, the United States is spending $500 million apiece for stealth bombers. A terrorist stealth bomber is a car that looks like every other car, with a bomb in the trunk.

Terrorism, Technology, and Beyond

Again, we are not suggesting terrorism is the fourth generation. It is not a new phenomenon, and so far it has proved largely ineffective.[4]

However, what do we see if we combine terrorism with some of the new technology we have discussed? For example, what effectiveness might the terrorist have if his car-bomb were a product of genetic engineering rather than high explosives?

To draw our potential fourth generation out still further, what if we combined terrorism, high technology and the following elements?

- A nonnational or transnational base such as an ideology or religion. Our national security capabilities are designed to operate within a nation-state framework. Outside that framework, they have great difficulties. The drug war provides an example. Because the drug traffic has no nation-state base, it is very difficult to attack. The nation-state shields the drug lords, but cannot control them. We cannot attack them without violating the sovereignty of a friendly nation. A fourth-generation attacker could well operate in a similar manner, as some Middle Eastern terrorists already do.
- A direct attack on the enemy's culture. Such an attack works from within, as well as from without. It can bypass not only the enemy's military, but the state itself. The United States is already suffering heavily from such a cultural attack in the form of the drug traffic. Drugs directly attack our culture. They have the support of a powerful "fifth column"—the drug buyers. They bypass the entire state apparatus, despite our best efforts. Some ideological elements in South America see drugs as a weapon; they call them the "poor man's ICBM [intercontinental ballistic missile]." They prize the drug traffic not only for the money it brings in—through which we finance the war against our-

selves—but also for the damage it does to the hated North Americans.

- Highly sophisticated psychological warfare, especially through manipulation of the media, particularly television news. Some terrorists already know how to play this game. More broadly, hostile forces could easily take advantage of a significant product or television reporting—the fact that, on television, the enemy's casualties can be almost as devastating on the home front as are friendly casualties. If we bomb an enemy city, the pictures of enemy civilians dead, brought into every living room in the country on the evening news, can easily turn what may have been a military success (assuming we also hit the military target) into a serious defeat.

All of these elements already exist. They are not the product of "futurism," of gazing into a crystal ball. We are simply asking, what would we face if they were all combined? Would such a combination constitute at least the beginnings of a fourth generation of warfare? One thought that suggests they might is that third- (not to speak of second-) generation militaries would seem to have little capability against such a synthesis. This is typical of generational shifts.

The purpose of this short article is to pose a question, not to answer it. The partial answers suggested here may, in fact, prove to be false leads. But in view of the fact that third-generation warfare is now 70 years old, we should be asking ourselves when the fourth generation will arrive and what it will bring. MR

NOTES

1. Brigadier General Franz Uhle-Wettler, *Battlefield Central Europe. Danger of Overreliance on Technology by the Armed Forces*, US Army translation, 2.

2. In practice, it was fully developed on both the tactical and operational levels in May 1940.

3. John A. English, *A Perspective on Infantry* (New York: Praeger Publishing, 1981), 6.

4. Some questions that apply to the future potential of terrorism include. Can the terrorist escalate his acts to the point where he becomes effective without turning into a conventional organization that can be targeted? Can he organize effectively without organizing visibly?

William S. Lind is director of the Center for Cultural Conservatism of the Free Congress Foundation, president of the Military Reform Institute; and an adviser to Representative Denny Smith of Oregon. He holds an A.B. from Dartmouth College and an M.A. from Princeton University. He served as a legislative aide for armed services for Senator Robert Taft Jr. of Ohio and held a similar position with Senator Gary Hart of Colorado.

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Lieutenant Colonel G. I. Wilson, US Marine Corps Reserve, is assigned to the First Marine Expeditionary Force, Camp Pendleton, California. An infantry officer and a logistician, he has written on maneuver warfare, special operations, logistics, remotely piloted vehicles, narcoterrorism and directed energy.

Bright Promise or Broken Dream?

Major Robert A. Strange, US Army

The author offers convincing discussion as to the relative importance of technology to warfighting. He concludes that "technology drives technology, not warfighting," and warns that we must not expect too much from technology, because it alone does not win wars.

MR

1989 MILITARY REVIEW WRITING CONTEST

1ST PRIZE

FROM THE FIRST time a crouching cave dweller picked up a stick and used it to club his neighbor into submission, man has pursued advances in weapons technology so as to gain a decisive military advantage over his opponents. Particularly in America's war experience, the drive to understand and master the art of war is often explained in terms of the relationship between the soldier and his weapons. In other words, the tools of war become a focal point for both the theory and doctrine of warfare. Today, some military writers and war theorists even go so far as arguing that technology is one of the two linchpins (the other being leadership) in America's military machine.

The unremitting pursuit of enhanced military capabilities invites speculation on the technological future of war. While such musing may whet the appetite for wonder weapons, it fails to consider basic questions about technological advances in military weapons and hardware. In the midst of the frenzied scramble to maintain a technologic edge, several essential questions must be considered and answered in some depth. First, what do we expect of high-tech systems and weapons? Second, in what way does the process of developing and fielding these new systems impinge on our war-fighting doctrine? Third, what sociological factors presage limits on the technology of the military force of the future? Finally—but first in importance—what is the nature of the threat in future wars?

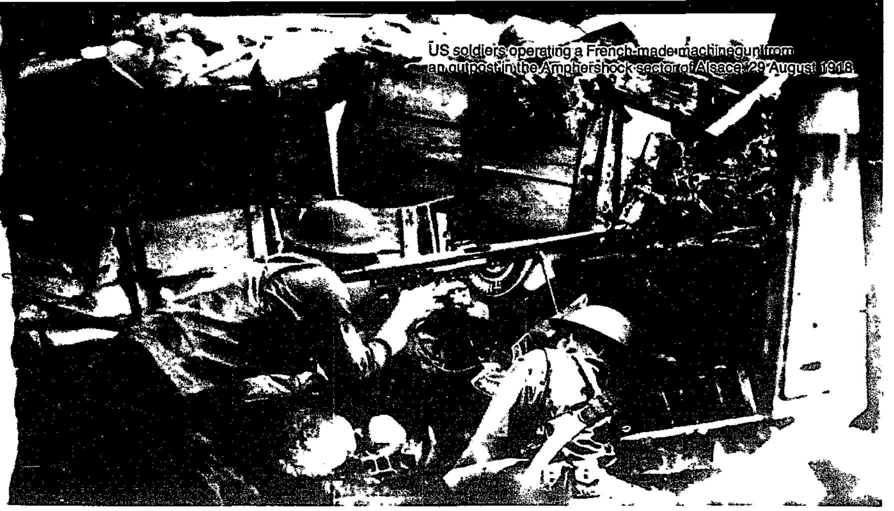
While technological advances in the military occur at an extraordinary pace, the aims remain fairly constant. The American experience in warfighting led the military to rely ever more heavily on firepower rather than maneuver. By bringing to the battlefield the mechanical advantages of industrialization, we sought to increase the lethality of our weapons in order to place our opponents in the untenable position in which resistance equaled annihilation.

Our culturally embedded belief that each individual is of inestimable value also led us to seek ways to use machines to aid and protect soldiers in all aspects of warfighting. To a great extent, we now seek to replace man on the battlefield with an array of advanced systems such as remotely piloted vehicles, robotic minefield clearing systems, and "fire-and-forget" munitions.

Our quest for bigger, better weapons has been guided by our vision that the next major war ". . . would require powerful blows to be delivered at an enemy stronger, more distant, and more inaccessible than any we have yet encountered. . . It will, therefore, be essential, should another war come, that this country be prepared in advance with such advantages in technology as will permit victory without catastrophic losses. . . The prospect that the United States might find itself involved in another major war imposes upon us the necessity of seeking to achieve a . . . technological margin over our opponents."[1]

Our culturally embedded belief that each individual is of inestimable value also led us to seek ways to use machines to aid and protect soldiers in all aspects of warfighting. To a great extent, we now seek to replace man on the battlefield with an array of advanced systems such as remotely piloted vehicles, robotic minefield clearing systems, and "fire-and-forget" munitions.

Technological innovations always seem so promising as they are developed and then first used on the battlefield. New weapons and hardware are seen as ways to save lives, to attain quick, decisive victories and to enhance command and control systems. Paradoxically, technology has just the opposite effects on warfighting. S. L. A. Marshall's words of four decades ago still ring true today: ". . . it is unfortunately the case that the masses of men are not capable of taking other than a superficial judgment on the effect of new weapons."[2]



Massed, accurate fire from new long-range rifles broke the back of on-line infantry and cavalry charges. The introduction of the machinegun more than offset the effectiveness of the rifle. The tank aided attacking forces in overcoming machinegun positions. Yet none of these technologically advanced weapons changed battle dynamics. They only made the battlefield a deadlier place.

Technological progress in modern wars has been impressive. Massed, accurate fire from new long-range rifles broke the back of on-line infantry and cavalry charges. The introduction of the machinegun more than offset the effectiveness of the rifle. The tank aided attacking forces in overcoming machinegun positions. Yet none of these technologically advanced weapons changed battle dynamics. They only made the battlefield a deadlier place where the quick battle became extended in both time and space, and command and control became increasingly more difficult rather than simplified.[3]

Do technological advances determine the outcome of wars between nations? It sometimes appears that the United States surely hopes so. But wars are not won by viewing technological prowess as the way to victory on the battlefield any more than they are by following only one principle of war.

When the US Army was deployed in strength in Vietnam, it used the "... traditional American methods of seeking a quick result by striking with massive firepower and technology at the roots and branches of enemy strength."[4] Yet more than three years after commitment of US ground forces, the North Vietnamese Army (NVA) and the Vietcong guerrilla forces launched a major offensive (Tet 1968) against US bases and installations in an effort to destroy both the fighting strength and the US national will to continue to support the war effort.

At Khe Sanh, the NVA, with some armor support, encircled a US Marine Corps encampment. For five months the United States demonstrated its technological might by sustaining the isolated Marines on a regular basis. The NVA threw its best forces and equipment into the battle, but it could not gain an advantage in the field. When the NVA finally abandoned its

Marine machine gunners lie on top of trench cover while they search for enemy movement, Khe Sanh, 1968.

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attempt, ". . . it conceded that overall failure was due to being wrecked by intense firepower and technology. It [the NVA] would need four years to rebuild its offensive capability."[5]

But rebuild it did. In 1972, the NVA resumed the offensive, attacking in the highlands, primarily at Binh Long. US forces again held the technological edge and destroyed 80 of the 100 NVA tanks employed. US helicopters, firing wire-guided antitank missiles, stopped some of the tanks. This new technology, the antitank guided missile (ATGM), could have forced the NVA to change its Soviet-style doctrine. Instead, when South Vietnam was overrun in 1975, the NVA used the same armor-intensive Soviet doctrine in the offensive.[6]

If technology were dominant in warfare, then the combined forces of the United States and Republic of South Vietnam should have won the war with ease. But in any protracted war, ". . . technology is rarely dominant. Countermeasures are always produced, an advantage is rarely enjoyed for long."[7]

Historically, the introduction of a new weapon on the battlefield has initially produced stunning tactical victories. But the temporarily stymied field commander quickly learned his lessons, adapted comparable or offsetting technologies and continued to fight. In many cases, such as Vietnam, the military force that suffered tactical defeat because of the enemy's weapons technology nevertheless continued to follow a well-conceived, popularly supported strategic plan and ultimately prevailed in the war.

Technology and Doctrine

Does technological modernization force changes in war-fighting doctrine? Again, the answer is no. A brief review of the use and abuse of technology in a contemporary conflict supports this conclusion. It also shows that few changes in war-fighting doctrine are needed to adapt to new technology.

But first, what is doctrine? The Army's tactical war-fighting manual espouses that doctrine is the "... condensed expression of its [an army's] approach to fighting campaigns, major operations, battles, and engagements."[8] While that definition is clearly stated, it has little utility in dealing with the effects technological advances have on our approach to warfighting. I prefer Ferdinand Foch's concept that doctrine is the "... *practical application* ... of a certain number of *principles* ... which ... must logically vary according to circumstances while always tending towards the ... objective goal."[9]

Foch's example of the doctrinal application of a principle is useful here because it clearly illustrates the relationship between doctrine and technology:

"A wild fowl flies up in front of a sportsman; if it goes from right to left, he fires in front and to the left; if from left to right, he fires in front and to the right; if it comes towards him, he fires high; if away from him, he fires low. In each of these cases, he applies in a *variable* way the *fixed* principle: to get three points [his eye, the sight and the quarry] upon one straight line ... at the moment the shot takes effect."[10]

In this case the technologically advanced shotgun is adapted to the objective of killing a duck. The doctrine would still be the same whether the hunter used a slingshot, a bow or a spear for duck hunting. While the shotgun gives the hunter a definite advantage over the ducks, it does not affect the doctrine of the interception of projectile and quarry.

The British campaign in the Falkland Islands in April 1982, demonstrated some of the potential for advanced technological developments in warfare. In response to the Argentine invasion of the Falklands, Britain launched the first elements of an amphibious attack force in less than a week. The task force traveled 8,000 miles through open seas and accomplished its assigned mission by ejecting Argentine forces from the Falklands in less than three weeks. Such a feat would have been virtually impossible 20 years ago.

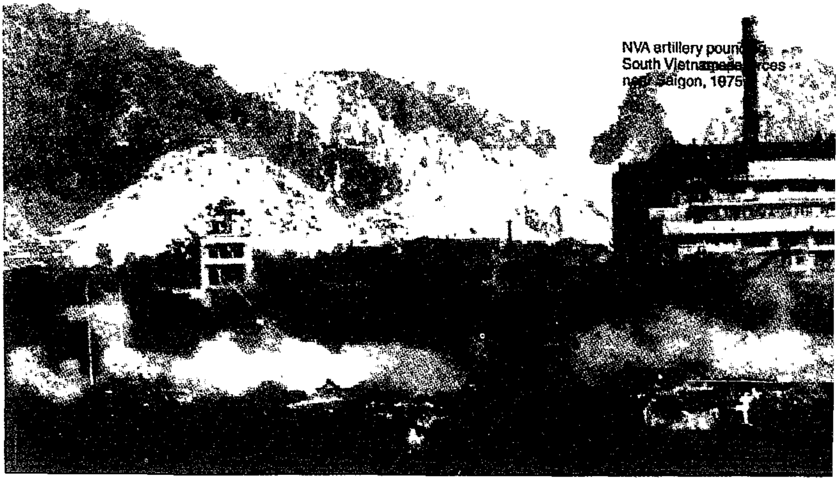
For several reasons, technology appeared to be the dominant factor in the campaign. First, a Vulcan bomber conducted a 7,800 mile round-trip flight to drop 21 1,000-pound bombs on the runway at Port Stanley. The mission required 17 in-flight refuelings of the bomber over the ocean—a remarkable feat of communications and coordination. Second, one modern British submarine bottled up the entire Argentine navy. And just one French-built Exocet missile destroyed a British ship.

Yet the entire campaign was doctrinally identical to almost any other amphibious operation in this century. "The Falklands [campaign] underlined that the latest technology, handled by trained men, will frequently defeat an amorphous mass— *always with the proviso that the minority can conserve its strength and has adequate reserves of similar quality to call upon* [emphasis added]."[11]

Societal Limits on Technology

In preparing for wars in the future, the US military is likely to discover that it will become most difficult to find the adequate reserves dictated by Kenneth Macksey's *Technology in War* proviso. Simply put, science and weapons development exceed the capacity of both the economy and society. That technology overruns budgetary capacities is evident in current weapons development and upgrade programs.

The M1 Abrams main battle tank is the world's most capable tank; and at a price tag of about $2.6 million, it is doubtless the most expensive. But certain technologies available when the tank was developed and produced were omitted because of the already high price. Now the Army seeks to upgrade the M1 Abrams to the M1A2 version which, according to studies, should "... show a 54 percent improvement in performance in the offense and 100 percent improvement when used in a defense emplacement."[12] The problem is that the upgrade costs nearly half a million dollars for *each* tank, a figure that the average US tax-



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The high cost of high technology plagues all the services. The final cost of the advanced medium-range air-to-air missile (AMRAAM) is a figure that is hotly debated by the GAO (government accounting office), Congress and defense contractors, but it is generally agreed to be more than $450,000 per missile. Granted, the AMRAAM has an impressive list of "dealer options." It tracks the enemy aircraft with its own radar, which is difficult to jam, and it can engage low-flying aircraft. But the Soviets may already have an ". . . elementary homing device for their AA-10 Alamo missile, enabling it to home in on and kill enemy fighters whenever they turn on their radar to search for targets. . . If that is true, the final, ironic epitaph of the AMRAAM would be that of an $11.2 billion magical missile [program] rendered obsolete by a simpler technology."[13]

What Price Victory?

If ever technology should have forced a decision in battle, the Arab-Israeli War in October 1973 was the time and the place. Egyptian and Syrian forces attacked Israel on two fronts on the Jewish Day of Atonement (Yom Kippur). The Arab leaders correctly assessed the Israelis' relaxed military posture. The Egyptian force bridged the Suez Canal and deployed massed Soviet ATGMs across the front. Antiaircraft missiles (SA-2 and SA-3, and the newer SA-6 and SA-7) and ZSU 23–4 air defense weapons provided a protective umbrella over airfields and bridgeheads.[14]

These technologically advanced weapons directly targeted Israel's two most powerful combat arms, armor and tactical air. Despite initial setbacks in the air and on the ground, Israel soon prevailed against the Arab forces. But the cost of the 18-day war was incredible: Egypt and Israel *each* spent more than $7 billion. The

Arabs lost 2,000 tanks and more than 500 planes, while Israel lost 804 tanks and 114 planes.[15]

Yet it was not the Arabs' use of advanced Soviet weapons systems that unbalanced the war at the outset. The problem was that Israel failed to fight its doctrine of preemptive air strikes. The failure arose from bureaucratic inertia and competing political interests rather than from any technological disparity between the forces. Politics did more to determine the shape of the battle than did technology.

The media's rush to publicize the lethality of the modern battlefield and the supposed futility of fighting mechanized warfare obscured several important features of the new technological battlefield. First, ATGM fires accounted for less than 25 percent of the tanks killed. As in past armor battles, tanks killed tanks. Second, "old-fashioned" antiaircraft artillery accounted for more than 40 percent of the Israeli-downed fighters. The statistical evidence refutes arguments that technology determines battle decisions. The lesson that clearly emerges from this short, intense war is that technology drives technology, not warfighting.

So, when the Soviet Union witnessed its tanks being destroyed at a rate of 50-to-1 on the Syrian front in 1973, it rushed to develop reactive armor to restore its armored advantage. The United States in turn began developing antitank systems to neutralize reactive armor. As mentioned before, in the continuing, costly pursuit of the high-tech edge in armored warfare, technological advantages tend to neutralize one another.

Societal Drag on High-Tech Thrust

Technological advance, despite its prominence in warfare since the mid-19th century, is not the major factor in determining the outcome of battles and engagements. Certainly, the military must be ". . . forward-looking and adaptable to changing technologies . . ."[16] But

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The British task force proceeding to the Falklands. The destroyer *Glamorgan* (foreground) was later damaged by a shore-based Exocet missile striking its stern as it was conducting a shore bombardment.

Ministry of Defence

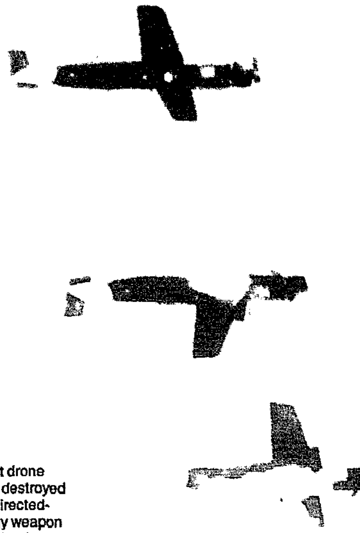
many other factors also influence the ways and means available for use in war. Political interests, bureaucratic inertia, an uneducated media reporting misleading information, and diplomatic maneuverings all will affect future warfighting. Our nation's industrial capability and its financial power base will also determine how we engage in future wars.

Technology is too much a part of the modern world to be ignored; but its adaptation to doctrine is limited by budget constraints. The research and development offices of military and industrial laboratories are stuffed with plans for wonder weapons that never survived congressional budget cuts. If technology were paramount, then many of these weapons would have been produced and fielded, regardless of the cost.

The Soldier's Load

The 1973 Middle East War showed technology in weapons systems had clearly outstripped the ability of the soldier to employ weapons systems to their full effectiveness.[17] *How* we fight wars is enhanced by technological advances in weapons; but *who* we use to fight the war remains the same. The most important element in the technological struggle is often the least obvious, for it is the *soldier* who drives both technology and warfighting.

All of our intensity in developing advanced weapons must be guided by the notion that ". . . the complexity of these weapons also implies that the quality of manpower required to operate them must be of the best."[18] Today, one of the harshest social developments the US military must deal with is the fact that ". . . of the 3,248,000 freshmen who entered high school in 1982, only 2,382,000 graduated in 1986—an effective dropout rate of 26.7 percent.[19] Unless some dramatic change occurs in the area of education, the military of the future will include considerable numbers of those who have neither the educational background nor the inclination to handle complicated technological systems.



Target drone being destroyed by a directed-energy weapon at Kirtland Air Force Base, New Mexico in 1981.

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In every ground war of the 20th century, the infantryman continued as one of the three principal arms. There is little evidence to suggest this situation will change in future wars. As an example, it is the soldier who, under fire, must guide the TOW (tube-launched, optically tracked, wire-guided) missile during its average 17-second flight to an enemy tank. As the military strains to equip the soldier with the best in technological capability and to substitute

M1 Abrams tanks approaching a bridge crossing site on the Aller River near Barnstedt, West Germany.

The M1 Abrams main battle tank is the world's most capable tank; and at a price tag of about $2.6 million, it is doubtless the most expensive. But certain technologies available when the tank was developed and produced were omitted because of the already high price. Now the Army seeks to upgrade the M1 . . . the upgrade costs nearly half a million dollars for each tank, a figure that the average US taxpayer probably believes ought to be the cost of a whole new tank.

machines for humans on the battlefield, it must recognize an unavoidable reality. The soldier must still be present to apply the technology available, because only man has the judgment to do so. Unfortunately, thus far in the history of warfare, as in other affairs of man, judgment has come from experience. And experience too often has come from using bad judgment.

At the same time, the immense capabilities of the soldier on the battlefield cannot be overlooked. "The infantryman as a vehicle for firepower has the disadvantage of being fragile, prone to fatigue and a slow mover, although these inherent characteristics can be relieved by transporting him to the scene of combat in an armored vehicle, or by air. [His] shortcomings are more than compensated for by his tactical mobility in any terrain. . . He presents a small and inconspicuous target . . . can easily hide himself and, given a little time, can burrow underground like a mole. He also has gifts, excellent optical and acoustic sensors and a small but unsurpassed neural computer, one fitted to each model."[20]

Where is the Front

The last concern forms the basis for all the others. What will future war be like? Where will it be fought? Against whom? In short, what is the threat against which we must pit our technologically superb military? General John R. Galvin cautions that "when we think about the possibilities of conflict we tend to invent for ourselves a comfortable vision of war, a theater with battlefields we know, conflict that fits our understanding of strategy and tactics, a combat environment that is consistent and predictable, fightable with the resources we have, one that fits our plans, our assumptions, our hopes, and our preconceived ideas."[21]

The US military concentrated its recent development efforts on improving its capabilities on the large conventional battlefield. Should the next war require a significant commitment of resources other than our mighty armor, antiarmor and air assets, we will face the twin problems of a lack of trained personnel and inadequate resources to commit to the fight. Consequently, any attempt to consider the technological future of warfare must begin with a threat assessment that focuses on where and how we *must* fight in the future, not on how we might like to fight.

In summary, technology may cause "... widespread destruction of high-cost, high-value weapon systems [which] will lead to a 'broken-backed war' or a stalemate of mutual exhaustion ... At one level, we are the inhabitants of the taught world of the 1980's, increasingly able to control our environment, harnessing galloping technology, and probing far beyond the confines of our own planet. At another, we are prisoners of our development and culture, and with all the mixed feelings of our fathers and grandfathers, we stand on the start line [of the next war], waiting only for the whistle."[22]

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Allowing for the unpredictable success of our advanced technology, we must continue to apply time-tested and battle-proven doctrine in fighting wars. At the same time, we should continue to adapt new weapons technology into our military. But we should not expect too much from technology, because it does not win wars. Wars will continue to be won by well-led forces that use sound doctrine in applying the principles of war to defeat an enemy. MR

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1 Dr Benjamin H. Williams, "The Importance of Research and Development to National Security," *Military Review* (February 1959) 14

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3 Two of the better treatments of this subject are John Keegan's books, *The Face of Battle* and *The Mask of Command*

4. Kenneth Macksey, *Technology in War* (New York Prentice Hall Press. 1986), 186

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7 Geoffrey Kemp, Robert L Pfalzgraff Jr and Uri Ra'anan, eds *The Other Arms Race New Technologies and Non-nuclear Conflict* (Toronto Heath & Co., 1975), 122

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13 Peter Cary, "The Pentagon's misguided missile." *U.S News & World Report* (1 May 1989), 36

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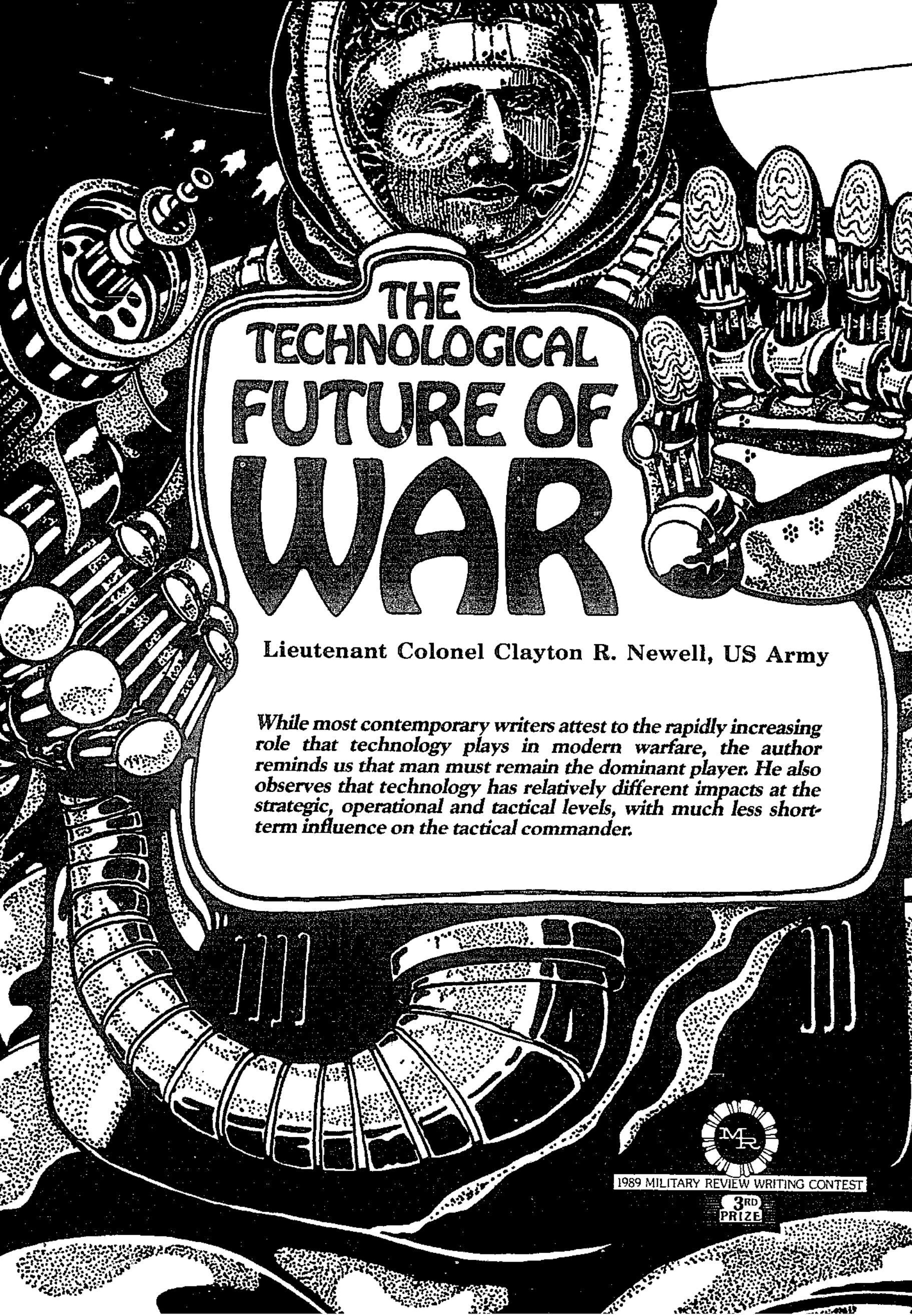

THE TECHNOLOGICAL FUTURE OF WAR

Lieutenant Colonel Clayton R. Newell, US Army

While most contemporary writers attest to the rapidly increasing role that technology plays in modern warfare, the author reminds us that man must remain the dominant player. He also observes that technology has relatively different impacts at the strategic, operational and tactical levels, with much less short-term influence on the tactical commander.

A RECENT issue of *Officer's Call*, a periodical published by the Army's Chief of Public Affairs, contains the rather surprising statement that "technology is the life blood of new and improved Army systems." The statement is surprising because it apparently shifts the Army's focus away from its traditional life blood, soldiers. Although technology plays an ever-increasing role in the future of war, the role of human beings must determine the technological future of war. In *War Without Men*, a book about the role of robots in future wars, the authors stress that "unless human beings control that future war, it might develop in ways that would prove very costly to our descendants." If man is to control the technological future of war, then man must remain the life blood of the Army.

We are in a technological age and there is every reason to believe that technology will exert an increasing influence on planning and conducting war. The future of war, however, depends on man, not technology. Just as an athlete can jump farther with a running start than from a standing start, we can explore the possibilities of the technological future of war by stepping briefly into the past to get a running start, so to speak, into the future.

Technology has always had an impact on war, but since the beginning of this century it has come to practically dominate the preparation for, and conduct of, war. Concern for the relationship between technology and war is a relatively recent development. Not too long ago, entire generations of warriors could fight and die with little or no concern for adapting to new weapons, simply because technology did not continually develop new weapons as has become commonplace today. In those times, weapons development just sort of happened when it happened.

As slow and haphazard as the development of weapons was, however, the development of doctrine appropriate to new weapons when they did appear on the battlefield was even slower. "Psychological change," Michael Howard observed in a 1986 lecture on war and technology, "always lags behind technological change." The problem was not technology per se, but the recognition of a substantive change in weapons technology, which in turn necessitated a psychological change in warriors to produce doctrine appropriate to the technological change. The culmination of technology outrunning doctrine was World War I, in which massed armies spent four years slaughtering each other with 20th century weapons while the generals dithered with 19th century doctrine.

Concern for the relationship between technology and war is a relatively recent development. Not too long ago, entire generations of warriors could fight and die with little or no concern for adapting to new weapons, simply because technology did not continually develop new weapons . . . weapons development just sort of happened when it happened.

If the profession of arms learned nothing else from World War I, it learned that if a little technology is good, then a lot of technology must be better. Between world wars, the conservative military attitude of shunning new weapons and technology that interfered with their traditional way of doing business changed. There was, instead, a close, almost desperate, embrace of technological solutions to virtually every battlefield problem.

Solving problems with technology, however, is expensive. As a direct result of demanding the latest in technology to prepare for war, armies, navies and air forces now actually have fewer weapons with which to conduct war. Not only are their expensive weapons fewer in number, the weapons are no longer particularly new. Today's military forces rely on the same basic weapons they discovered in World War I, and the ideas for some of those weapons even go back as far as the 15th century and the fertile mind of Leonardo da Vinci.

Today, armies rely on tanks, air forces rely on airplanes, and navies rely on aircraft carriers and submarines for their combat power. Each of these weapons systems saw active service in World War I, experienced development during the interwar period and then dominated the conduct of World War II. Since then they have been refined to virtual perfection. Although critics of each system periodically predict its demise, each remains dominant in its area of specialization: the tank on land, the airplane in the air, the aircraft carrier on the surface of the sea and the submarine beneath it.

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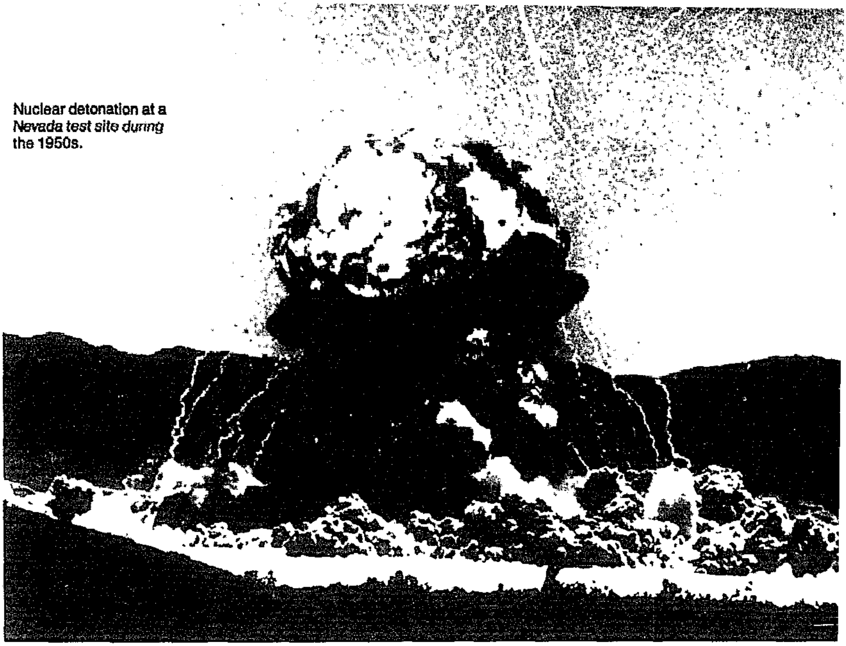
Since World War II only one truly new and revolutionary weapon has entered the arsenals of the world. The awesome power of nuclear weapons ended World War II and introduced the nuclear age of warfare. Nuclear weapons have not, however, been used in anger since. While they have perhaps revolutionized thinking about and preparing for war, nuclear weapons themselves have not yet substantively changed the actual conduct of war.

The wars fought since 1945 have relied on the traditional weapons of the 20th century: tanks, airplanes, aircraft carriers and submarines. Although technology has certainly refined them all into electronic and mechanical marvels, they remain the same basic weapons systems introduced in World War I. While one may argue that helicopters or jet engines for aircraft were revolutionary, they are really simply refinements of the heavier-than-air flying vehicle. In the conduct of war, the jet aircraft has on occasion proved to be too fast to be effective, and the helicopter, although used in combat, has yet to actually prove itself on a high-technology battlefield. We will apparently reach the end of the 20th century using the same weapons we had at its beginning.

With the 20th century's traditional weapons becoming too expensive and too complex for practical routine use in training or even combat and nuclear weapons generally deemed too powerful for any practical use, the technological future of war depends more on man's ability to retain control over his creations than it does on creating new weapons. While technology is a creation of man, and man must retain control of what he creates, technology already exerts some control over its creator. The authors of *War Without Men* caution that "humans must take measures to ensure that mankind remains in control of [those] metal creatures capable of great destruction." Although their warning refers to robots, it is timely because from the strategic perspective of war, technology already influences the actions of men. Nuclear weapons, the ultimate technology in weaponry (at least for the moment), have already taken control of strategy since in the mind of man they are too terrible to actually be used. The developers of the technology, therefore, find themselves in the paradoxical position of creating the ultimate weapon without being able to use it. From the strategic perspective, the preparation for war has surpassed man's capability to conduct war.

From the tactical perspective of war, the situation is a bit different. Man is trying hard to reverse the historic experience of having technology drive doctrine development. In its posture statement prepared for the 101st Congress, the US Army looks to the future with an AirLand Battle-Future concept, "intended to guide

Nuclear detonation at a *Nevada test site during* the 1950s.



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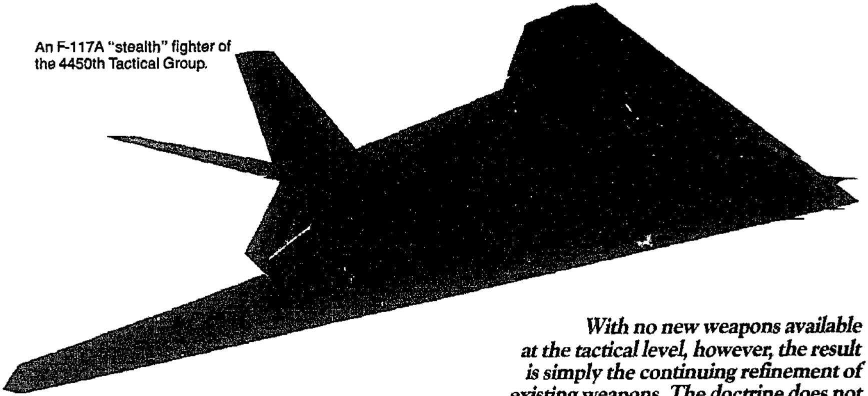
the development . . . doctrine, equipment, organizations, training, leader development, and support." This system of driving technology with doctrine becomes possible only when technological advances are rapid and military acceptance of new technology is widespread. With no new weapons available at the tactical level, however, the result is simply the continuing refinement of existing weapons. The doctrine does not really drive the search for revolutionary new weapons; it simply demands further refinements of the 20th century traditional weapons that remain comfortable companions to another generation of warriors.

Between the technological paralysis of nuclear strategy and the tactical conservatism of traditional 20th century weaponry lies the gray area of operational art, the perspective of war thus far least affected by technology. But even from the operational perspective of war, which according to US Army Field Manual (FM) 100—5, *Operations*, requires the essentially nontechnological attributes of "broad vision, the ability to anticipate, a careful understanding of the relationship of means to ends, and effective joint and combined cooperation," An F-117A "stealth" fighter of the 4450th Tactical Group.



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technology plays an ever-increasing role in the conduct of war.

The effect of technology on operational art remains to be seen, but it would seem that the increased capabilities of command and control systems, which allows commanders to extend their vision and coordinate effective joint and combined operations, could only help the conduct of war from the operational perspective. Chris Bellamy, however, writing in *The Future of Land Warfare*, a book that concentrates on the operational level of war, cautions that while command and control systems have "kept pace with, and perhaps exceeded, the rate of improvements in mobility and communications themselves" they also "may actually be slowing things down" by increasing the size of the headquarters required to maintain those increasingly complex systems. Similarly, Martin van Creveld points out in *Command in War* that "[t]he more available information . . . the longer time needed to process it, and the greater the danger of failing to distinguish between the relevant and the irrelevant, the important and the unimportant, the reliable and the unreliable, the true and the false." Technology may be threatening to overwhelm man's control of operational art just as nuclear weapons have apparently stagnated strategy. And once again there is the possibility of the creation holding the creator hostage.

Perhaps this is all to the good. The technological future of war may turn out to eliminate war, or at least reduce its scale. Predicting the future, however, depends on how far one looks into the future. Bellamy limited his analysis of the future of land warfare to a quarter of a century simply "because major weapons systems being introduced or envisaged at the time of writing are likely to be in service during that period." Limiting the distance based on weapons keeps predictions within the bounds of 20th century traditional weapons. While this may lead to fairly accurate predictions in the short term, it may also limit the imagination to simply what we know rather than stimulating a search for what we need to know for the technological future of war.

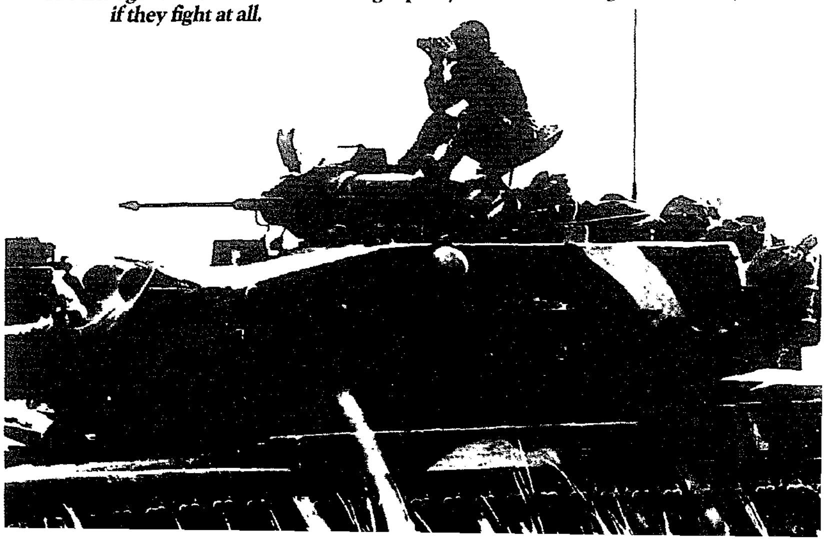
Looking too far into the future, however, may produce such fantastic visions of war and technology that the fundamentally conservative military mind will simply reject them. It is one thing to use technology to improve familiar items such as tanks or airplanes, but it is quite another to accept Robert A. Heinlein's vision in his science fiction novel of the 1950s, *Starship Troopers*, where mobile infantry in self-contained fighting suits routinely drop from spaceships commanded by women onto the surface of planets far from Earth to wage war.

The technological future of war correlates to the structure of war itself. Generally the higher the perspective of war, the greater influence technology now has. If one can make the assumption that there is probably a general desire among the nuclear powers to avoid destroying the world, then from the strategic perspective man bows to the demands of technology. The latest answer to nuclear weapons, the Strategic Defense Initiative (SDI), would put the defense against them wholly in the realm of technology. Writing in the *Bulletin of Atomic Scientists*, John Mauling, a veteran of the Manhattan Project, characterizes SDI as "technology that completely removes all human involvement except that connected with being a target."

This latest technological development in the preparation for war has apparently spurred greater efforts for arms control between the superpowers. One of the reasons given for the increased acceptance of arms control is that there is now technology to police the agreements. The technological future of war from the strategic perspective lies for the moment in arms control to prevent, or at least limit, the actual conduct of war.

From the tactical perspective of war, man continues to adapt technology to his demands, and so far, the creator retains control of his creations. While the military has apparently accepted that technology has an increasingly dominant role in war, from the tactical perspective the weapons have remained comfortably familiar. For a society that has seen man go from the birth of powered air flight to supersonic pas-

From the tactical perspective of war, man continues to adapt technology to his demands, and so far, the creator retains control of his creations. While the military has apparently accepted that technology has an increasingly dominant role in war, from the tactical perspective the weapons have remained comfortably familiar . . . The next generation of warriors will fight pretty much as the last generation did, if they fight at all.



While command and control systems have "kept pace with, and perhaps exceeded, the rate of improvements in mobility and communications themselves" they also "may actually be slowing things down" by increasing the size of the headquarters required to maintain those increasingly complex systems.

senger travel in less than a century, has seen the telephone become an essential item of daily life in half a century, and has seen television grow from a fad into an international system of information exchange in a quarter of a century, the weapons of war have not really changed very much. This basic conservatism does not provide a very high probability for change in the foreseeable future. The next generation of warriors will fight pretty much as the last generation did, if they fight at all.

Viewing the technological future of war from the operational perspective presents a confused picture. On the one hand, man may be running out of room on Earth to deploy large nonnuclear military forces with their full panoply of combat, combat support and combat service support systems necessary to conduct high-intensity conventional warfare. On the other hand, man is not quite ready to take his wars into space, where presumably there will be ample room to deploy and use even the most exotic weaponry. Robert O'Connell concludes his book, *Of Arms and Men*, a study of man's relationship to his weapons, with the observation that if nuclear weapons continue to exist (and there is no reason to believe that they would not), "it seems appropriate that their venue be deep space rather than our small, blue planet." From the operational perspective of war, where military forces are used to achieve national objectives by force, the actual conduct of war is outgrowing planet Earth. The ultimate result may be an increasing reluctance to wage war, looking instead to other means of settling disputes among members of the international community of nations.

Whatever the future holds, man must maintain dominance over the weapons of war; any other circumstance will simply be the end of man. Man's mind, the society that mind builds and the warrior ethos of the period will decide the technological future of war. Paul Kern, a professor of ancient history, writing of military technology in Greek warfare in the journal *War and Society*, reminds us that this has always been so. "The way a society fights a war," he writes, "is a product of both the military technology and the attitudes and values of that society." American society at least, now looks to a future that holds little prospect of general war, although that same society will apparently support short, limited wars waged with the latest technology.

The conduct of war from any perspective depends more and more on complex technology. It may be that the only way man can maintain control of that technology is to never use the weapons it produces. The technological future of war may be a paradox in which technology eventually eliminates the very activity it is trying to improve. MR

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ANTIMATERIEL TECHNOLOGY

Colonel John B. Alexander, US Army, Retired

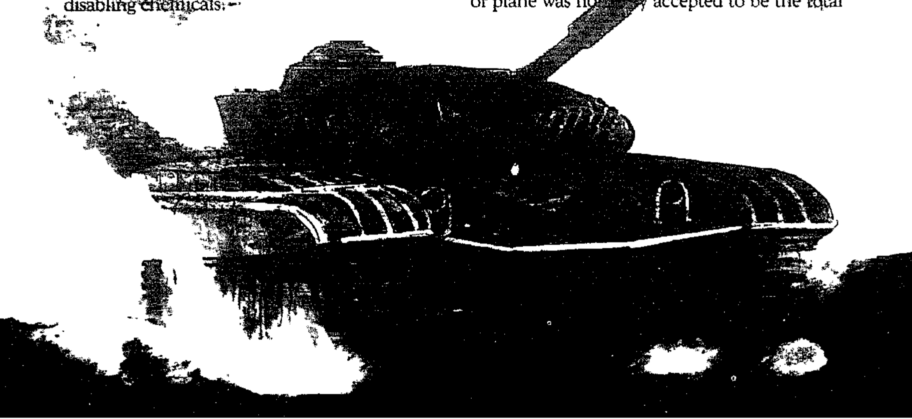
With the cost of new weapons systems escalating at an unacceptable pace, alternative means for defeating and degrading threat capabilities must be explored. The author offers that antimateriel technology, as developed through virtual prototyping, provides numerous methods for attaining "soft kills" and substantial degradation of weapons and unit effectiveness.

MODERN armed forces are increasingly dependent on machine locomotion. Hence, offensive and defensive weapons have been devised to forcefully damage or destroy military vehicles causing what is known as "hard kill," the result of proximate explosion(s) or impact of projectiles. Recent technology has lent impetus to another class of weapons that incapacitate a military machine without brute force attack, achieving what has previously been termed "soft kill" or more recently "antimateriel technology." This article outlines an approach to thinking about such antimateriel technology as electromagnetic pulse, high-power microwaves, isotropic light, internal combustion engine inhibitors and crew-disabling chemicals.

The term soft kill was in vogue for a while but was dropped when some military leaders misunderstood it as meaning "less than effective." Other terms that have been used to convey the general concept include "mission kill" or "operational kill." All of these terms are very vague, as they do not describe a clearly definable objective and refer to "kill" instead of system degradation. With many of the proposed weapons systems in this category, the most probable effect will be the degradation of a critical component or subsystem of the attacked weapons platform.

No Burning Cinder

In the past, a kill of an armored vehicle, ship or plane was normally accepted to be the total



or near total destruction of that weapons platform. The categories were dead or not dead—no ambiguity. It was easy to determine which category the platform fell into, as there was usually a pile of wreckage. This simple categorization gave commanders and soldiers on the battlefield a great deal of confidence in the effectiveness of their weapons. It also gave rise to what may be called the "burning cinder" or "smoldering hulk" syndrome. That is, troops wanted to see a pile of wreckage or burning cinder on the battlefield to be assured that an opponent's weapons platform was destroyed or "killed."

The survivability designed into many current and future weapons systems makes a hard kill both very difficult and impractical without employing nuclear weapons. It will be virtually impossible to build conventional weapons systems, or families of weapons, that can produce a hard kill for all threat platforms when the number of potential targets is considered.

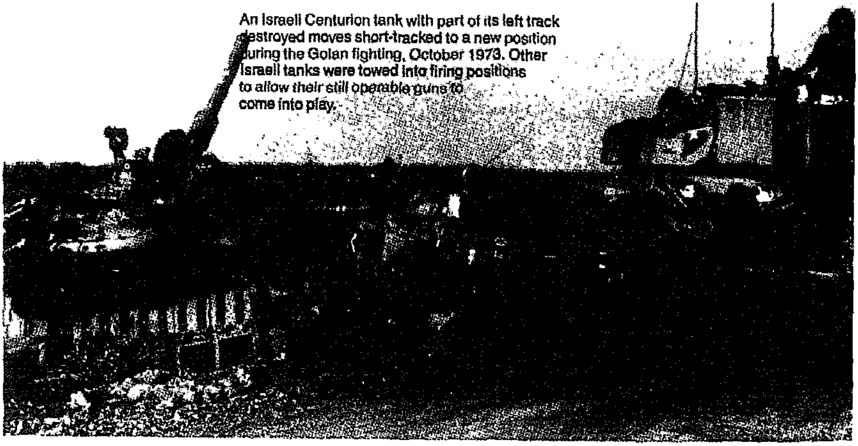
A frequently cited example of the desire to be absolutely certain that an enemy weapons system is totally out of commission comes from the Israeli pursuit of the Egyptian armored forces across the Sinai in 1973. It was reported that as each Israeli unit came in visual contact with an Egyptian tank, one or two antitank rounds were fired into it. Tanks that had been destroyed early in the retreat were hit over and over again as each reinforcing unit passed by. These tanks became bullet sumps for large quantities of Israeli rounds. Given the status of war at that point, the Israelis thought they could afford the luxury of expending multiple rounds per target. The most important point is that in combat, soldiers were not psychologically prepared to take the chance that there might be any possibility that the enemy might have a fighting capability in their rear area.

While the redundant kill approach does provide high confidence, it will simply not be affordable on future mid- to high-intensity battlefields with limited numbers of very expensive munitions. US doctrine has always recognized the necessity for fire discipline but it has rarely been practiced in combat. In recent years, particularly during the Vietnam War, we relied on overwhelming firepower to overcome all obstacles. We employed artillery and aircraft against snipers and had "mad minutes" (a large volume of fire from all available weapons) before moving out in the morning, just to be sure that the enemy was not lurking about. We tend to justify these large ammunition expenditures by citing the advantages gained by suppressive fires. Although a case can be made for the value of suppression during combat maneuvering, too frequently those fires are used to make the shooter feel good (safe) instead of for their real tactical benefit. Our history does not reflect the discipline that will be required to defeat large numbers of hard targets. That is not to say it cannot be done.

Antimateriel Technology Taxonomy

For the purposes of this article, I have chosen to use "antimateriel technology" to describe a broad spectrum of techniques for attack. Establishing the taxonomy of antimateriel technology weapons systems is most difficult, as there is no clear consensus of the demarcation between hard and soft systems. Frequently, they may be best delineated from what antimateriel technology systems are not.

Antimateriel technologies are those that do not penetrate protective armor by use of brute physical force. Examples of the brute force approach include chemical and kinetic energy penetrators of antiarmor weapons and the blast or fragmentation effects of artillery fire. Those effects destroy the target by means of overcoming the protective measures by shear force. This approach requires expenditure of relatively large amounts of energy to destroy very hard



An Israeli Centurion tank with part of its left track destroyed moves short-tracked to a new position during the Golan fighting, October 1973. Other Israeli tanks were towed into firing positions to allow their still operable guns to come into play.

The two best examples of degradation without catastrophic failure are mobility kills and firepower kills. In one case, an armored vehicle may be physically stopped and unable to move for a significant period of time but is still capable of delivering aimed fire on targets within its field of view and range. In the other case, an armored vehicle may be fully mobile and yet unable to shoot.

targets such as tanks, armored personnel carriers or self-propelled artillery. Ships have been designed as relatively hard systems through application of thick armor, whereas aircraft owe much of their physical survivability to maneuverability, electronic countermeasures and redundant subsystems. Planes and submarines both rely heavily on signature reduction to escape detection by all but the most sophisticated techniques. They also have carefully designed compartments, which allows them to sustain substantial structural damage and still survive, often with the capacity to complete their mission.

The survivability designed into many current and future weapons systems makes a hard kill both very difficult and impractical without employing nuclear weapons. It will be virtually impossible to build conventional weapons systems, or families of weapons, that can produce a hard kill for all threat platforms when the number of potential targets is considered. Antimateriel technology offers a viable alternative that can defeat the threat, whoever that may be at any given time, at the operational level.

Antimateriel technologies tend to be less energy intensive and may or may not induce catastrophic failure. Frequently, antimateriel mechanisms produce a degradation in weapon system functioning without totally decommissioning that system. The two best examples of degradation without catastrophic failure are mobility kills and firepower kills. In one case, an armored vehicle may be physically stopped and unable to move for a significant period of time but is still capable of delivering aimed fire

At the top levels of leadership, the need for alternatives to hard kill weapons has been recognized and generally accepted. What is needed now is an understanding of the necessity to develop and employ antimateriel technology weapons to be inculcated throughout the military.

on targets within its field of view and range. In the other case, an armored vehicle may be fully mobile and yet unable to shoot. This allows the vehicle freedom to move to a location to make repairs or to continue in an attack for the shock value afforded by speed and numbers of armored vehicles.

In either case, firepower or mobility kill, the weapons system may appear to be totally operational. It is impossible to look at the platform and quickly determine its combat status. Extensive observation over a period of time is required to definitively determine its status. This inability is one of the drawbacks to antimateriel technology systems. This is particularly stressful when units are in direct combat. However, when employed in the deep battle, kill assessment concerns are greatly lessened.

In the 1967 Arab-Israeli War we learned that "what can be seen can be hit; what can be hit can be killed." Clearly, lethality on the battlefield had taken a major leap forward following the end of World War II. In the 22 years since that Mid-East war, technology has greatly enhanced both the ability to protect hard targets and the capability to locate and hit those targets with extreme precision.

Major effort and enormous expense have gone into the armor/antiarmor (A^3) "do-loop." The A^3 weapons are constantly increasing in size, strength and technological sophistication. For each improvement in armor there is a new penetrator; for new penetrators there is new armor. The cycle goes on and on. A myriad of hardening and other survivability programs have provided incremental improvement in the capability of weapons systems to remain effective in an extremely hostile battlefield environment.

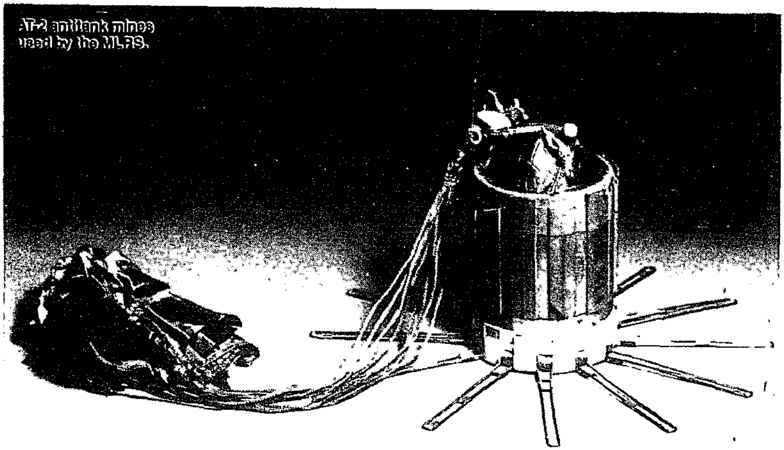
Similar competition can be observed between technological advances in air defense and changes in aviation doctrine accompanied by survivability programs. Artillery improvements have generated increased emphasis on counterbattery location and fires, while the demand for more communication runs against efforts for security and antijam requirements.

One outcome of those programs has been the greatly increased cost and complexity of new weapons systems and the requirement for extensive retrofit of fielded systems that must remain in the inventory. For each advance there has been a countermove, usually followed by a counter-counterinitiative. There are direct costs in procurement of each system and indirect costs in additional weight and complexity. The bottom line is that at some point in the not too distant future, weapons systems will become so complex and expensive that they will not be viewed as affordable by the taxpayers or Congress.

The Antimateriel Alternative

Alternative solutions exist to hard kill of *all* threat targets. The application of these solutions requires both development of new doctrine and a new mind-set on the part of military leaders at all levels. While the doctrinal changes do not represent a radical departure from the present, they do require that the United States adopt a policy accepting calculated degradation of an opposing force as a criterion for success. This infers a willingness to employ weapons systems that reduce the functioning of threat systems but without the absolute destruction of *all* elements of that force. Of course the requirement to service targets with hard kill weapons will remain a primary concern. Antimateriel technology will complement, not replace, hard kill.

The change in mind-set will be more difficult for many soldiers, especially those who are



AT-2 antitank mines used by the MLRS.

By employing long-range or stay-behind antimateriel technology systems designed to degrade enemy mobility, the tempo required by threat doctrine can be seriously inhibited. Small disruptions in mobility patterns deep in the enemy rear can have cascading effects further along. A 1-hour delay of an enemy force deep in its own territory . . . could be critical to the US force that must engage targets at the FLOT.

directly opposed by a potentially belligerent adversary. At the top levels of leadership, the need for alternatives to hard kill weapons has been recognized and generally accepted. What is needed now is an understanding of the necessity to develop and employ antimateriel technology weapons to be inculcated throughout the military. These systems should be understood and accepted for their ability to make major contributions on the battlefield.

There are some historical examples that support antimateriel solutions. One of the most ancient techniques, and one that has continued application, is the use of smoke to degrade mobility and firepower. Today, multispectral obscurants serve to block sensors that can "see" beyond the visual range, thus degrading enemy weapons systems and increasing system survivability. Other examples include the World War II use of meconing to lure aircraft into well-defended areas, which increased their vulnerability while detracting them from their assigned targets.

There are a number of advantages to current adoption of an antimateriel technology approach. First and foremost, it will be effective in fighting at the operational level of war. Effective attacks against deep targets are a precondition for the accomplishment of the land force's mission.[1] By employing long-range or stay-behind antimateriel technology systems designed to degrade enemy mobility, the tempo required by threat doctrine can be seriously inhibited. Small disruptions in mobility patterns deep in the enemy rear can have cascading effects further along. A 1-hour delay of an enemy force deep in its own territory could result in that force failing to reach its assigned deployment position until several hours after its scheduled time of attack. That period could be critical to the US force that must engage targets

The weapons systems derived from these technologies are well suited to attacking the traditional Soviet vulnerabilities of constrained logistical networks, dependence on mass, and centralized decision and control systems.

at the forward line of own troops (FLOT), in that such a disruption would reduce the number of enemy armored vehicles that directly oppose them at any given time. The time saved will provide commanders an opportunity to obtain more intelligence, make better estimates of the situation, communicate operations orders and exercise the mobility required to defeat a numerically superior armored force. This is a critical advantage that has been repeatedly demonstrated through field exercises and modeling. The US commander's ability to make key decisions and reposition forces faster than the threat can respond plays a major role in deciding the outcome of the battle.

The use of antimateriel technologies fits well with the emerging doctrine of competitive strategies by emphasizing our traditional strength of scientific innovation (creative technology). The weapons systems derived from these technologies are well suited to attacking the traditional Soviet vulnerabilities of constrained logistical networks, dependence on mass, and centralized decision and control systems. For the most part, proposed antimateriel weapons systems may be used to keep troops out of harm's way, thereby assisting in maintaining the necessary superior force agility.[2]

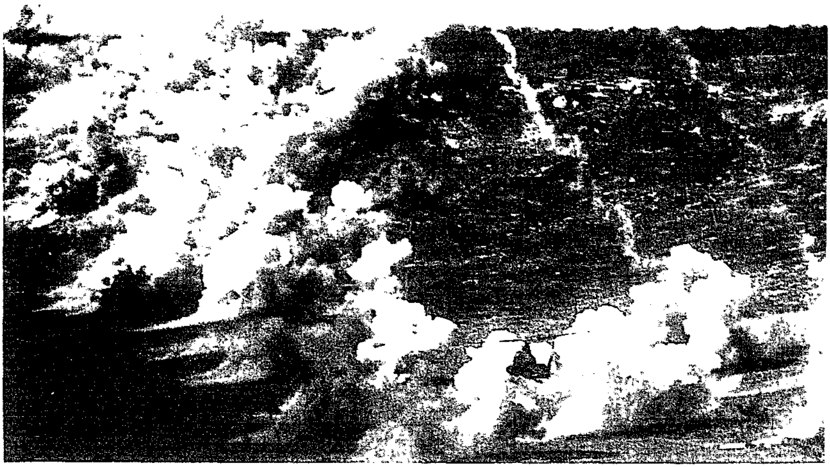
Compared with hard kill weapons, most antimateriel weapons will achieve lower cost per kill. Many proposed antimateriel systems are area weapons that can successfully engage multiple targets simultaneously. As examples, the use of isotropic light to flash-blind opponents would affect the optical/infrared sensors of any system that was looking in the direction of the explosion. High-power microwave (HPM) weapons could eliminate communications systems and other susceptible electronics that were located within the footprint of the microwave pulse. In both of these examples, the total energy required to adversely affect the target is probably far less than that required to physically destroy that target with kinetic or chemical energy.

Another application of antimateriel technology as an energy-efficient area weapon could be to employ substances that interrupt engine functioning. Professor Hoenig of the University of Arizona proposed such a technique several years ago, only to have his ideas rejected.[3]

Antimateriel weapons systems may be employed in a fashion similar to engineer use of barriers and minefields. Those techniques are never employed alone, but are used to canalize the enemy force and are covered by fire. Antimateriel systems can likewise canalize the enemy into designated kill zones and be used to increase the probability of kill (P_k) of weapons systems designed to penetrate armor.

As an example, since maneuverability of a platform decreases the probability of hit (P_h) and the P_k, if an armored vehicle could be caused to stall, even temporarily, then hard kill mechanisms such as SADARM, Hellfire or Copperhead would be more effective. The P_h will increase as the mobility of the targets decreases. In another approach, if soil trafficability could be altered in selected areas, then the threat forces would be forced to stay with established road networks. This action would then enhance both P_h and P_k for smart weapons by reducing the search area for the onboard sensors.

At closer ranges it may be desirable to make antimateriel systems available to light infantry.



Aircraft, both helicopters and "fast movers," are very sensitive to the ingestion of foreign materiel into their engines. The development of airborne substances designed to induce engine failure would be one approach to air defense.

While the air mine's substance could be made invisible, there may be advantages to combining it with a colored gas . . . Once [pilots] observed other aircraft crashing, they would stay out of the cloud . . . Later, the colored smoke could be employed without the noxious substance with equal effect in deterring enemy aircraft.

By having a system that induces engine failure, the infantryman can choose to extricate himself from a position in danger of being overrun by the faster vehicles, or to allow time for aimed fire at a stationary target by his antitank weapon system. Such a concept could greatly assist in the dilemma faced by military commanders concerned with the introduction of light infantry units in the mid- to high-intensity battlefield dominated by armored and mechanized infantry forces supported by self-propelled artillery.

There is also a potential air defense role for antimateriel technology. Aircraft, both helicopters and "fast movers," are very sensitive to the ingestion of foreign materiel into their engines. The development of airborne substances designed to induce engine failure would be one approach to air defense. These substances could be dispersed in the path of aircraft and would cause temporary interruption or catastrophic failure. Electromagnetically induced engine stall or fogging of the canopy represent other antimateriel possibilities. In any case, the threat aircraft would be deterred from completion of its assigned mission.

By combining emerging technologies, advanced applications for air defense can be conceptualized. If noncooperative identification, friend or foe (IFF) technologies were coupled with an engine-inhibiting aerosol, then air mines could be employed to control airspace not physically covered by existing Forward Area Air Defense (FAAD) systems. Even with IFF incorporation, the introduction of these systems would add to the complexity of air traffic control.

Because of the speed with which new technologies are becoming available, there will be an urgent need to get training and doctrine developers involved in planning with materiel developers at an earlier phase. This generates a requirement for advanced modeling capabilities . . . The present [trial-and-error process] is changing, but so far it is not fast enough to keep up with advances in weapons systems.

While the air mine's substance could be made invisible, there may be advantages to combining it with a colored gas. By making the cloud visible, pilots would have the option of flying through it or not. Once they observed other aircraft crashing, they would stay out of the cloud. A positive virtual attrition factor could then be generated. Later, the colored smoke could be employed without the noxious substance with equal effect in deterring enemy aircraft from entering the area.

Antimateriel systems also offer great opportunity in support of installation security. An advantage in their application in this role is the relatively controlled environment in which to operate. Chemical concentrations can be generated at any density necessary to accomplish the mission. As an example, an embassy could install nonlethal chemical generators in the gates to the compound. These generators could be activated either manually by the guards, or by sophisticated sensors designed to detect explosives. This nonlethal approach would have dramatic diplomatic value if terrorists could be captured alive or at least deterred from their objective.

New Requirements of Command

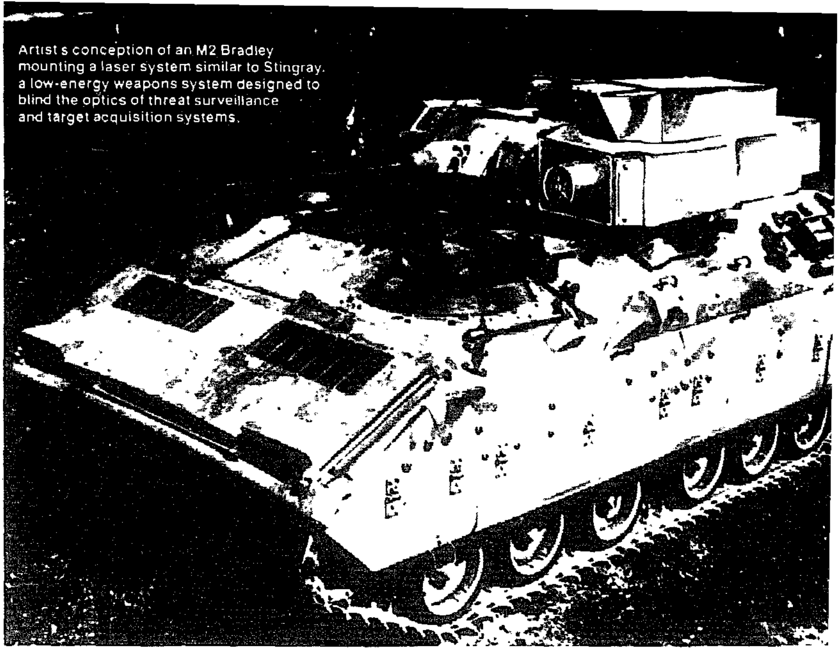
With most area weapons there is a fratricide issue. That problem can be resolved if properly addressed in the development of doctrine but needs considerable thought. The command and control of such systems will require strict discipline. Some systems may not be suitable for close combat but could be decisive in the deep battle.

The commander responsible for employment of these systems must have some understanding of how the technologies work so that he can use them safely and effectively. The commander using antimateriel systems will be faced with a significantly more complex battlefield. Although it is not anticipated that the commander will be a scientist, a basic knowledge of physics, chemistry and weapons engineering may become much more important than in the past. It is not too early to begin consideration of including basic science reviews in the curricula of our service schools at all levels.

Of course every effort will be made to make new technologies as transparent as possible to the soldier. Still, troops will need to know more than just which way to point a weapon, both from the perspective of the effects of the weapon on the enemy and for personal safety. For instance, knowing how to protect oneself from electromagnetic weapons may become equally important as the knowledge of present dangers from nuclear, biological or chemical threats. This is exemplified by the addition of laser protection already required for forward-deployed units.

Electromagnetic Weapons

Electromagnetic weapons represent a class of antimateriel systems that are gradually making



Artist's conception of an M2 Bradley mounting a laser system similar to Stingray, a low-energy weapons system designed to blind the optics of threat surveillance and target acquisition systems.

The technology for Stingray is classic antimateriel technology and was successfully demonstrated under field conditions several years ago. Still lacking is the determination of force structure and doctrine on how to fight this system. It was not clear how many Stingrays would be required to protect what size force, how targets would be handed off for hard kill, and how commanders would employ the system to ensure that friendly forces were not also affected.

their way onto the battlefield. So far this has been a piecemeal approach, with individual technologies and systems being introduced and developed in semi-isolation. Lasers were first employed on ground-based weapons as range finders and later considered as defensive, then offensive, weapons as increased power levels became available. Propagation and power requirements will most likely keep the use of ground system lasers to low to medium power in the near term. High-energy "hole burners" have not met their promised potential after many years of research and development.

The use of lasers as weapons on the battlefield has been held up because of the inability to determine command and control issues and a lack of confidence in cost and operational effectiveness analyses. The Stingray, as an example, is a low-energy laser weapon system designed to assist in the defense of an armored force.[4] The technology for Stingray is classic antimateriel technology and was successfully demonstrated under field conditions several years ago. Still lacking is the determination of force structure and doctrine on how to fight this system. It was not clear how many Stingrays would be required to protect what size force, how targets would be handed off for hard kill, and how commanders would employ the system to ensure that friendly forces were not also affected. Those problems need to be resolved if determinations are to be made as to whether

An example of inducing systems degradation without attacking an armored vehicle could entail the use of highly corrosive chemicals against ammunition or fuel resupply convoys . . . We must look for the soft point. For instance, it may be more advantageous to attack resupply convoys rather than dispersing antimateriel agents against an operational armored unit, in that the wheeled vehicles of the resupply convoy offer softer targets that must travel over known and constrained logistical nets.

the cost effectiveness warrants the introduction of a new system. Even so, lasers will certainly become more prevalent on the battlefield and demand more doctrinal attention.

With the detonation of nuclear weapons, we discovered the problems associated with electromagnetic pulse (EMP). Following that, programs were initiated to protect our systems against EMP effects, as well as designing ways to develop weapons that could employ both nuclear and nonnuclear EMP. In addition, high-power microwaves were seen to be of potential military benefit and programs established to develop their potential.

In 1988, a war game was conducted at Waterways Experiment Station to 'examine the impact of emerging technologies on future warfighting. One of the clear winning technologies was High Power Microwave (HPM). The finding was that "remotely operated [HPM] systems appeared to offer the potential of significantly suppressing enemy C^3I in the combat area."[5] Little thought has been put into the impact of HPM from a doctrinal standpoint. In addition to hardening of our communications systems, we must explore the defensive concepts required to fight in that electromagnetically intensive environment.

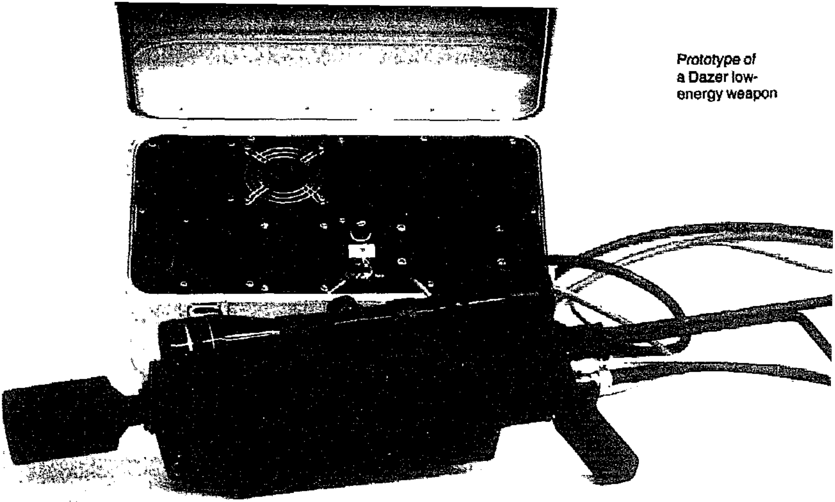
What is now needed and is beginning to emerge, is a coordinated national program covering the full spectrum of electromagnetic weapons. This expanded approach will facilitate the development and fielding of advanced electromagnetic weapons, thus requiring more serious thought about the doctrine for their use.

Virtual Prototyping

There are many advanced technologies that lend themselves to antimateriel systems. By their very nature, several of them are classified. At this point, there needs to be an intensive dialogue between the "user" community and the "developer" community so that we can take advantage of the technological opportunities that are available. This must be a balance of technology "push" and requirements "pull." We need users with sufficient technical competence to understand the advantages and implications of advanced technology. Conversely, we need technical developers who are sensitive to the operational needs of the soldiers who must use the weapons systems once they are developed and fielded. This can only be accomplished through close coordination and an iterative process.

Because of the speed with which new technologies are becoming available, there will be an urgent need to get training and doctrine developers involved in planning with materiel developers at an earlier phase. This generates a requirement for advanced modeling capabilities. One way to accomplish concurrent development is by means of virtual prototyping. The present approach to doctrine development and systems engineering tends to be a trial-and-error process. This is changing, but so far it is not fast enough to keep up with advances in weapons systems.[6]

The concept of virtual prototyping is to create an engagement simulation of a future battlefield, complete with friendly and threat



Prototype of a Dazer low-energy weapon

Electromagnetic weapons represent a class of antimateriel systems that are gradually making their way onto the battlefield . . . Lasers were first employed on ground-based weapons as range finders and later considered as defensive, then offensive, weapons as increased power levels became available. Propagation and power requirements will most likely keep the use of ground system lasers to low to medium power in the near term.

systems, that would be fielded at the designated time. Virtual prototyping allows developers to hypothesize a notional system and assign it certain technical parameters. The characteristics of that notional system can then be placed into a simulation and fought in a variety of scenarios. The operator of the notional system would be trained just as if that system were real.

There would be the opportunity to fit the notional system into a combined arms team to explore "FIGHTPRINT," "TRAINPRINT" and MANPRINT (manpower and personnel integration) perspectives. This infers that FIGHTPRINT allows concept development and evaluation of how the notional system would actually be fought, while TRAINPRINT would provide answers required to establish the best training procedures. The combined results would help drive the generation and validation of the requirements documents by which the real weapons system can be developed. This approach may also provide relatively inexpensive data to indicate whether a notional system should not go forward into engineering development.

In addition to validating requirements, virtual prototyping will allow doctrine developers to observe various concepts for fighting notional systems and assist them in establishing and validating future doctrine. Virtual prototyping will provide a relatively inexpensive option for exploring multiple new technologies to determine which will provide the biggest payoff. At the same time, the training developers can get well ahead of the game instead of following, which has too often been the case.

When applying virtual prototyping to antimateriel technology, great attention must be paid to the calculated attrition induced by the notional system. The figures must reflect reasonably expected capabilities of the notional system at a given level of performance. Part of the exercise will be to determine what militarily significant results must be achieved and to provide guidelines for packaging envelopes and delivery systems.

As an example, for an HPM system to be effective from a military perspective, the model could provide the footprint of the pulse at a given energy level that would be required to degrade a specified percentage of enemy communications systems. The developer could then determine the size of the power source required to ensure that sufficient energy is directed at the target footprint area to knock out those systems. The developer could also determine if there is an existing delivery mechanism that can carry the power source and the other components of the weapon. Those data will tell the developer if current or projected technology can meet the requirements for developing such a weapon. Appropriate developmental risk factors can then be determined and evaluated.

Antimateriel weapons systems may be employed in a fashion similar to engineer use of barriers and minefields. Those techniques are never employed alone, but are used to canalize the enemy force and are covered by fire. Antimateriel systems can likewise canalize the enemy into designated kill zones.

System Vulnerability

To properly utilize the potential offered by antimateriel technologies, there is a need to conceptualize weapons systems in the broadest possible terms. This process should include the attributes of the systems as a whole, as well as each of the subsystems that support the mission effectiveness of the platform. Also included in the thought process should be all of the supporting mechanisms, their design, function and relationship to the primary system. The intent is to identify any weak links in the chain.

It may be possible to degrade a weapons system without attacking the primary platform. An example of inducing systems degradation without attacking an armored vehicle could entail the use of highly corrosive chemicals against ammunition or fuel resupply convoys. These materials could be designed to quickly erode the tires of wheeled vehicles or to damage filters or hoses in their engines. Another approach could be to develop agents that infiltrate the fuel being carried or to interact with the propellant of the ammunition, thereby altering the chemical characteristics required for those supplies to function properly. No soldier wants rounds that do not fire correctly or contaminated fuel in a combat situation.

The agents described can be introduced at any stage of the life cycle of the target. With planning, the raw materials could be compromised, or the manufactured product can be intercepted and contaminated prior to issue or en route to the battlefield. We must look for the soft point. For instance, it may be more advantageous to attack resupply convoys rather than dispersing antimateriel agents against an operational armored unit, in that the wheeled vehicles of the resupply convoy offer softer targets that must travel over known and constrained logistical nets. What is required is "cradle-to-grave" analysis of the weapons system to be degraded, followed by development of unique applications of the new and emerging technologies against the vulnerabilities discovered.

Properly identified, systems vulnerable to antimateriel weapons can provide a class of targets that fit well with the doctrine of "decide-detect-deliver" when fighting a deep battle. Vehicle convoys, supply points or headquarters elements, by their nature, have identifiable characteristics or signatures that enable targeting algorithms to be developed. The interdiction of command and control or resupply functions through introduction of these kinds of area weapons, deep in the enemy's rear, provides division and corps commanders an effective alternative to hard-kill mechanisms. These weapons can seriously disrupt the threat tempo and contribute to the defeat on the enemy both at the FLOT and on an operational level.

Another advantage that some antimateriel technologies offer is the potential for increasing the range of options open to a commander in any given situation. By having nonlethal systems available, a commander may be able to expand the rules of engagement, thereby lessening the danger to his troops. Such systems provide excellent options for highly volatile situations in which open hostility has not officially occurred but tensions are running very high.

As an example, a commander might authorize the use of a system that could disable a vehicle in a restricted area, whereas there might be hesitancy to act if the only options available were likely to cause loss of life. From a diplomatic standpoint it is much easier to negotiate an incident involving property damage than one where death or personal injury has occurred.

Similarly, in many low-intensity conflict or counterterror scenarios hard kill—particularly with collateral damage—is politically unacceptable. Here, technologies such as explosively driven optical munitions can be employed to flash blind or otherwise temporarily incapacitate the aggressors.

At this point, there needs to be an intensive dialogue between the "user" community and the "developer" community so that we can take advantage of the technological opportunities that are available. This must be a balance of technology "push" and requirements "pull."

Antimateriel technology weapons bring several advantages to the future battlefield. They will be a cost-effective alternative to hard-kill mechanisms if it can be accepted that systems degradation provides militarily significant disruption to the threat tempo of operations. To make optimum use of this potential, threat systems must be analyzed in a cradle-to-grave fashion, vulnerabilities determined and creative technological avenues explored. When successfully developed, antimateriel technology will provide a wider range of effective options to the commander on the mid- to high-intensity battlefield and in low-intensity conflict situations. To quote Major General Robert Sunnell, "to counter the Soviet threat, the United States must offer a revolutionary change in the use of its technology on a future battlefield."[7] Antimateriel technology offers such a revolutionary change as a viable option to hard-kill mechanisms. MR

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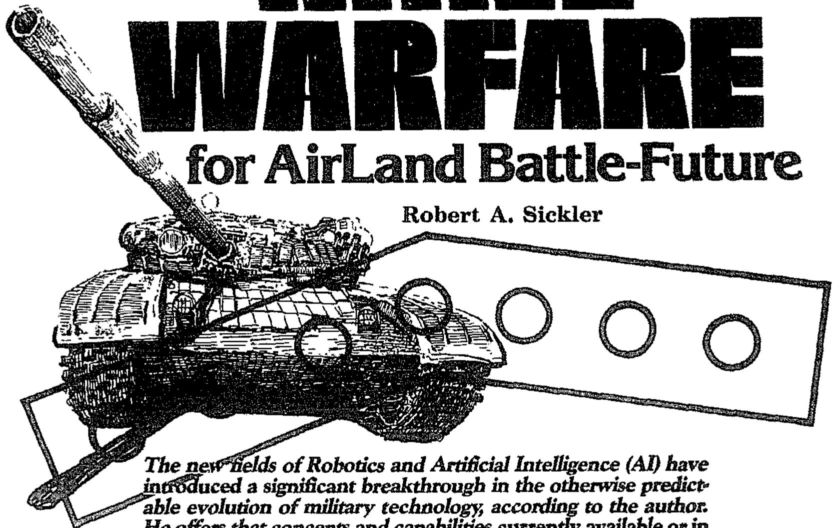
Colonel John B. Alexander, US Army, Retired, manages Antimateriel Technology at Los Alamos National Laboratory, Los Alamos, New Mexico. His military assignments included: director, Advanced Systems Concepts Office, Laboratory Command; manager, Technology Integration Office, Army Materiel Command, assistant deputy chief of staff, Technology Planning and Management, Army Materiel Command, and chief, Advanced Human Technology, Intelligence and Security Command.

MINE WARFARE
for AirLand Battle-Future



Robert A. Sickler

The new fields of Robotics and Artificial Intelligence (AI) have introduced a significant breakthrough in the otherwise predictable evolution of military technology, according to the author. He offers that concepts and capabilities currently available or in emerging technologies leap far ahead of conventional systems. In the area of intelligent minefields, they provide dramatic new capabilities to delay and weaken threat forces.

CATASTROPHIC events such as war or epidemics are often a catalyst that initiates spawning of innovative technologies. However, during periods of peace or limited conflict, the evolution of military systems will often enter a quiescent state. This condition generally continues until threat activity reveals a shortcoming in one of our systems or until there is a significant breakthrough in a relevant research area. Either of these events can result in a burst of developmental activity proportional to the magnitude of the system inadequacy or of the research breakthrough.

A classic example of this stepwise evolution of military systems is found in the history of mine warfare. During the Middle Ages, two military technologies came face to face on the battlefield—the older technology of building fortifications and the newly emerging technology of gunpowder. In 1776, Professor M. J. M. Geuss defined this newly developed art, of breaching fortifications, in a comprehensive treatise on mining techniques called *Theorie De L'Art Du Mineur*. Geuss's application of mining technology dominated mine warfare until 1917, when the British army introduced tanks to the battlefield at Cambrai.

Antivehicle land mine warfare continued to slowly evolve, primarily in response to developments in armored tactics. As a result, mines became more portable, they possessed greater power per unit size and they could be armed with a series of different detonation mechanisms. Through all of this development, the mine continued to be designed as an integral part of the static defense plan and was deployed as an obstacle or as part of an obstacle system. The only deviation in the otherwise predictable, evolutionary path of mine development was in the utilization of "dog mines" by Soviets against German Panzers during World War II.

This attempt by the Soviets to develop "smart-mine systems" was short lived, however, and as World War II closed with the introduction of nuclear weapons, arms developers shifted emphasis from conventional weapons to strategic weapons. For more than three decades, nuclear deterrence dominated weapons development, and conventional munitions such as mines languished in military archives. Eventually, major world forces began planning for "limited" use of nuclear weapons, which brought a revived interest in modernizing conventional munitions. Today, with the ratification of the intermediate-range nuclear forces (INF) treaty, there is an even stronger emphasis on conventional war-fighting capabilities and subsequently a renewed demand for countermobility technology to meet anticipated needs.

The limited nuclear battlefield of the future has generated an ever-increasing demand for the development of nonnuclear but highly effective weapons systems. One of the most promising areas for increasing countermobility effectiveness is in the development of "smart systems." The term smart system is used to indicate an individual mine or field of mines that can:

- Search for targets.
- Detect targets.
- Discriminate between friend and foe.
- Select its own target.
- Engage targets without human intervention.

For the combat materiel developer, this translates into a willingness to utilize innovative technologies, such as artificial intelligence (AI) and robotics, in the development of future materiel systems.

Land Mine Warfare Today

Since early in its employment, the land mine's principal application has been in the defense. In this use, the minefield knows neither friend nor foe and thus is a bidirectional obstacle. Unfortunately, this classical application of mines does not adequately meet anticipated future needs. Minefields of the future must not only be directional obstacles but they must also be lethal weapon systems capable of both offensive and defensive action.

Future minefields are described as having the same capabilities as those in the near term, but with the additional criterion that they must also capitalize on the economy of force factor associated with wide-area automatic munitions . . . [and] the requirement that friendly minefields must restrict enemy movement without significantly impeding friendly mobility.

The US Army Training and Doctrine Command (TRADOC) operational concept for land mine warfare, pamphlet (PAM) 525—19, describes land mine warfare as the deployment of explosive devices to produce a deterioration in threat mobility. In the near-term role, conventional minefields degrade threat mobility by disrupting, channelizing, delaying, fixing and killing threat forces on the battlefield. Degradation of threat mobility begins when threat forces encounter the minefield through reconnaissance or vehicle contact with the perimeter of the minefield. The threat vehicles killed, if any, during detection are secondary to the minefield's primary mission of being an obstacle.

The current concept of land mine warfare calls for mines to be usable on any part of the battlefield and under all conceivable weather conditions. Our inventory of mines can be deployed on the battlefield through various scattering mechanisms or by hand emplacement. These mines are generally employed as defensive barriers consisting of antipersonnel mines, antitank mines or a combination of the two. Minefield barriers may be hastily employed in the reaction to the existing battlefield situation, or they may be used in the "obstacle and denial plan" where they become an integral part of a larger obstacle complex.

> ***Future minefields must be capable of functioning as major force multipliers in both defensive and offensive operations. To accomplish this, they will have to be directional, rapidly deployed, flexible, and lethal barriers that will effectively hold a piece of terrain without assistance from other resources.***

In the near-term employment of conventional minefields, it is recognized that the effectiveness of the minefield can be enhanced by the use of covering fire. Not only will direct and indirect fire increase the overall destruction of threat forces; it will also hamper the threat's efforts to breach the barrier. In this manner, both scatterable and conventional mines can be employed in the defense to disrupt enemy mobility and to increase the effectiveness of friendly fire. In offensive operations, scatterable minefields, because of their rapid and flexible deployment, can be used to disrupt the enemy's ability to mass or reinforce.

In TRADOC PAM 525—19, future minefields are described as having the same capabilities as those in the near term, but with the additional criterion that they must also capitalize on the economy of force factor associated with wide-area automatic munitions. This call for an automated countermobility system is further tempered by the requirement that friendly minefields must restrict enemy movement without significantly impeding friendly mobility. Currently, the only resource that comes even close to meeting these needs is the programmable self-destruct capability found in some of our newer mines.

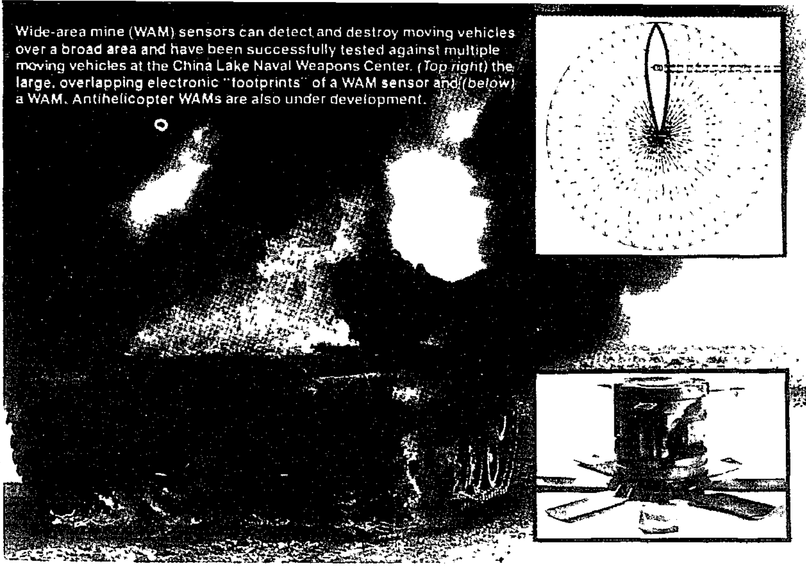
It is evident, then, that our existing land mine warfare capability meets past needs, but is deficient in providing the required level of countermobility needed in AirLand Battle-Future. Future minefields must be capable of functioning as major force multipliers in both defensive and offensive operations. To accomplish this, they will have to be directional, rapidly deployed, flexible, and lethal barriers that will effectively hold a piece of terrain without assistance from other resources.

Intelligent Minefields and AirLand Battle-Future

Intelligent minefields, when used as an integral part of the close-combat heavy force, will become an active component of the antiarmor battle rather than a passive element.

Soviet military art calls for a very aggressive force that can turn even limited tactical successes into operational success, through rapid and deep deployment. Large static defenses have very little effect against tactics of this nature, especially when defending force economics and logistics are restricted. In response to this problem, AirLand Battle-Future doctrine has evolved. Part of this concept calls for meeting the Soviet threat with a flexible and multidimensional defense that draws threat forces into a position where extensive resources are being consumed, thus destroying threat momentum.

As Soviet echelons strive to preempt and dominate friendly forces, a countermobility program using "intelligent minefields" (a smart system) would significantly reduce the threat's ability to maintain the tempo his offensive operations require. This use of intelligent minefields would probably be carried out across the full spectrum of operational areas. Massive intelligent minefields could be employed to delay threat advances over large areas. Smaller and



Wide-area mine (WAM) sensors can detect and destroy moving vehicles over a broad area and have been successfully tested against multiple moving vehicles at the China Lake Naval Weapons Center. (*Top right*) the large, overlapping electronic "footprints" of a WAM sensor and (*below*) a WAM. Antihelicopter WAMs are also under development.

Textron Defense Systems

Massive intelligent minefields could be employed to delay threat advances over large areas. Smaller and less complex intelligent minefields could be used to hold key terrain in both close- and rear-battle operations. An intelligent minefield countermobility program, deep in threat divisional rear areas or army rear areas, would destroy the threat's ability to rapidly reconstruct logistic support.

less complex intelligent minefields could be used to hold key terrain in both close- and rear-battle operations. An intelligent minefield countermobility program, deep in threat divisional rear areas or army rear areas, would destroy the threat's ability to rapidly reconstruct logistic support.

The Massive Intelligent Minefield

In close-battle operations, during the early stages of a NATO-Soviet Warsaw Pact confrontation, NATO forces will be hard pressed to react to the threat's massive operational level attack. Based on historical operations such as Belorussian and Vistula-Oder, Soviet forces will employ multiaxis fronts, where individual axes seek a point or points of weakness. Once an axis shows promise of becoming a breakthrough, reinforcements will be rushed to that area and second-echelon forces moved to follow through. In this conflict, NATO forces must possess the capability to absorb the shock of the Soviet armored thrust, without collapsing. It is anticipated that ground must be yielded, but in such a manner that Soviet forces are crippled beyond recovery. To accomplish this, it will be necessary to construct delaying zones, similar in concept to the Israeli bar lev line, but with greater lethality and endurance. One method of constructing such a delaying zone would be through the use of massive close-battle area intelligent minefields.

The minefield would have to cover a very extensive portion of the front, along with an area designated to react to threat forces as a weak zone. Through prior preparation, the

As Soviet echelons strive to preempt and dominate friendly forces, a countermobility program using "intelligent minefields" (a smart system) would significantly reduce the threat's ability to maintain the tempo his offensive operations require. This use of intelligent minefields would probably be carried out across the full spectrum of operational areas.

mined areas would be both concealed and hardened, allowing them, for the most part, to survive Soviet preparatory fires. As threat pressure builds up, NATO forces would fall back through a series of mine belts and wide-area killing zones (fig. 1). The majority of friendly forces would vacate the mined areas, leaving small select units behind to remotely arm mines, man direct-fire weapons and to provide communication/control for the combined arms defense.

In this manner, advancing Soviet forces would find their units repeatedly trapped between two minefield belts. Before threat units could react to the minefield belts, wide-area munitions would begin engaging targets in the killing zone, between the belts. Both natural and man-made obstacles would restrict lateral maneuvering or channel threat vehicles into wide-area munitions or into fields of controllable bottom-attack mines. This delaying action would be enhanced by the continuing urbanization of West Germany, as new towns and villages become candidates for large smart mine bunker complexes. These mined key urban areas would deny the threat badly needed transportation and logistics centers, thus gaining further time for NATO forces.

The Reinforcing Intelligent Minefield

As the inevitable pressure builds, NATO fronts begin to roll back and Soviet operational maneuver groups (OMGs) push deep into NATO territory, the battlefield will take on a fluid nature. At this time, maneuver commanders will be required to make optimum use of force deployment to meet key threat advances in both the close-battle and rear-battle areas. As

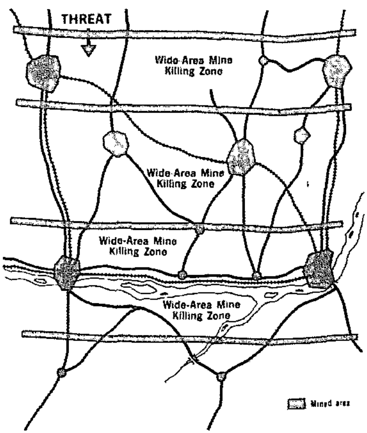


Figure 1 Operational intelligent minefield (IMF)

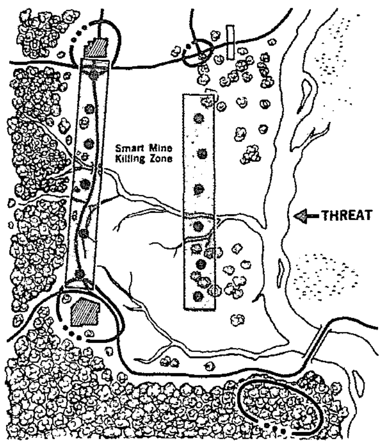


Figure 2. Stand-alone IMF in close battle area

A robotic vehicle being developed for explosive ordnance disposal teams, Picatinny Arsenal, New Jersey.

The technology employed in minefield construction can still be subdivided into three basic systems: mines, sensors and expert control systems. Also, based on current technology, there is a strong probability that large complex minefields will eventually contain robotic vehicles used for mine emplacement, minefield maintenance and mine retrieval.

a result, the commander will be faced with an ever-changing array of weak areas and gaps in his defense structure.

To keep his forces at a functional density and still cover a reasonable front, the battlefield commander will need the assistance of intelligent minefields. These minefields would allow manpower and firepower to be concentrated at other portions of the contested area while the minefield is left, at least temporarily, to hold the gap or weak area. In this reinforcing mode, future minefields will deviate from the conventional minefield by functioning as a flexible barrier that possesses both terrain obstacles and lethal weapon systems.

The reinforcing intelligent minefield would be configured with two parallel mine belts that are separated by a wide-area smart mine killing zone (fig. 2). The entire minefield would remain in a latent mode during early probing by threat reconnaissance patrols. If the minefield has been properly constructed, threat reconnaissance will perceive the gap in friendly lines to be just that, a gap. The threat commander, being locked into a rather rigid set of lower unit-level tactics, would almost be forced into trying to take advantage of what he perceives to be a gap in enemy lines. In this manner, those portions of the defense manned by the human element would be relieved of pressure as the minefield is engaged by the brunt of threat forces.

In this AirLand Battle-Future scenario, the minefield would go to alert status when threat forward security elements, or perhaps advance guard lead elements, enter the outer mine belt. The minefield would allow threat forces to proceed through the central killing zone, to the perimeter of the inner mine belt. The wide-area mines in the inner belt would destroy any breaching effort and thus stop lead threat elements, causing following forces to either pile up in the smart mine killing zone or come to a complete stop. The minefield would then activate the outer minefield belt, trapping threat vehicles in an area where wide-area munitions would begin a systematic engagement of threat systems. The time gained by having the threat tied up in fighting the intelligent minefields would give the maneuver commander operational space for a countermaneuver.

As threat pressure builds up, NATO forces would fall back through a series of mine belts and wide-area killing zones. The majority of friendly forces would vacate the mined areas, leaving small select units behind to remotely arm mines, man direct-fire weapons and to provide communication/control for the combined arms defense.

The Deep Intelligent Minefield

The delaying tactics of NATO will cause Soviet forces to expend considerable resources that must be resupplied if the threat is to maintain momentum. NATO's success in holding ground in Europe until it is reinforced from abroad, will hinge on the disruption of threat logistics. One of the most promising systems for this deep operational-area mission is the deep-battle area intelligent minefield (fig. 3).

Deep-battle area intelligent minefields would be tactically located to hamper threat forces in their attempt to transition from their "initial offensive phase" into their "subsequent offensive phase." To accomplish this mission,

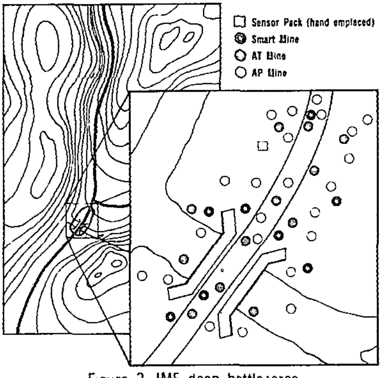


Figure 3 IMF deep battle area

intelligent minefields would be targeted deep in threat divisional rear areas, army rear areas or perhaps even in "forces of the rear" areas. By disrupting routes of travel and logistics bases, it will make it difficult for the threat to support both its main axis and the supporting axes offensives.

For economic reasons, the majority of the mines used in deep intelligent minefields would be scatterables, with only enough smart mines to reinforce the minefield. For targets that are of special interest or targets where the minefield must contain threat forces for a prolonged time, special operation forces (SOF) would be used to hand emplace a more sophisticated intelligent minefield, one similar to those used in the close-battle area.

In developing countermobility systems for AirLand Battle-Future, an underlying predicate must be "major force multiplication in both defensive and offensive operations through the utilization of smart systems." One possible solution is the intelligent minefield that, because of its "stand-alone" capabilities, offers the battlefield commander the options of:

- Generating large delaying zones.
- Reinforcing key objectives.
- Disrupting logistics in threat territory.

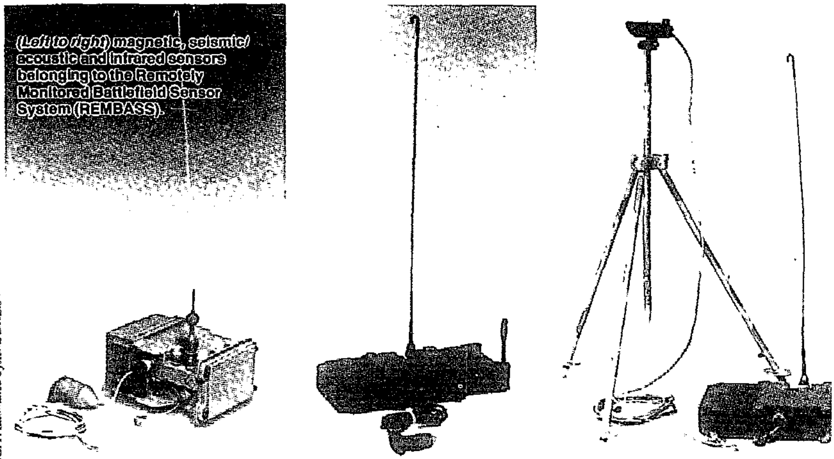
These future minefields and their munitions will posses the ability to:

- Search for targets.
- Detect targets.
- Discriminate between targets.
- Select targets.
- Engage targets with lethal weapons.

Thus, the intelligent minefield is conceived as a "smart weapon" that would add a new dimension to the engineer's countermobility capabilities in AirLand Battle-Future.

Intelligent Minefield Technology

For future intelligent minefields to function at their full capability, they must rely on technology that is just now emerging from the fields of computer science, vision, communications, sensing and robotics. Although there is a strong



(Left to right) magnetic, seismic/acoustic and infrared sensors belonging to the Remotely Monitored Battlefield Sensor System (REMBASS).

RCA Automated Systems Division

The remote reconnaissance system would contain a full suite of sensors to not only survey the battlefield but also to acquire targets. These multisensory packages would generally be located to the rear of the minefield, in an overwatch position, where they could function in relative safety.

probability that there will be substantial diversity in future minefield design, the technology employed in minefield construction can still be subdivided into three basic systems: mines, sensors and expert control systems. Also, based on current technology, there is a strong probability that large complex minefields will eventually contain robotic vehicles used for mine emplacement, minefield maintenance and mine retrieval.

Weapons Systems. Weapon systems used in future minefields will probably cover the full gamut of munitions available to the battlefield commander. Of these munitions, the conventional mine may receive wide use in large permanent obstacles because of its low cost. However, where friendly maneuver is required or in areas where the minefield must possess enhanced lethality, improved conventional mines—conventional mines with an on/off capability—must be employed.

Improved conventional mines would be used primarily in the construction of band or block minefields. The primary objective of these improved conventional minefields would be to:

- Trap enemy units within a field of mines.
- Control threat mobility within an intelligent minefield.
- Divide a threat unit.

An enhancement to both the block and the band minefield would be the capability of "zone control" to allow the subdivision of the band or block into a series of tactical zones, as dictated by the terrain and the tactical situation. In this manner, instead of activating the entire field of improved conventional mines, only those zones of critical importance would be activated. Subsequent zones could be activated as additional threat forces make contact with the obstacle, or as a measure to confound breaching attempts. The concept of zone control within fields of improved conventional mines would allow for a reduction in communication demands (zones of mines are controlled, rather than individual mines) and would give added depth of control to the overall intelligent minefield complex.

A third type of mine that would find extensive use in future intelligent minefields is wide-area mines that possess a kill range considerably greater than the space just above their location. These mines would be employed to reinforce obstacles within the minefield and to add an element of endurance to the minefield. The basic method of operation for these mines is to fire a lethal mechanism into the air where it then engages threat vehicles "from above." There is also the probability that a wide-area mine that fires horizontally would be employed. This concept is currently called the Wide Area Side Penetrating Mine (WASPM).

These minefields would allow manpower and firepower to be concentrated at other portions of the contested area while the minefield is left, at least temporarily, to hold the gap or weak area. In this reinforcing mode, future minefields will deviate from the conventional minefield by functioning as a flexible barrier that possesses both terrain obstacles and lethal weapon systems.

Sensors. In an intelligent minefield, the effectiveness of smart mines would be directly proportional to the quality of sensors employed. For reasons of security, all sensors used in intelligent minefields would probably operate in a passive mode, at least up until the conflict is initiated. Once the fighting has begun, active sensor systems may be used for target acquisition and tracking. In general, there are three basic uses of sensors:

- In a remote reconnaissance package to gather battlefield information.
- As an integral part of the mine and used to detect the presence and location of threat vehicles.
- In sensor-fuzed munitions.

The remote reconnaissance system would contain a full suite of sensors to not only survey the battlefield but also to acquire targets. These multisensory packages would generally be located to the rear of the minefield, in an overwatch position, where they could function in relative safety. This safe position will lose much of its usefulness, however, when the minefield becomes obscured during conflict due to dust, fog, darkness or intentional use of obscurants. Intelligent minefields could overcome this shortcoming through the use of smaller passive sensor packs (seismic or acoustic) located within the minefield itself.

A second type of system would contain sensors within those mines not relying on the minefield control system for target designation. These mines would possess onboard sensors, similar to those in the small remote reconnaissance systems, to detect the presence of threat vehicles. In the "off" mode, the mines will remain dormant, but when switched "on" by the minefield control, they will immediately begin "listening" for the presence of vehicles in their area of influence. Once vehicle-produced energy has been detected by on-board sensors, this information will be used by the mine to engage the threat vehicle. In the case where the mine launches a sensor-fuzed weapon in the general direction of a vehicle, the third class of sensors, located within the weapon, would acquire the target.

Expert Systems. To provide the level of intelligence required by future minefields, an "expert system," or computer, would be used to process sensor information and to control the minefield's reaction to threat activity. This intelligent control system would use sensor data to determine the nature and magnitude of threat forces and to then formulate a tactical response. The complexity and degree of intelligence in the control system will depend on the complexity of the minefield and its munitions system. In general, there will be two basic classes of expert systems: one to control deep or hasty close employments and thus, will not require an extensive knowledge base; the other will control the larger and more complex preparatory minefield, which will require a very large knowledge base.

Where We Are Today

The concept of intelligent minefields, as outlined here, is not a futuristic dream founded on "Buck Rogers" gadgets. Rather, it is a concept predicated on existing technology. A vast majority of this technology has already been developed for other systems and, therefore, can be used to support the intelligent minefield concept. For example, many of the weapon systems described for intelligent minefields exist or are in the proof-of-principle development stage. Sensors described herein for use in intelligent minefields are taken from mature technology and have found extensive use in civilian and military systems. Computer technology to manage the minefield is taken from existing computational systems and from the newly emerging field of expert systems.

There are a number of research endeavors underway that will quantify technology required for future use in sensor monitoring and computer control. Foremost among these efforts are programs to make optimum use of automated data fusion and generate real-time battlefield information in areas such as remote reconnaissance packages, minefield management systems and minefield command and control. These are just a few of the activities in the military and civilian community that are looking into areas of sensor, mine and computer use relative to smart minefield systems.

The concept of intelligent minefields, as outlined here, is not a futuristic dream founded on "Buck Rogers" gadgets . . . many of the weapon systems described for intelligent minefields exist or are in the proof-of-principle development stage.

To meet the demands of AirLand Battle-Future doctrine, future minefields will not only have to be directional barriers—they will also have to be lethal weapon systems that can function in both defensive and offensive operations. Also, because NATO forces will be faced with unfavorable force ratios, there is a very strong need for future countermobility systems that require minimal external resources. Developers of future materiel systems must recognize these parameters and design future countermobility systems accordingly.

Those who plan and build for the future must remember that tomorrow's war cannot be successfully fought using yesterday's technology. It is a grave fallacy to believe that we can meet the high technology requirements of AirLand Battle-Future with antiquated methodologies from our past. If NATO forces are to meet and hold the mass of armor that the Soviets and the Warsaw Pact can throw westward, new and novel methods of countermobility must be employed. The intelligent minefield, with its increased lethality, prolonged duration of operation and enhanced countermobility features, would be one such obstacle. MR

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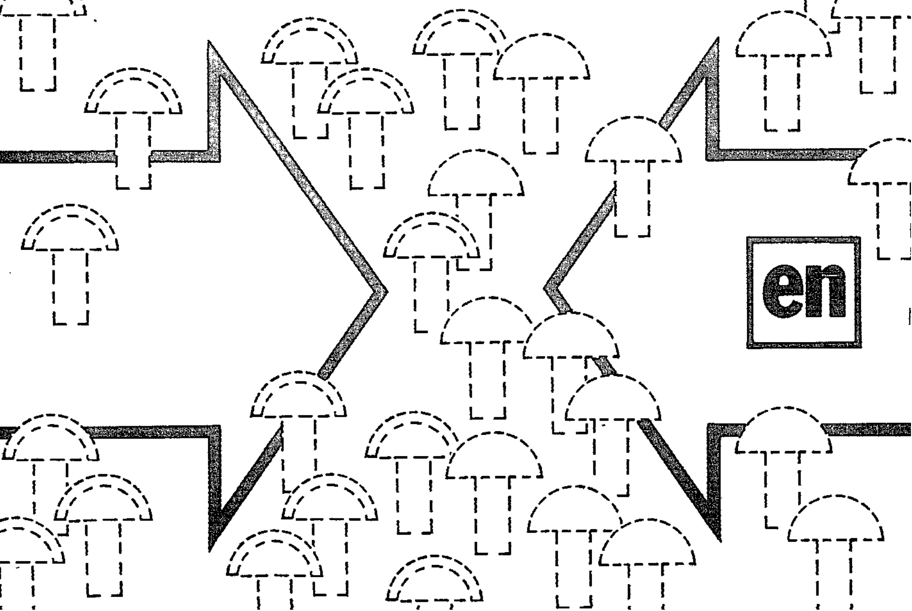
Battlefield Nuclear Weapons and Tactical GRIDLOCK in Europe

Major Michael W. Cannon, US Army

The author has two very important premises here. He posits that a battlefield nuclear exchange in Europe will eliminate maneuver warfare of the type envisioned in AirLand Battle doctrine. He also offers that the US Army and its officers do not train for, and are not prepared to deal with, the nuclear battlefield. He provides convincing evidence of both.



IN THE YEARS following World War II, one of the most troublesome issues for US decision makers concerned the type and size of military force structure that would be required to support proposed policies. After the Korean War, however, Massive Retaliation became the nation's military strategy, with its centerpiece being the atomic bomb. During the 1950s, the Army began to integrate the rapidly increasing stock of nuclear weaponry into its arsenal. Changes in organization and doctrine to support this integration were needed on a large scale. Validations of the shifts from the Army's World War II organization were required as well and were carried on throughout the 1950s in field tests and command post exercises. One of the best-known field exercises was held in November 1955 and was called *SAGEBRUSH*.

Held in the maneuver area around Fort Polk, Louisiana, *SAGEBRUSH* was designed to provide an "extended test" of the atomic age Army's capabilities on the nuclear battlefield. More than 100,000 troops from four divisions conducted maneuvers in a "nuclear" environment for a little over two weeks. Simulated nuclear strikes totalling more than 19,000 kilotons (kt) were delivered by Army and Air Force weaponry (ranging in yield from 2 kt to 500 kt). Over 20,000 personnel and 2,700 vehicles were assessed as casualties.[1]

Unhappily for the Army, and anyone who would have been living in the Fort Polk area, the results of *SAGEBRUSH* indicated that the "large-scale use of nuclear weapons could make maneuver impossible."[2] The Army chief of staff, General Maxwell D. Taylor, commented that "if *SAGEBRUSH* had been a war instead of a maneuver, with about half a hundred nuclear weapons used against the ground forces, within a few days of combat it is unlikely that the Army—as we know it today—could have continued to fight as a coherent, integrated combat force."[3]

Other studies confirmed the unprecedented destructiveness of a nuclear war, particularly in a European theater. The "picture that emerged . . . was fairly consistent. In a nuclear battle on NATO territory, between 200 and 250 nuclear 'strikes' of an average yield of 20 kt would be exploded in the space of a few days in an area no more than 50 by 30 miles." Furthermore, the

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"numbers of nuclear weapons that would be fired [on] . . . a corps front would cause so much physical damage as to render the idea of mobile or any other form of warfare meaningless."[4] Rather than allowing sweeping battles of maneuver, nuclear weapons were bringing untold destruction and "gridlock" to the battlefield.[5]

It was in the mid-1950s that US technology appeared to promise an answer with the development of "fractional" or subkiloton atomic weapons. The potential tactical benefits were significant. The area of NIGA (neutron-induced gamma activity—the area irradiated in the vicinity of ground zero by the weapon) was much smaller and the fallout hazard was also less, as the area that would be affected by the blast was much smaller. These weapons have long since left the theoretical stage and are the types of weapons that are now available for use by battlefield commanders.

The benefits of the shift to smaller weapons at the tactical and operational levels are still being hotly debated, however. In West Germany, the Max Planck Institute conducted a large-scale survey in 1971 that looked at the effects a nuclear war would have on Germany.

The study group's conclusions were not encouraging. They determined that if *only* 10 percent of NATO's battlefield nuclear weapons (BNW) were employed *only* in the area of operations (with densely populated areas being spared), heavy damage would result.[6] What is most discouraging is that when Soviet weapons were included, the "political annihilation" of the Federal Republic of Germany would result.[7] Based on results of studies such as these, many have come to believe that nuclear weapons are "political devices that have very little war-fighting utility."[8] Others, however, disagree. As an example, Majors John P. Rose and Calvin A. Buzzell argue that ". . . nuclear weapons will tend to limit density rather than suppress maneuver" in an article in *Military Review*.[9] These authors contend that nuclear weapons can be used as war-fighting implements if certain doctrinal changes are made.

A major difficulty with the arguments on both sides is that they are backed more by intuition than by cold, hard analysis. Unfortunately, the military has shown little inclination to study tactical nuclear warfare on a large scale. "In the . . . 1950s, the atomic battlefield attracted widespread interest" and "the staff college at Leavenworth devoted half its curriculum" to this topic.[10] Contrast this with my recent experience as a student at the Command and General Staff College [CGSC] where, in the course of the school year, we never discussed nuclear weapons or their influence on operational and tactical matters.

One of the reasons for this lack of study is the sheer amount of material that needs to be covered in a one-year course. Another, and perhaps more plausible, reason is that ". . . what is absolutely clear is that to engage in nuclear war . . . would be to enter the realm of the unknown and the unknowable . . ."[11] The problem faced by the tactician or practitioner of the operational art, however, is that ". . . use of tactical nuclear weapons is likely to alter ground war in ways that are by no means easy to predict."[12]

As it now stands, it appears that the military is making little effort toward overcoming this lack of information in the public domain. The overarching issue, therefore, is that "the services need to revitalize interest in tactical nuclear doctrine."[13] A suitable starting place would be answering the question as to whether the new generation of small-yield nuclear weapons will bring about tactical "gridlock" on the battlefield as they seemed to do in exercises in the 1950s and 1960s.

The thrust of this article will be toward developing a solution using the Training and Doctrine Command (TRADOC) Common Teaching Scenario (TCTS) as a guide. The TCTS is the basis for exercises conducted at CGSC and revolves around actions undertaken by the fictitious US X Corps in the US area of responsibility in Germany.[14] Prior to launching into a war game of this corps problem, however, the assumptions underlying its conduct need to be laid out, including a brief review of the major aspects of US and Soviet doctrine that pertain to this situation and assumptions drawn from them. The problem will then be analyzed using a combination of the "avenue-in-depth" and "box" war gaming methods, with particular emphasis on the likely areas of nuclear weapons use.[15] An analysis of losses and, more important, contaminated areas will then be conducted to determine if the use of nuclear weapons hinders or promotes maneuver. Other issues that may have an impact on US doctrine will then be discussed.

Assumptions

Two of the most critical assumptions deal with the numbers of nuclear weapons systems that would be employed in a corps area and their relative yields (to include weapons effects data). Although more precise numbers are surely available in classified documents, I have purposely avoided them in order to provide a nonclassified study. Total numbers of BNW in Europe are difficult to pin down, yet according to one source, the stockpile of weapons numbers around 4,600.[16] Another source claims that this can be further broken down into approximately 1,400 artillery shells, 400 Lance warheads and 700 to 800 tactical bombs. Altogether, given limits on the sizes of bombs that can be employed at the forward edge of the battle area (FEBA) and the use of a number of these weapons in the deep battle, ". . . NATO could probably deliver considerably fewer than 2,000 nuclear munitions on or near battlefields in Central Europe."[17] Assuming a strength of 50 NATO divisions, this works out to be roughly 40 weapons per divisional sector. Current doctrine precludes such a neat marshaling of weaponry, however.[18]

US doctrine involves the concept of "packages" of nuclear weapons. A package is a request for BNW, submitted by a corps commander, that is defined using four parameters: "a *specified number* of nuclear weapons . . . by yield, or yield and delivery systems . . . the *purpose* for which the package will be employed . . . [such as] support of OPLAN 10 . . . a *time* for employment"; and a specific area.[19] Once approved, refinements that can be made to the package are limited and pertain only to certain aspects such as "adjusting . . . aimpoints [where the rounds will detonate] within the area [specified] . . . exchanging weapons . . . on a one-for-one basis" for smaller yields, adjusting times and schedules of fires to yield the best tactical effects, or ". . . coordinating nonnuclear fires to be delivered in conjunction with the nuclear pulse."[20]

The result is that each package is highly situation dependent. Shown in figure 1 are the packages provided in the TCTS for a divisional unit and one developed for a corps-size unit.[21] Numbers, therefore, can vary widely. For this study, the package developed for the Pre-Command Course teaching scenario will be used (see Package Red in figure 1).[22]

Numbers and yields for Soviet forces are even more difficult to develop from unclassified sources. Yields for a "typical" threat weapon range from 10 to 50 kt.[23] One source even suggests that "a reasonable rule of thumb would assume a 100-kiloton standard and vary it up or down depending upon current battlefield intelligence."[24] What is evident is that their ". . . ability to fight a truly limited nuclear battle appears to be slight," as they do not have ". . . a short range, low yield capability comparable with NATO's."[25] Moreover, since Soviet systems have inherently large delivery/accuracy errors, yields would have to be larger than NATO's for comparatively similar missions.[26]

A related issue concerns the type of systems the Soviets have available to deliver nuclear weapons. Soviet forces undergo organizational changes, as do NATO and US forces, resulting in disparities between desired and actual tables of organization. A common assumption within this framework is to treat any Soviet weapon of 152mm or greater as having a nuclear capa-

Weapon System	Yield(KT)	Corps PNL[1]	Package Darby	Package Smurf	Package Bingo
155mm	.2	63	-	6	5
	1	155	7	2	4
203mm	1	-	1	-	-
	2	70	-	7	6
	8	95	4	2	3
Lance	5	-	-	-	-
	10	54	3	-	1
ADM	1	-	-	-	-
TACAIR	2	-	-	-	-
	10	-	2	2	4
Total Yields =		1607.6KT	90KT	53.2KT	91KT

PCC Corps PNL[2]			Package Red		
WPN	KT	Nos	Corps	23AD	52MECH
155	2.5	60	10	10	7
203	1	16	8		
	2	18	10		
	8	22	15		
Lance	10	15	10		
	100	5	2		
Bombs	20	0	9		
	100	0	2		

Total yield in corps. package is 895 5 KT

[1]PNL is the Prescribed Nuclear Load — the nuclear basic load
[2]PCC is the Pre-Command Course

Extracted from FM 101 31-3, TCTS, and the PCC Extract

Figure 1. Types of corps "packages"

bility.[27] Using the TCTS organization and tables in US Army Field Manual (FM) 100—2—3, *The Soviet Army: Troops, Organization and Equipment*, produces the number of weapon systems and range of weapon yields shown in figure 2. Weapon effects data was drawn from FM 3—3, *NBC Contamination Avoidance*, and FM 3—100, *NBC Operations*.[28] Weapon yields used in the course of running the scenarios were determined based on the type of targets engaged.

Another set of assumptions deals with how nuclear weapons will be employed by both sides. There are marked differences between the US and Soviet viewpoints on the nature of nuclear weapons that cause their approaches to be dissimilar. Current NATO policy stresses controlled and deliberate escalation to convey limited goals.[29] Since the release of BNW cannot be predicted, BNW must be continuously integrated into existing maneuver schemes and plans of fire support.

From a Western standpoint, there is "nothing magically decisive about nuclear weapons at the operational and tactical levels of warfare

US			
Weapons	Nos	Yields	Ranges
155mm How	240	sub KT to 2	18.1 KM to 23 5 (RAP)*
8 inch How	96	1 10KT	22.9 to 30 KM (RAP)
Lance Missile	18	1 100KT	115 (nuclear rounds) 83 (nonnuclear)

*RAP is Rocket Assisted Projectile

US air assets vary—see figure 3 for examples

Soviet			
Weapons	Nos	Yields	Ranges
FROG 7	15 Bns 60 Wpns	50-300KT	70 KM
152mm How	14 Bns (252-336 Wpns)	1KT(?)	27 KM
Scud-B (SS1C)	11 Bns (132-264 (Wpns)	100-500KT	300 KM
SS12	3 Bns 12 Wpns	200KT to 1MT	900 KM
240mm mortars	2 Bns (24 Wpns)	2 8KT	.8 to 9.2 KM

Figure 2 Nuclear delivery systems in a corps area

unless they are integrated with other fires and maneuver. *Their employment alone does not guarantee decisive results* (emphasis added)."[30] No targets are specifically reserved for nuclear strikes. If they are "the best means to defeat the target, and are available, then they are [used]. However, if the target can readily be defeated by maneuver forces or conventional fire . . ." then those means will be employed first.[31]

Units in contact (in the close battle at the FEBA) will probably find that combat remains conventional. Nuclear fires will be used to attack reserves, stop advancing armor formations and protect the flank of maneuvering forces. Targets close to friendly forces will be "targeted with low-yield, artillery weapons for safety . . ."[32]

Responsibility for directing this tighly controlled, discrete use of firepower resides at corps level. The corps commander will determine the degree of autonomy a division can exercise in the employment of subpackages within the given package parameters. Maneuver brigade commanders and their fire support elements then analyze the effects specific aimpoints have on brigade schemes of maneuver and inform the division commanders.[33]

The corps may not, however, be the lowest level of nuclear control. "Because of the possible loss of command and control elements, the authority to employ these weapons may be decentralized to brigade level."[34] This is viewed by some as a good compromise, as "enough staff and communications exist there to support the use of nuclear weapons." It also coincides with current doctrine on chemical weapons' release that recommends decentralization of release authority to division and brigade level to enhance responsiveness.[35]

US doctrine, then, holds that nuclear weapons are to be used only when necessary, in the lowest yield possible to do the job and in a surge or "pulse," to demonstrate to the enemy that we are determined to meet our commitments. This is all the more critical since BNW "are available only in limited quantities and are [to be] employed judiciously."[36] The result is a doctrine that builds from the battlefield outward.

The question as to whether the Soviets would resort to the use of nuclear weapons in a European conflict is a real one with protagonists on both sides of the argument. Army doctrinal literature states that the "use of nuclear weapons is a fundamental part of the threat warfighting capability . . ."[37] Recent trends indicate that the Soviets are moving away from a nuclear force orientation in Europe, however, as ". . . Soviet military spokesmen . . . expect that in a nuclear war they could obtain, at best, only a pyrrhic victory."[38] Even with this understanding, the point to be made is that the Soviets have thought a great deal about how a nuclear war in Europe would be conducted.

From a Soviet perspective, *limited* nuclear war refers to "concepts of protracted nuclear conflict involving selective targeting against strategic and operational targets."[39] The one "true firebreak" recognized by the Soviets "is the conventional-to-nuclear" one.[40] Thus, the Soviet concept of graduated escalation does not coincide with NATO's.

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What "one finds in contemporary Soviet military writings . . . is not . . . concern about escalation control . . . but concern about battle management."[41]

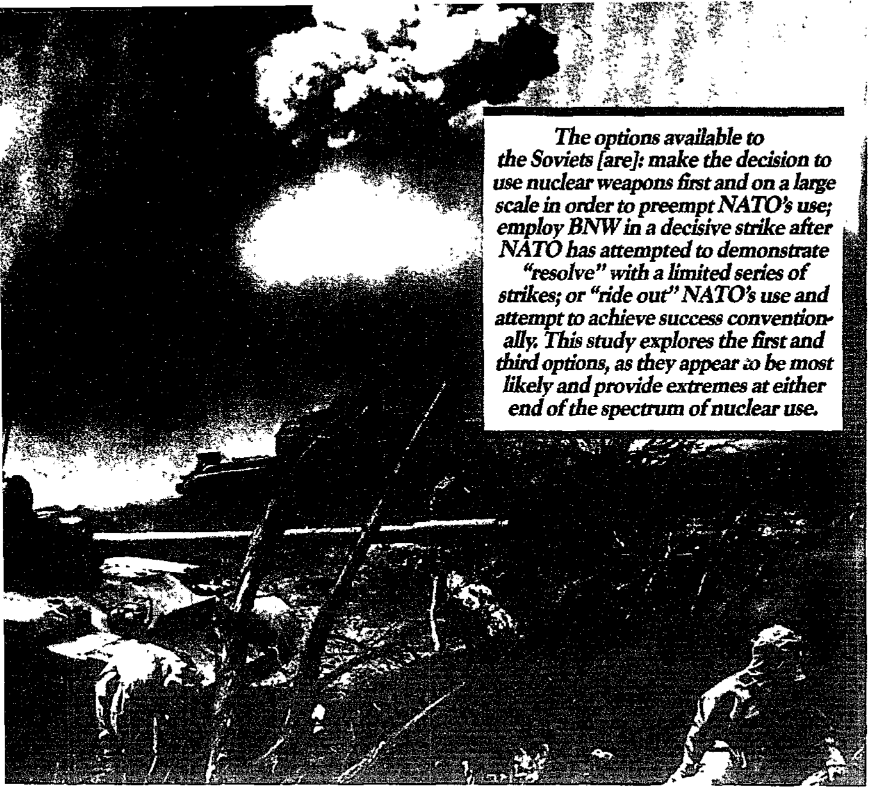
Moreover, "Soviet military planners point out that the task of anticipating the enemy is not so much one of 'beating the enemy to the draw' as it is being the first to employ forces in a decisive way . . . What will be important . . . is that the subsequent use of Soviet TNW [theater nuclear weapons] should be decisive, seizing the initiative through pre-emptive nuclear strikes against enemy TNW and other targets. In other words, *it is not the first nuclear use per se that is of concern to Soviet military planners, so much as the first decisive use of nuclear weapons in the theater*."[42]

It is not certain that the Soviets' conventional abilities to achieve a quick victory "match the demands made upon that strategy under contemporary conditions." The Soviets may "face the requirement to introduce nuclear weapons in the early stages of conflict."[43] NATO, therefore, may not be the side that initiates the use of nuclear weapons.

Indications are that a preemptive Soviet strike would be far different than those conducted by NATO as the Soviets would start with strategic and operational targets. Soviet target groups suggest that "battlefield nuclear strikes would come either simultaneously with, or much more likely after, strategic nuclear strikes against major sectors of the operational and strategic rear areas in the European Theater, but certainly not before. *In this respect, Soviet military strategy calls for jumping several rungs of the escalation ladder, then climbing down*."[44]

Concentration of strikes will be against high-priority targets. As one Soviet officer has written, "Use of nuclear weapons against insignificant, secondary objectives contradicts the very nature of this weapon. The selection of targets should be approached with special care and nuclear weapons should not be thrown around like hand grenades."[45]

Massed nuclear strikes will also be made "along axes of attack and against the most important objectives."[46] Yet another option apparently exists. If the Soviets are meeting with success in the conventional realm, there may be the chance that they will merely "ride out" NATO's use of BNW and employ anti-



The options available to the Soviets [are]: make the decision to use nuclear weapons first and on a large scale in order to preempt NATO's use; employ BNW in a decisive strike after NATO has attempted to demonstrate "resolve" with a limited series of strikes; or "ride out" NATO's use and attempt to achieve success conventionally. This study explores the first and third options, as they appear to be most likely and provide extremes at either end of the spectrum of nuclear use.

nuclear maneuver (tactics that stress dispersion and contact with NATO forces, also referred to as "hugging").[47]

These, then, are the options available to the Soviets: make the decision to use nuclear weapons first and on a large scale in order to preempt NATO's use; employ BNW in a decisive strike after NATO has attempted to demonstrate "resolve" with a limited series of strikes; or "ride out" NATO's use and attempt to achieve success conventionally. This study explores the first and third options, as they appear to be most likely and provide extremes at either end of the spectrum of nuclear use.

A final assumption concerns the ability of a force to operate in the chaos that would be inherent in a nuclear conflict. Whether any force could be adequately trained for such an intense and thoroughly nasty type of conflict should be in question. Merely surviving in an environment saturated with the byproducts of nuclear and chemical use will be difficult. Although for the purpose of this study it is necessary to assume that military units will be able to function in this environment, it would be worthwhile to bear in mind the contention of William Kaufmann:

"Force versatility is . . . difficult to achieve . . . [as] even small units with a great deal of experience have difficulty adapting rapidly to new

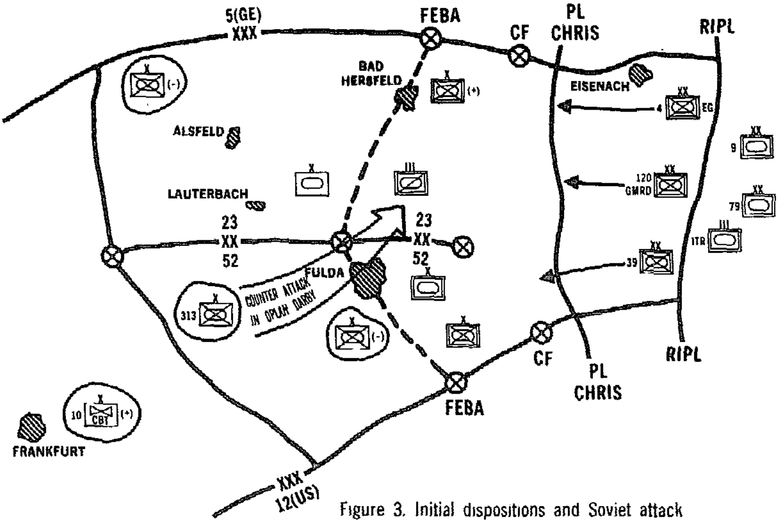


Figure 3. Initial dispositions and Soviet attack

conditions and the demands of specific missions. It is no disparagement to say that large military units are like elephants in a ballet company. Their repertories are bound to be limited and they are not very adept at rapid change."[48]

Analysis

In the TCTS, the US X Corps is a part of the Central Army Group (CENTAG) in NATO and is defending the area known to generations of American soldiers as the "Fulda Gap." The corps consists of one each mechanized and armored division, a cavalry regiment, a separate mechanized brigade, three field artillery brigades, a combat aviation brigade and the appropriate support elements. It is faced by the 2d Western *Front* which is attacking in the sector of the X Corps with the 8th Combined Arms Army (8CAA) and the 1st Guards Tank Army (1GTA), possessing between them a total of five motorized rifle divisions and five tank divisions with supporting assets. Figure 3 shows the initial dispositions of both sides. The CENTAG operations order comments that threat forces may use nuclear or chemical weapons, but in the TCTS, no additional dispersion of units is made to account for this threat. The corps "package" is based on OPLAN *Darby* which has the corps reserve (the 313th Mechanized Brigade) attacking from an assembly area to west of Fulda to destroy the second-echelon divisions of the 8CAA.[49]

Although this exercise focuses on the effects of nuclear weaponry, it should be pointed out that in this type of environment, chemical usage will be just as prolific. The chemical basic load for the corps (given in rounds) is as follows:

	Agent	52d Mech	23d AD	208th	313th	Corps
155mm How	GB	366	250	65	65	1,392
	VX	170	100	40	40	1,550
203mm How	GB					1,925
	VX					685

This is roughly enough in the way of munitions to cover a 12.5 square kilometer area. Soviet capabilities are not listed, but are certainly far greater.[50]

In the first scenario, the battle developed along the lines shown in figures 3 and 4. A Soviet theaterwide nuclear offensive struck tar-

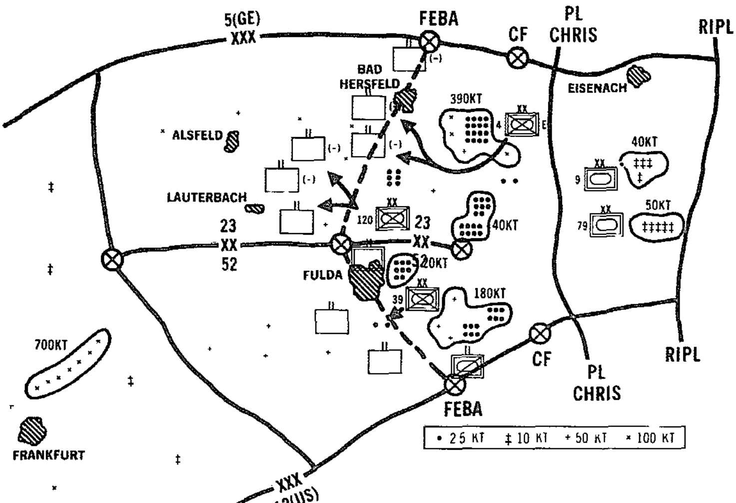


Figure 4. Nuclear Strikes/Situation · H+24

gets throughout the width and depth of the corps area. The corps commander was at a distinct disadvantage in this situation. The Scud missile allowed the Soviets to strike with impunity at depths that the United States could not reach except with aircraft (which, at this time, would be on theater counterair missions). In the initial strikes, five 50-kt and nine 100-kt missiles landed in the corps area, with four and one, respectively, landing forward of the division rear boundaries. It was assumed that, based on the Soviet first use, NATO nuclear release would be readily forthcoming and that available munitions could then be used beginning around H+12 by US forces.[51] The situation as it ended at H+24 is shown in figure 4, with the Soviet forces poised to make a breakthrough in the center.

The second scenario was run in the same manner, yet the use of nuclear weapons was delayed until H+24, when NATO authorities granted release. The strikes then carried out by US forces halted the Soviets on a line essentially along the FEBA, but both sides had suffered heavy losses. The Soviets retained an

From FM 3-3, pg. L-1		Extrapolations for This Study		
Yield (KT)	Radius (meters)	Yield (KT)	Radius (meters)	Area in Sq. KM*
.1	200	2.5	800	2 (1.4 × 1.4)
1	700	8	950	2.8 (1.7 × 1.7)
10	1000	10	1000	3.1 (1.8 × 1.8)
100	1600	50	1200	4.5 (2.1 × 2.1)
1000	2000	100	1600	8 (2.8 × 2.8)
		200	1650	8.54 (2.9 × 2.9)
		1000	2000	12.6 (3.5 × 3.5)

*The figure in parenthesis is a rectangular area approximately equal to the circular contamination When working with a rectangular grid on a map this was easier to use

Figure 5. Residual radiation by weapon

Yield (KT)	Zone I (Sq KM)	Zone II (Sq KM)	Total Area (Sq. KM)
2.5	30	60	90
8	75	150	225
10	100	220	320
50	435	870	1305
100	880	1760	2640
200	1288	2576	3854
1000	5880	11,760	17,640

(approximate by weapon), wind speed = 16 kph

Figure 6. Areas contaminated by fallout

advantage in both scenarios, in that the second-echelon Soviet army had not been committed.

The numbers used to determine radioactive contamination based on the projected nuclear strikes are provided in figures 5 and 6. The areas of residual radiation, NIGA, were derived by the procedure presented in FM 3—3 that essentially involves extrapolation from a table. The yields used for Soviet and US weapons were limited to those in figure 6 as this corresponded with Package Red.[52] The target-oriented method was chosen to plot where rounds would land as opposed to the preclusion method.[53]

Figure 7 summarizes the data gleaned from the first and second scenarios.[54] The tables highlight what may be the crux of the argument concerning whether gridlock will occur—the issue of air versus surface bursts. The areas of residual contamination shown will be present whether or not there is militarily significant fallout.[55] In these two scenarios, the ground contaminated through NIGA represented only 1.8 and 3.5 percent of a corps area of roughly 22,400 square kilometers (based on the TCTS). Although these contaminated areas were located along major avenues of approach and supply routes, this type of radioactivity is expected to last only from 24 to 96 hours. Routine occupancy is possible after two to five days with periodic monitoring.[56] Chemical contamination is also expected to be transitory, within the area of attack, becoming minimal after two to four days, and the surrounding areas seeing relief even sooner.[57] Based purely on the use of air bursts then, the employment of BNW does not seem to pose a problem for maneuver.

The difference comes when fallout is factored into the problem. FM 101—31—1 states that the "area contaminated by fallout from large surface bursts poses an operational problem of great importance. Fallout may extend to greater distances from GZ (ground zero) than any other nuclear weapon effect. It may influence the battlefield for a considerable time after a detonation."[58] In these two cases, if all weapons were detonated as surface bursts, the areas of fallout would amount to three times the corps area in the first scenario and 35 percent of the corps area in the second.[59] Although overlap of the fallout area was not computed, the overlap generally involved smaller weapons. Moreover, larger weapons were employed throughout the battle area, with smaller weapons being concentrated around battalion and regiment-size engagements. The projected areas of fallout, therefore, would not be substantially smaller.

The main bone of contention centers around delivery system reliability. If 100 percent accuracy is achieved, the damage to the combat area would not be much more than that caused by conventional combat. If the Clausewitzian concept of friction, or its American cousin, Murphy, raise their ugly heads and the weapons fail to match technical specifications, things will be far different. If both sides use nuclear weapons and only 25 percent of them cause fallout, this will irradiate the entire corps area. Up to 10 percent of the area will be affected if only the United States employs them (in scenario 1). With the associated tree blowdown and collateral damage to buildings that will result,

Scenario Number 1			
Yields (KT)	Numbers Detonated	Contaminated Areas (Sq KM – Approximate)	
		NIGA	Fallout
2.5	76	152	6840
10	15	46.5	4800
50	11	49.5	14,355
100	19	152	50,160
	Totals =	400	76,155

Scenario Number 2			
Yields (KT)	Numbers Detonated	Contaminated Areas (Sq. KM – Approximate)	
		NIGA	Fallout
2.5	27	54	2430
8	10	28	2250
10	10	31	3200
	Totals -	113	7880

*In Scenario 1, approximately 100 sq KM were hit with persistent agents. In Scenario 2, the usage was greater

*The Corps area is approximately 22,400 sq KM

Figure 7 Contaminated areas based on weapons usage maneuver will be difficult at best or done at a cost in radiation casualties that will be prohibitive.

Two factors exist that pull in different directions along the scale of nuclear use which can affect the results of any study on this topic: control problems and the nature of war itself. Under ideal conditions like the ones under consideration here, the release and control procedures work. Indications are, however, that "current NATO target selection procedures are too slow to permit using nuclear weapons against troop units . . . aircraft can strike only relatively immobile targets. Even cannon and Lance missiles can take an hour or more to prepare and fire, precluding their use against moving targets."[60] Yet, effective use of a limited supply of weapons and the need to ". . . apply incrementally increasing pressure on the enemy . . ." necessitates centralized control.[61] Based upon the exercises in which I have been involved, the higher the level of control, the more difficult it is to strike moving targets, particularly those close to the FEBA. These considerations may, therefore, reduce the scale of nuclear use along the line of contact. In one of the paradoxes of the nuclear age, it may be safer near the FEBA on the nuclear battlefield than in the rear areas.

The higher the level of control, the more difficult it is to strike moving targets, particularly those close to the FEBA. These considerations may, therefore, reduce the scale of nuclear use along the line of contact. In one of the paradoxes of the nuclear age, it may be safer near the FEBA on the nuclear battlefield than in the rear areas.

Other issues that make control difficult, and thus the use of BNW on a large scale less likely, are those of the electromagnetic pulse (EMP) and communications blackouts. The actual interference that will be caused "will depend on how many nuclear bursts occur in what period of time, at what altitudes, and over what areas."[62] When this is coupled with the possibility of preinitiation of rounds, resulting in lower yields, there may only be a certain level to which the use of BNW can proceed tactically before the system collapses on its own and can no longer be employed.

On the other hand, both Western and Soviet writers have noted a tendency of war to escalate even if political and military leaders strive to keep it under control. William Kaufmann wrote that "war . . . is a process so dynamic that it positively invites the resort to increasingly destructive [influences]."[63] Some Soviet statements are even more pessimistic:

"Once the military movements on land and sea have been started, they are no longer subject to the desires and plans of diplomacy, but rather to their own laws, which cannot be violated without endangering the entire expedition."[64]

It is quite possible that a field commander would "tend to use more and more weapons if it became apparent that a previous weight of attack was not having the desired effect . . . Once the weapons he used included nuclear warheads, the likelihood is that more would be used."[65] Leon Sigal writes, in a sobering thought, that ". . . in some cases there are no physical impediments to keep division commanders from deciding on their own to use the nuclear artillery at their disposal."[66] The tendency to use more rather than fewer BNWs is, therefore, a likely aspect of any nuclear conflict; yet, it falls into the category of the unquantifiable and imponderable.

Other Issues

Several other concerns were highlighted by this study. A controversial topic, yet one that should be addressed if BNW are to be used as war-fighting implements, remains what is the best level at which to place authority to expend nuclear munitions? The Western concept concerning the use of nuclear weapons once release is authorized mandates the centralized control of nuclear munitions at corps level. This is a two-edged sword, however. On the positive side, the corps commander has the capability to mass nuclear fires as he can other tactical fires, thus swinging the balance of a fight immediately and decisively in his favor. At the same time, the efficient use of a limited number of warheads can only come through the type of control centralization affords. Unfortunately, the nuclear environment may not be conducive to control from higher echelons. A solution that would allow for better battlefield integration may be to allow, once release has been authorized, division and *brigade* commanders freedom to employ nuclear munitions under their control in accordance with agreed preclusion data within their zones or sectors. This would provide for better use of nuclear weapons in the fluid situations likely to be found in the forward battle areas. As it stands now, the use of subkiloton nuclear weapons in mobile situations is difficult, if not impossible, to orchestrate.

Another issue centers around what tactics to use at division and corps levels. The doctrinal solution for fighting on a nuclear battlefield is to increase unit frontages to enhance dispersion. In the TCTS, the X Corps was responsible for a frontage that varied in width from 55 to 80 kilometers. According to Field Circular (FC) 50—20, *Nuclear Considerations for Operations on the AirLand Battlefield*, this frontage could have been increased to between 160 and 200 km.[67] The area assigned to the X Corps in this scenario, however, appeared to be consistent with its environment and the assigned mission. More width was not needed, but given the coordination problems mentioned above, would increased depth be the answer to a more efficient targeting of attacking forces? What is evident is that the adage that sprang from the 1973 Arab-Israeli War is borne out with a vengeance in a nuclear environment—"if you can be seen, you can be hit . . . if you can be hit, you can be killed." Under these conditions, safety seems to reside in a unit's ability to continue moving and not have its location pinpointed.

"Neutron," or enhanced radiation weapons (ERW), pose yet another quandary. Proponents of this weapon argue that the increased radiation effects allow for the substitution of smaller yields to perform certain tasks. Since blast and thermal effects will essentially be those of the smaller yield, the amount of fallout will be reduced for similar missions. The problem lies in the fact that the most common substitution of the ERW mentioned is at the tactical level, in particular, is the 1 kt for the 10 kt. This is unfortunately the level where the greatest control problems are located and the difficulties in integrating nuclear weapons into a scheme of maneuver, most complex. The likelihood of limited use of smaller weapons due to the cumbersome nature of the system has already been mentioned. There is no reason to assume that ERW will make the problem more readily soluble. Considering that the smaller-yield weapons contributed less than nine and 30 percent of the contamination (see fig. 7) in the scenarios indicates that this in fact may be an unimportant issue for the question asked in this article.[68]

Finally, are today's officers equipped to handle the technical details arising from the resort to nuclear war? The more one gets into the employment considerations and technical intricacies associated with BNW, the more it feels as if one is studying the arcane rites of an obscure priesthood. Is *either* side technically proficient enough to employ BNW in a manner consistent with doctrinal dictates?

The question remains—will the use of battlefield nuclear weapons in a conflict in Europe result in a "gridlock," or cessation of maneuver? The data presented in figures 3 through 5 indicate that contamination will be spread over a sizable area—how large being unpredictable. The numbers of weapons systems available in a corps area (fig. 2) almost assure that as long as nuclear warheads remain in friendly hands, there will be systems available for their delivery.

The use of nuclear weapons, therefore, will more than likely be "tapped out" as opposed to limited. (Note that in scenario 1, almost 3,000 kt were used in 24 hours). My belief is that a war in Europe would rapidly approach Clausewitz's concept of "absolute war," gradually becoming more and more chaotic. Chance and passion may come to dominate political dictates. Taken together, these points lead to the conclusion that the use of nuclear weapons in Europe will bring about a situation in which maneuver will be impossible.

Bernard Brodie once wrote that "history suggests . . . Europe is *not* a good place to have a war if one wants to keep it reasonably manageable."[69] When people in the West talk about a Soviet invasion and our possible countermeasures, we blithely state that "we will let the situation deteriorate only so far and then use nuclear weapons," ending the phrase with a period. In reality it should end—"nukes . . ."—as we have only opened Pandora's "box of atomic conflict" and briefly peeked inside. The horrors of a nuclear war are not in doubt, yet we do not have a clue as to how to cope with the gremlins and shadows that will be unleashed. Merely turning our backs on the problem and hoping the lid will close, or better yet, remain shut of its own accord is not enough. As a profession, we must, through more thorough study, consider the means and ways of conducting a war with nuclear weapons so that the ends we are striving for are not lost in a nuclear Armageddon. MR

NOTES

1 John J Midgley Jr., *Deadly Illusions. Army Policy For The Nuclear Battlefield*, (Boulder, CO Westview Press, 1986), 51

2. Ibid , 63

3 Hanson W Baldwin, "The New Face of War," *Bulletin of the Atomic Scientists*, vol. 12, no 5, May 1956. 154

4. Solly Zuckerman, *Nuclear Illusion and Reality* (New York Vintage Books, 1983), x xi, 62 65

5 The Random House Dictionary defines "gridlock" as "the total paralysis of vehicular traffic in all directions in an urban area because key intersections are blocked by traffic" As used here, the term implies the cessation of maneuver for units of brigade size or larger due to destruction or radiological contamination brought about by the use of nuclear weapons

6. US Department of the Army Field Manual (FM) 100—30. *Nuclear Operations in Support of AirLand Battle* (final draft being submitted to TRADOC for approval), (US Army Combined Arms Combat Developments Activity [CACDA], December 1987), Glossary-10 Defines tactical nuclear weapons by area, yield and weapons system. They are "for battlefield use [against military targets], with deployment, ranges and yields consistent with such use and confined to the immediate zone of military operations in a localized conflict [term applies to strikes against military forces in and around the forward edge of the battlefield] Primarily sub-kiloton nuclear weapons but could go as high as 10 kt Artillery fired atomic projectile tactical air plus other systems that can fire within above area and yield constraints" Based on these considerations, the weapons involved in this study are not necessarily tactical An argument has also been made that any nuclear weapon used on allied soil would be considered strategic by the unfortunate ally I will, therefore, use the term "battlefield nuclear weapons (BNW)" to refer to the weapons in this study

7 Klaus Reinhardt. "Problems of Employing Nuclear Weapons Considering the Special Situation of the Federal Republic of Germany," US Army Reference Book (RB) 101 — 31, *Tactical Nuclear Operations* (Fort Leavenworth, KS US Army Command and General Staff College [USACGSC] April 1980), 7-7 to 7-8

8 From comments made by Admiral Stansfield Turner in a speech to the Naval War College, as reported by retired Colonel Harry G Summers in "Military advice for new president [sic]," *The Kansas City Times* (17 September 1988), A21

9 MAJ Calvin A. Buzzell and MAJ John P Rose, "New Concept for Battlefield Employment of Nuclear Weapons," *Military Review* (August 1981) 69

10 Jerry M Sollinger, *Improving US Theater Nuclear Doctrine A Critical Analysis* (Washington, DC National Defense University Press, 1983), 21

11 Michael E Howard, "On Fighting a Nuclear War," *International Security* vol 5, no 4, (Spring 1981) 14

12. Morton H. Halperin, *Limited War in the Nuclear Age* (Westport, CT Greenwood Press, 1963), 59

13 Sollinger, 21

14 *TRADOC Common Teaching Scenario*, revised October 1985, (Fort Leavenworth, KS USACGSC), I-1 States that the TCTS "was designed to teach military operations applying AirLand Battle doctrine It does not purport to reflect the plans, intentions, or policies of the United States of America or its Allies."

15 CGSC Student Text (ST) 100 — 9, *The Command Estimate*, (Fort Leavenworth, KS USACGSC, July 1988), 4-3 to 4-4 There are three war-gaming techniques. The "avenue-in-depth" method focuses on one avenue of approach at a time, with emphasis on the main avenue The "belt" technique divides the battlefield into sectors along its width. The gamer then analyzes actions sequentially along its depth to determine possible actions and counteractions of opposing forces The "box" technique is a "microanalysis of a few critical areas" and focuses in on the most critical areas in a more detailed analysis I have attempted to have the agencies on post that run computer simulations run these scenarios None of the computer models that involve the use of nuclear weapons considers the effects of fallout or residual radiation, however

16. Catherine Kelleher, "Managing NATO's Tactical Nuclear Operations," *Survival* (International Institute for Strategic Studies, Jan/Feb 1988) 61

17 James M. Garrett, "Nuclear Weapons for the Battlefield Deterrent or Fantasy?" *The Journal of Strategic Studies*, vol 10, no 2, (June 1987) 169 (figures and quote).

18 Ibid , 169 One author writes that "the significant [feature] is not numbers of delivery vehicles but numbers of deliverable nuclear explosives"

19 CGSC ST 3 — 1, *Fundamentals of NBC Operations* (Fort Leavenworth, KS USACGSC, July 1987), 5 49

20 Ibid , 5-51 A pulse is the firing of a package "in the shortest possible time to convey to an enemy that nuclear weapons are being used in a limited manner" Jean D Reed, *NATO's Theater Nuclear Forces A Coherent Strategy for the 1980s* (Washington, DC National Defense University Press, 1983), 42

21 This example of a corps "package" was provided by the Nuclear and Chemical Directorate, CACDA One source claims that in CGSC instruction in 1973, a package of 200 BNW was used. Reed, 43

22 The Pre-Command Course is a short block of instruction given at Fort Leavenworth, Kansas, to newly selected battalion and brigade commanders to acquaint them with the latest doctrines and administrative procedures in the Army

23. FC 50 — 10, 2-5 States that the "50 kiloton yield was chosen [in a particular example] as being representative of a 'typical' Threat yield weapon." FC 50 — 20, *Nuclear Considerations for Operations on the AirLand Battlefield* (Fort Leavenworth, KS USACACDA, Nuclear and Chemical Directorate, February 1984), 1-11 Uses a 10-kiloton weapon in the attack of an artillery battalion Stephen Meyer, *Soviet Theater Nuclear Forces Part I. Development of Doctrine and Objectives* (London The International Institute

for Strategic Studies, 1983), 37 Claims that Soviet studies "suggest that a 20-kiloton (KT) weapon is sufficient to render an infantry battalion useless" A 50-division force would require between 18 and 25 megatons "Of course, poor accuracy would drive warhead yields up and survivability would call for a greater number of delivery vehicles and warheads "

24 Sollinger, 15

25 Garrett, 180

26 ST 3—1, 5-47.

27 William M. Arkin and Richard W Fieldhouse, *Nuclear Battlefields. Global Links in the Arms Race* (Cambridge, MA. Ballinger Publishing Co, 1985), 61 The authors state "DOD has concluded that the 152mm, 180mm, 203mm, and 240mm calibers are nuclear-capable Nuclear-capable self-propelled 152mm artillery guns are now assigned to Soviet divisions"

28 FM 100—2—3; ST 100—3, *Battle Book* (Fort Leavenworth, KS USACGSC. Center for Army Tactics. April 1988); FC 101—5—2, *Staff Officers Handbook* (Fort Leavenworth, KS USACGSC, March 1987) Soviet numbers include all weapons belonging to the 2d Western *Front* which is attacking two separate corps areas Approximately 2/3 of these weapons will face X Corps if the 1st Guards Tank Army in the second echelon is committed in support of the 8th Combined Arms Army (the first echelon).

29 Kelleher, 70

30 FM 100—30, 3-5 (emphasis added).

31 FC 50—20, 2-4

32 RB 100—30, vol 1, *Tactical Nuclear Operations—Doctrine*, (Fort Leavenworth, KS USACGSC, April 1975), 2-3

33 FM 100—30, A-B-2

34 FC 50—20, 1-3, FM 100—30, A-B-2, has apparently modified this somewhat as the brigade commander and his fire support coordination officer will "determine the effects a given nuclear aim point will have on the brigade scheme of maneuver. He will then inform the division commander of the consequences of the parameters of the subpackage"

35 Reed, 13

36 FM 101—31—1, *Staff Officer's Field Manual Nuclear Weapons Employment Doctrine and Procedures*, 2

37 FM 100—30, 1-2

38 Robert L Arnett, "Soviet Views on Nuclear War" in William H Kincade and Jeffrey D Porro, eds, *Negotiating Security An Arms Control Reader* (Washington, DC The Carnegie Endowment for International Peace, 1979), 120

39 Ibid. These targets include command and control facilities, air bases ICBM silos, and so on

40 Meyer, 25

41 Ibid, 32

42 Ibid., 28 (Emphasis in original).

43 Stephen Cimbala, "Soviet 'Blitzkrieg' in Europe. The Abiding Nuclear Dimension," *Strategic Review*, vol. 14, no 3, (Summer 1986) 68

44 Meyer, 30

45 Ibid, 31

46 Ibid, 47 n 121

47 From an interview with Dr Jacob Kipp, Soviet Army Studies Office, Fort Leavenworth, KS, 1 November 1988.

48 William W Kaufmann, *Planning Conventional Forces, 1950-80* (Washington, DC The Brookings Institution, 1982), 22.

49 This information is drawn from various places in the TCTS US forces are fully modernized and equipped with M1s and M2s Although air units are not played in this study's scenarios over 600 Warsaw Pact sorties are expected *per day* in the *corps* area until D+2, when sortie rates are expected to drop off A number of these aircraft are expected to be nuclear-capable

50 TCTS, XXIV-35

51 This is, admittedly, an optimistic figure Kelleher states that the estimate of 24 hours from time of request to release is "obviously dependent upon the situation Other estimates suggest perhaps as many as 60 hours would be required even under the most favorable conditions " Kelleher, 65

52 FM 3—3, D-1 and D-2 I have chosen to use the 2 5 yield for the US and Soviet low-yield artillery weapons, as the numbers were not very different in terms of contamination and made the computations simpler. Fallout Zone I is an area of "immediate operational concern" Units in this area can expect to receive up to 150 centigrays (cGys)—the metric equivalent of rads—in less than 4 hours. "Major disruptions of unit operations within portions" of this area are expected Personnel in Zone II can continue critical missions for up to 4 hours if they have not been previously exposed If the cumulative dosage has been up to 150 cGys, serious disruption of the unit's mission and casualty producing doses can be expected.

53 The preclusion method of targeting involves looking for areas in which limited damage is intended and adjusting aimingpoints or weapons yields accordingly The target-oriented method involves looking for the best aimpoint and yield to achieve maximum damage to the target

54 The "Totals" column represents total Zone I and II contamination by weapon. This does not occur in bands across the battlefield but as a series of "hot spots" where a number of rounds have detonated and are surrounded in some places by fallout zones The pattern is otherwise random.

55 FM 3—3, 1-2

56 Ibid, 3-2 and K-2 Unless monitoring is done, long-term casualties can result from accumulated radiation at lower dose rates The rate of decay of the areas contaminated by fallout depends on many factors It cannot be predicted until a series of dose-rate readings are taken after fallout has stopped. It may drop off fairly quickly or stay in the area as a significant obstacle for several days, weeks or months.

57. Ibid., N-9

58 FM 101—31—1, 79 The following is derived from FM 3—3 NIGA is expected to be the quickest type of residual radiation to decay Soil composition is the most important factor in predicting the decay rate, as the percentage by weight of materials is the prime determinant Soils have been classified into four types for use in calculating decay Fallout calculations are more difficult "Meaningful dose rate and total dose calculations cannot be performed until the decay rate is known Accurate determination must wait until several sets of directed NBC-4 [contamination] reports are available"

59 FM 101—31—1, 11-1 I used a simplified fallout prediction to develop these numbers The prediction of fallout is inherently inaccurate, thus "these methods can be used only to identify suspect areas for early monitoring and survey or to plan the movement of units They are not to be used as a sole basis for executing operational moves" They do, however, indicate the scale of projected "hot spots" on the battlefield It is not clear whose forces fallout will hamper the most Although the ability of Soviet forces to maneuver may be restricted the most near the FLOT, due to Soviet use of nuclear weapons in rear areas, the movement of NATO brigade and higher reserve formations or logistic units may be severely constrained

60 Garrett, 175

61 Ibid

62 FM 101—31—1, 89

63 William W Kaufmann, "Limited Warfare," *Military Policy and National Security*, William W Kaufmann ed, (Princeton, NJ Princeton University Press, 1956), 112

64 Joseph Douglass Jr and Amoretta M Hoeber, *Soviet Strategy for Nuclear War*, Leland Stanford Junior University Reproduced in part in *Readings in Theater Operations Strategic Nuclear Warfare* (Fort Leavenworth, KS USACGSC, AY1984-85).

65 Zuckerman, 68

66 Leon V Sigal, *Nuclear Forces in Europe Enduring Dilemmas, Present Prospects* (Washington, DC The Brookings Institution, 1984), 161

67 FC 50—20, 2-1

68 Milton Leitenberg, "The Neutron Bomb—Enhanced Radiation Warheads," *The Journal of Strategic Studies*, vol 5 no 3, (September 1982) 344-45

69 Bernard Brodie, "Unlimited Weapons and Limited Wars," *The Reporter* (18 November 1954) 20

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G. F. R. HENDERSON and the CHALLENGE of CHANGE

Major David A. Fastabend, US Army

The author warns all men of arms that there is little they can do to avoid the challenge of change. He calls our attention to the open-mindedness and studious dedication of one soldier who met the challenge and provided his profession with writings of uncommon insight. The short career of G. F. R. Henderson left a legacy of contributions for those who study the military and its evolution over time.

A FUMBLED rifle clatters across the desert stones. The lieutenant of the York and Lancaster Regiment curses silently. In the predawn darkness, the tension of the impending assault magnifies every noise to deafening proportions. For several hours, his company of infantrymen has struggled to maintain its alignment among the 11,000 British soldiers inching their way through the morning darkness. Their objective? The four-mile stretch of Egyptian rebel entrenchments and guns at Tel-el-Kebir. Their mission? To seize those entrenchments "at the point of the bayonet." Only surprise can destroy a superior enemy force of 20,000 rebels and 59 guns—and only silence guarantees surprise. The lieutenant's mind is racing:

"Another halt. Whispers—dress up the line! How close are we? Is that a tinge of red on the horizon? If dawn exposes us short of the rebel trench, those guns will . . . a shot! Who fired? That man should be . . . no . . . a sentry . . . their sentry . . . our men are kneeling . . . fixing bayonets . . . lots of fire now . . . 400 yards . . . my Lord, they're all firing . . . let's move for God's sake . . . the charge . . ."

The desert dawn of 13 September 1882 unveils the full scope of the British victory. Two thousand enemy dead lie in the captured trenches at Tel-el-Kebir. The Egyptian rebellion is a collection of fugitives pursued by British cavalry. Our lieutenant has survived the terrors of a night bayonet assault on an entrenched position. Is he a veteran of the ultimate military challenge? Perhaps not. Challenges are met not only in moments, but in lifetimes as well. Evidence of a more subtle, long-term struggle surrounds the lieutenant. The British coordinate their Napoleonic assault via field telegraph. Steamships evacuate the wounded along the Suez Canal.[1] The cavalry finds its fodder in railroad boxcars along the Ismailia-Cairo line. Our lieutenant has faced the challenge of combat, but ahead of him lies the lifelong encounter confronting every military professional—the challenge of change.

The lieutenant of the York and Lancaster

Regiment is George Francis Robert Henderson. He will develop into one of the premier thinkers of the British army during a career that will span a period of intense technological evolution. Henderson's lifelong attempt to deal with change—to recognize it and project its consequences—demonstrates important lessons for the modern military professional.

Born in 1854, at St. Heliers, Jersey, Henderson began his education at Leeds Grammar School, where his father was headmaster. He cut short an Oxford history scholarship to enter Sandhurst, where he was commissioned a second lieutenant in the York and Lancaster Regiment in 1878.[2] After joining his regiment in Dinapur, India, he accompanied it to Ireland, where it was available for commitment to the British expedition that quelled the Egyptian rebellion of 1882.[3] His battalion was subsequently posted to Bermuda and Halifax, Nova Scotia.[4]

This garrison duty was a welcome respite from the rigors of the Egyptian Campaign. Henderson rekindled his interest in history and revived his voracious reading habits. He frequently traveled to the United States, where he toured the Civil War battlefields and met many of its principal veterans.[5]

Henderson's US battlefield tours triggered his first serious writing effort, the 1886 publication of *The Campaign of Fredericksburg*. His thorough analysis of the fighting performance of two volunteer armies drew widespread attention, for England was itself placing increasing reliance on its "volunteer" mobilization forces.[6] Lord Garnet J. Wolseley, commander in chief of the British army, made it his business to find out the identity of "Line Officer," the anonymous author of *The Campaign of Fredericksburg*. Upon discovering that Henderson was languishing in the Commissariat and Transport Staff, Wolseley initiated actions leading to Henderson's 1890 appointment to the Royal Military College at Sandhurst.[7]

In the early 1890s, only a few officers of the Sandhurst faculty were responsible for parades and field training. Cadets held such "gentlemen of action" in high esteem. Purveyors of the theoretical disciplines were not so beloved. Cadets disparaged the academic staff as "ushers"; Henderson's assignment as instructor in tactics,

The British coordinate their Napoleonic assault via field telegraph. Steamships evacuate the wounded along the Suez Canal. The cavalry finds its fodder in railroad boxcars . . . Our lieutenant has faced the challenge of combat, but ahead of him lies the lifelong encounter confronting every military professional —the challenge of change.

military administration and law clearly placed him in the ushers' camp. But what sort of usher was this? Voluntarily accompanying the cadets on skirmishing and patrolling exercises, umpiring the cricket team that he had himself captained as a cadet, Henderson defied the usher stigma to emerge as one of the most popular faculty members. His emphasis on physical training, his sincere interest in his students and his agreeable personality were the hallmarks of his mentoring role at both Sandhurst and the Staff College, to which he was promoted in 1892.[8]

Henderson's teaching tours afforded a superb vantage point for the assessment of change. His lecturing duties included not only the Staff College military art and history curriculum, but also numerous presentations to the Aldershot Military Society, the Dublin Military Society and the Royal United Service Institution. His responsibilities included Continental staff rides in which he led his students in firsthand examination of the most important battlefields of the recent European conflicts. In the 1890s, British army convention did not preclude supplemental employment, so Henderson served as a regular military correspondent to the *London*

Henderson's observations on* The Framing of Orders in the Field *(1896) could easily serve as a Leavenworth first draft on doctrine for "commander's intent": ". . . if [the commander's] intentions have been . . . clearly expressed . . . then energy will take the place of hesitation; quick decision and rapid action will forestall the endeavors of the enemy; opportunities will be utilized."

Times for foreign military maneuvers. His observations of major French and German exercises were excellent opportunities to witness the evolution of military doctrine and equipment.[9]

Henderson's examination of history, war and the technical developments of his era induced a flood of lectures, essays and texts that document his contest with change. Henderson generally skirted obscure academic topics in order to focus on matters of intense relevance to his military and citizen-soldier audience. Writing to instruct rather than to impress, he employed the witty, conversational style of the British officers' mess. That instructive style is clearly demonstrated in his 1891 masterpiece of campaign analysis, *The Battle of Spicheren*. "What should have been the object of the six batteries on the Galgenberg?"—Henderson queries of his readers—"How would you have carried out the counterstroke of 2 p.m.?" Page references hinted at answers for the citizen-soldier, who would not fail to notice that the Spicheren environs bore close resemblance to the land approaches to London.[10]

An intense interest in the performance of citizen-soldiers led Henderson to a lifelong interest in the American Civil War. The European focus on Prussia's defeat of Austria at Königgrätz (1866) and France (1870) had muted interest in the American experience. Many European observers attributed the staggering losses and prolonged duration of the Civil War fighting to a low level of officer professionalism and individual combat skills. Henderson resisted this interpretation, citing the likelihood that future European armies "will be constituted, at least in part, as were the armies of the American Civil War . . ."[11] Henderson lectured that the 1864 Wilderness Campaign with its field entrenchments was "a better clue to the fighting of the future than any other which history records."[12] Douglas Haig, Edmund H. H. Allenby, F. E. E. Wilson and John D. P. French were in the Staff College audience. Presumably these future World War I commanders took notes.

Henderson's Civil War work was not only a historical analysis, but also a framework for his evolving theories of both tactics and strategy. He was fascinated by Thomas J. "Stonewall" Jackson and the extent to which his Virginia exploits epitomized the "spirit of war," particularly the moral influences of leadership and the effects of rapidity, surprise and secrecy. Henderson crowned years of meticulous research with the 1898 publication of *Stonewall Jackson and the American Civil War*. The immense success of this text earned Henderson national attention and a niche in the pantheon of influential British military theorists.

Henderson's generation pondered not only war's past, but also its future. The Industrial Revolution presented many issues for the military thinkers of his period. Would the shock of bayonets or rifled firepower be the dominant effect of infantry? Was smokeless powder of tactical significance? Did cavalry retain a viable role on the modern battlefield? What was the secret of the recent string of German military successes?

Spenser Wilkinson, Henderson's contemporary, had already presented the phenomenon of the German General Staff in his 1890 *The Brain of an Army*. Henderson's explanation of German tactical success, however, included not only the German General Staff, but also its cultivation of the extraordinary subordinate initiative we now call *Auftragstaktik*:

"The study of war had done far more for Prus-

Union troops examine Confederate trenches and fieldworks destroyed by shelling, Fort Mahone, Virginia, 3 April 1865.

Many European observers attributed the staggering losses and prolonged duration of the Civil War fighting to a low level of officer professionalism and individual combat skills. Henderson resisted this interpretation, citing the likelihood that future European armies "will be constituted, at least in part, as were the armies of the American Civil War . . ." Henderson lectured that the 1864 Wilderness Campaign with its field entrenchments was "a better clue to the fighting of the future than any other which history records."

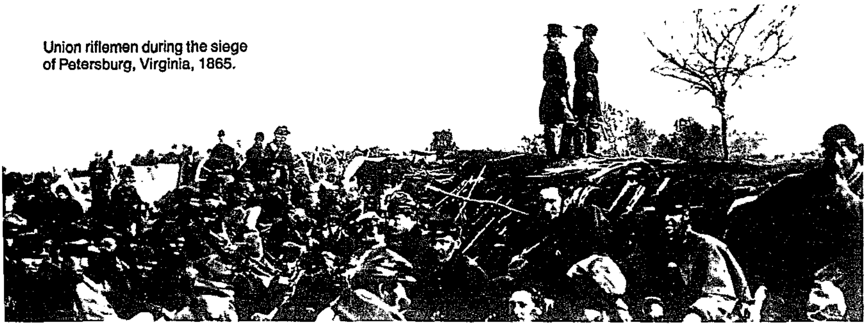
sia than educating its soldiers and producing a sound system of organization. It had led to the establishment of a sound system of command . . . It was based on the recognition of three facts: first, that an army cannot be effectively controlled by direct orders from headquarters; second, that the man on the spot is the best judge of the situation; and third, that intelligent cooperation is of infinitely more value than mechanical obedience."[13]

Henderson's observations on *The Framing of Orders in the Field* (1896) could easily serve as a Leavenworth first draft on doctrine for "commander's intent":

". . . if [the commander's] intentions have been . . . clearly expressed . . . then energy will take the place of hesitation; quick decision and rapid action will forestall the endeavors of the enemy; opportunities will be utilized."[14]

Changes were not only doctrinal, but technical as well. The British army had not experienced major combat using smokeless powder, a comparatively recent innovation (1885). In an endnote to his *The Battle of Spicheren*, Henderson noted that some reviewers had suggested that he analyze the impact that smokeless powder would have had on the battle outcome. In his initial analysis, Henderson believed that "smokeless powder would have made no difference whatsoever."[15]

Was the increased firepower of the ordinary infantryman also insignificant? Henderson's Civil War studies convinced him that the infantryman's increased firepower seriously undermined the dominant "shock" theories of European cavalry employment. Infantry firing the



Henderson's Civil War studies convinced him that the infantryman's increased firepower seriously undermined the dominant "shock" theories of European cavalry employment. Infantry firing the conoid bullet would greatly reduce opportunities for traditional cavalry assault with sword and lance. Cavalry forces retained their reconnaissance role . . . [but] firepower would balance shock as a principal effect of cavalry.

conoid bullet would greatly reduce opportunities for traditional cavalry assault with sword and lance. Cavalry forces retained their reconnaissance role, he believed, but as mobile mounted riflemen who would fight dismounted.[16] Firepower would balance shock as a principal effect of cavalry.

The shock-versus-firepower debate extended to the role of infantry in the attack. Could infantry close successfully against the devastating firepower of modern weapons? In 1895, Henderson was confident that it could:

"It can hardly be doubted, I think, if the first line is able to advance to 250 yards from the position, and at that close range to pour in a magazine fire, that assault, in whatever formation it may be made, is nearly bound to succeed."[17]

It was true that there had been numerous reports of troops going to ground in the costly assaults of the Franco-Prussian War. Henderson, the veteran of the Tel-el-Kebir bayonet assault, was not sympathetic to "skulking" in the attack:

". . . it is scarcely necessary to revolutionize tactics in order to check an evil with which a few fire-closers, aided by a copious vocabulary and the regulation revolver, would be well able to deal."[18]

Henderson's optimism extended even to the bayonet assault. In *The War in South Africa* (January 1900), Henderson deprecated the Boer opponents because:

". . . they act by fire, and by fire alone . . . surprise by fire and envelopment are their only idea of tactics . . . cold steel has no place in their armoury."[19]

As these comments appeared in the *Edinburgh Review*, their author was already en route to South Africa. In spite of the Boer's "limited ideas of tactics," Great Britain had faired poorly in the initial episodes of the Boer War. A relief expedition under Lord Frederick S. Roberts was dispatched to retrieve British fortunes. Roberts selected the renowned Staff College historian as a member of his staff.

The Boer War was auditing the validity of years of Staff College projections. As director of intelligence for South Africa, Henderson was not in a position to take personal part in the combat accounting. But he accompanied forces in the field and took an active role in the campaign planning, until fate dealt him a cruel hand. Henderson—the scholar-athlete who "never ceased to advocate the duty of officers to go in for cricket, athletics and hunting to keep their bodies fit to resist the strains of war"—collapsed from malaria and exhaustion after only a few months in South Africa.[20]

The Boer War had shattered not only Henderson's health, but also his preconceptions of modern combat. The relative ineffectiveness of British cavalry confirmed his opinion that cavalry "armed, trained and equipped as the cavalry of the Continent, is as obsolete as the crusaders."[21] The littered fields of Modder River and Spion Kop called for a new assessment of the infantry shock-versus-firepower issue. It was an assessment that Henderson did not hesitate to make.

The man who had earlier determined that smokeless powder "made no difference whatsoever" wrote in 1901 that:

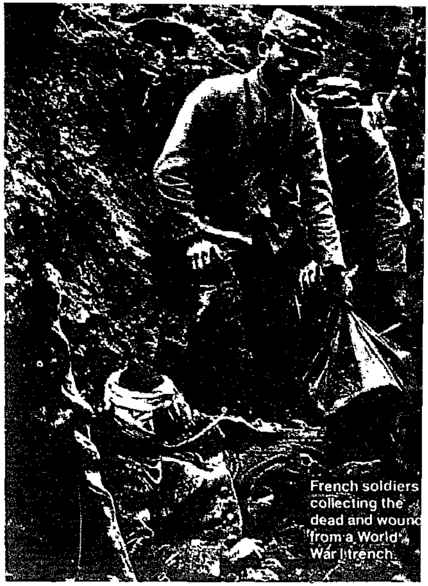
". . . the critics give far too little credit to the terribly demoralizing effect of modern fire and the embarrassments created by smokeless powder . . . the flat trajectory of the small-bore rifle, together with the invisibility of the man who uses it, have wrought a complete revolution in the art of fighting battles."[22]

Henderson similarly revised his faith in the efficacy of the infantry assault:

". . . an article of faith that four things only are necessary in the infantry attack—discipline, energy, unity and numbers . . . contains two fatal flaws. First, that in these days of a flat trajectory and the magazine, mere weight of numbers will have the same effect as in the days of Napoleon. Second, that a dense line . . . will pour in so heavy and effective a fire as to render the return fire of the defenders comparatively innocuous."[23]

The implications of this observation were enormous. Synthesizing the impact of technical change with his appreciation of the moral aspect of combat, Henderson projected a vision of the Somme:

"It is not to be denied that numerical superiority is generally essential to success. But superiority, or at least equality of morale, is just as necessary; and when the preponderating masses suffer enormous losses; when they feel, as they will feel, that other less costly means of achieving the same end might have been adopted, what will become of their morale?"[24]


French soldiers collecting the dead and wounded from a World War I trench.

Brief campaigns, the decisive battle, the primacy of military over political considerations—all were tragic misconceptions to be painfully exposed in the horror of World War I. In the perpetual contest with change, Henderson had only gotten close—and close was far from enough.

In reversing so many of his opinions held prior to the Boer War, Henderson demonstrated the powers of recognition and intellectual flexibility essential for dealing with change. Henderson's post-Boer War writings offer a fascinating glimpse of the specter of attrition warfare that would wrack the European continent within a few years. His revised estimates for the future of cavalry, the superiority of mission-type orders and the relative dominance of firepower were prescient in every respect. But a partial glance is one thing, total perception is another. The sobering aspect of Henderson's contest with change is that—having got so much of it right

—he ultimately got it all wrong! In his 1902 *Encyclopaedia Britannica Supplement*, Henderson projected that:

"Campaigns are not likely to be prolonged, space has been annihilated by steam. Troops are so easily transported and fed by means of railways and steamers, and organisation is so perfect, that as a general rule, far larger numbers will be assembled for the initial encounters than heretofore. There will be more in front and fewer in rear; and the first battles have assumed new importance . . . they may be as decisive as Jena, Eckmuhl, or Waterloo. It is therefore of the utmost importance that once the campaign plan has been approved, the military chiefs upon the spot should be given an absolutely free hand . . ."[25]

The Boer War had shattered . . . his preconceptions of modern combat. The relative ineffectiveness of British cavalry confirmed his opinion that cavalry "armed, trained and equipped as the cavalry of the Continent, is as obsolete as the crusaders." The littered fields of Modder River and Spion Kop called for a new assessment of the infantry shock-versus-firepower issue. It was an assessment that Henderson did not hesitate to make.

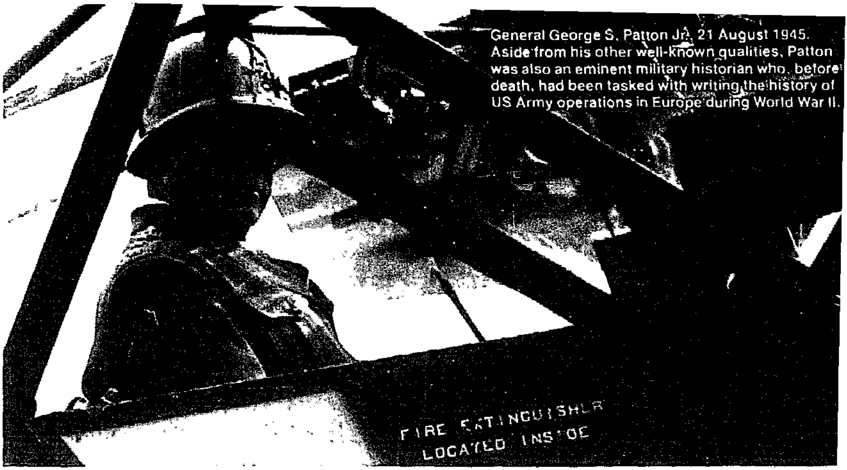
Brief campaigns, the decisive battle, the primacy of military over political considerations—all were tragic misconceptions to be painfully exposed in the horror of World War I. In the perpetual contest with change, Henderson had only gotten close—and close was far from enough.

It is discomforting to note that Henderson, in spite of his enormous efforts, was far from completely successful in projecting the consequences of change. Henderson's experience is testimony to the enormous difficulty of such undertakings. But Henderson's experience is more than testimony—it is also opportunity. The advantage of historical hindsight gives us a unique perspective from which to examine Henderson's writings. The comparison of his thoughtful projections to the subsequent historical reality may indicate some of the challenges we face in our own contest with change.

Change has both qualitative and quantitative aspects. Henderson's post-Boer War prescription for successful infantry assault included careful combined arms coordination and the imperative of the flank attack—recommendations that were qualitatively sound. The flaw in his assessment was that he could not imagine the implications of the mass European mobilizations—the possibility that such large mobilizations could actually *eliminate* flanks. The *quantity* of the European conflict assumed an intrinsic *quality* that escaped Henderson's projection.

Our own assessments of change frequently assume this qualitative focus. We view technical progress as qualitative advances in range, accuracy or penetrating power, ignoring or even sacrificing quantity for quality. For years NATO has wagered its future on hopes of a perpetual qualitative superiority. Even before that superiority began to fade, however, we began to appreciate that "quantity has a quality all its own." A preoccupation with qualitative rather than quantitative factors is one potential pitfall in our encounter with change.

Institutional biases—both external and internal—can cripple an organization's ability to deal with change. Institutional inertia and military chauvinism are particularly dangerous external biases. It was military chauvinism—the prejudiced belief in the superiority of one's own group—that Henderson had successfully resisted in drawing lessons from the American Civil War. Yet even Henderson was not immune to this type of external bias. His accurate identification of subordinate initiative as the key to success in the German orders process, for example, did not lead to his advocacy of that practice. He viewed the disorder of the German tac-



General George S. Patton Jr., 21 August 1945. Aside from his other well-known qualities, Patton was also an eminent military historian who, before death, had been tasked with writing the history of US Army operations in Europe during World War II.

[It is] impractical to determine if our Army is vulnerable to the anti-intellectual charge. An organization of more than 760,000 defies stereotype. But many officers have encountered senior leaders who carefully cultivate the swaggering "man of action" image of a George S. Patton Jr. Hopefully these mimics are also secret scholars who privately emulate Patton's lifelong habits of reading and historical study.

tics with alarm and noted approvingly that:

"... the majority of English soldiers [are] loath to throw away, at the bidding, as it were, of a foreign power, the heritage of tactical skill which is the birthright of our race ... To the mingled strain of Norsemen, Celt and Saxon we owe that combination of staunchness on the defensive and élan on the attack ... that a capacity for conquest is inherent in the English-speaking race it would be useless to deny ... we have, therefore, no need to ask another nation to teach us to fight, nor are we bound to accept the 'Tactics of 1870' or the German 'Field Exercise' of today as infallible and conclusive."[26]

Henderson's "Celt and Saxon" racism is obviously hidebound to the current generation of US Army officers. We are particularly sensitive to the slightest inference of racial prejudice. But is there not a tinge of bigotry in our general disparagement of Soviet command and control methods? Are we perhaps too confident that "American ingenuity" will permit us to invent our way out of any tactical dilemma? Do the Soviets only emphasize drill and the mechanical calculation of combat power requirements "because they have to"?

A related external bias that further clouds an organization's appreciation of current change is institutional inertia. Historians have documented the persistent tendency of military organizations to discount foreign experience as situation-dependent or else to adopt select lessons that reinforce a favorite preconception. Thus each side of the firepower-versus-shock debate drew reinforcing evidence from the example of the Russo-Japanese War.[27] To his credit, Henderson was aware of this pitfall. He was particularly disturbed by Continental dismissal of the British Boer War experience:

"To have to confess that the organization and training of their gigantic armies is based on antiquated principles would be more than humiliating: it would be the signal for the most costly and laborious reforms. Yet the phenomena of the South African conflict permit no doubt that the revolution is an accomplished fact. It is foolish, therefore, to say the least, to attempt to explain away these phenomena by questioning the courage of the English cavalry, or by calmly assuming that our methods of attack were prehistoric, that our shooting was bad, and our patrolling careless."[28]

Henderson's post-Boer War writings offer a fascinating glimpse of the specter of attrition warfare that would wrack the European continent within a few years . . . The sobering aspect of [his] contest with change is that—having got so much of it right —he ultimately got it all wrong!

Was that inexplicable bloodletting along the Shatt-al-Arab a unique product of circumstance or a portent of the future? Can nations afford modern combat? Was Iran-Iraq our Russo-Japanese War?

Internal biases can compete with external ones in crippling an army's capacity for change. Suppression of unorthodox ideas is particularly devastating. The British army suppressed Henderson's draft history of the Boer War because his observations were considered to be too inflammatory and uncomplimentary.[29] We can only speculate at the role that this censorship played in prolonging the firepower-shock debate to its final resolution in the horrors of the Somme and Passchendaele. We would hope that our Army reflects the free thinking of the nation it protects. Yet we are no strangers to the notion that there comes a time when one must "shut up and salute." The dividing line between suppression and loyalty is treacherous at best.

An equally pernicious internal bias is anti-intellectualism. The Royal United Services Institute has preserved the discussion notes from Henderson's original 1894 presentation of "Lessons from the Past for the Present." At the conclusion of Henderson's plea for a vigorous program of professional reading, the chairman (Sir Evelyn Wood) cautions the audience to "look at Blucher, look at Lord Clyde: these two men were certainly not clever, they were certainly not well read, but they had force of character." Wood concluded that:

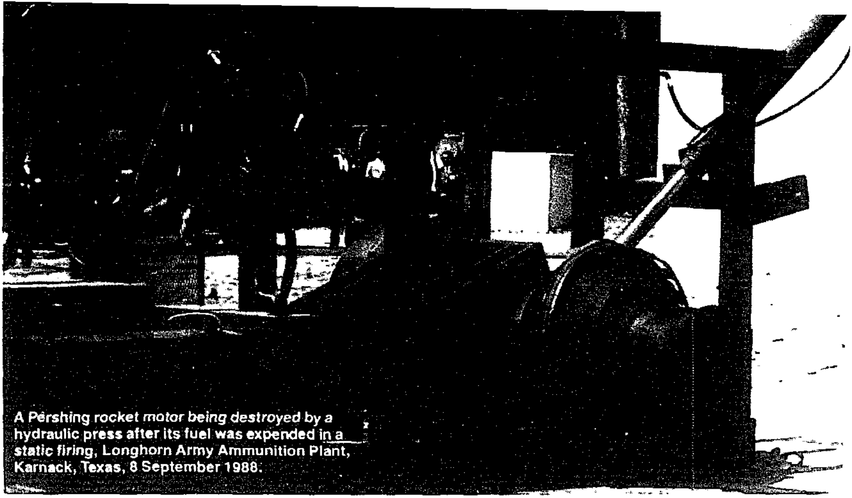
". . . force of character was a much more valuable possession for the leader of an army or fleet than any amount of technical or naval or military knowledge."[30]

It is imprudent (could we say chauvinistic?) to label an entire generation of British officers as "anti-intellectual." But in *The Killing Ground*, Tim Travers has documented a pervasive prewar British anti-intellectualism that neglected doctrine in favor of "experience," "initiative," "common sense" or "imagination."[31] Wolseley prayed that "the officers of Her Majesty's Army may never degenerate into bookworms."[32] Theoretical study was presented as a less preferable alternative to virility, manliness and of course—"character."

It is likewise impractical to determine if our Army is vulnerable to the anti-intellectual charge. An organization of more than 760,000 defies stereotype. But many officers have encountered senior leaders who carefully cultivate the swaggering "man of action" image of a George S. Patton Jr. Hopefully these mimics are also secret scholars who privately emulate Patton's lifelong habits of reading and historical study.

Henderson's experience demonstrates that war is a complex phenomenon that can be described—as Edward N. Luttwak does in his recent text, *Strategy*—as having horizontal and vertical dimensions. Any attempt to assess change without recognition of these dimensions of war is potentially disastrous.

The horizontal dimension of war is the Clausewitzian "duel" between two reacting opponents. This dueling relationship with a reacting enemy induces a dynamic character to change that is all too frequently overlooked. Henderson's pre-Boer War conjecture that an attacking line armed with magazine rifles could


A Pershing rocket motor being destroyed by a hydraulic press after its fuel was expended in a static firing, Longhorn Army Ammunition Plant, Karnack, Texas, 8 September 1988.

The recent debate over the INF Treaty and the nuclear balance in Europe is an excellent demonstration of the challenge of assessing change throughout the various vertical dimensions of the levels of war. The political sensitivities of a nervous populace, the strategic linkage to intercontinental weapons, the ability to strike command and control centers at operational depth and the technical-tactical capabilities of conventional forces present multidimensional considerations of appalling complexity.

always deliver a devastating suppressive fire was fantastic in its neglect of the horizontal dimension. The defenders' own magazine fire—delivered from static and protected positions—was significantly *more* devastating. The horizontal, dynamic interaction of dueling participants is the impetus that propels change at its breakneck pace. NATO should not be surprised and frustrated, therefore, that the Soviet Union has fielded reactive armor to counter the shaped-charge, antiarmor missile. Shallow surface logic that ignores the horizontal dimension of enemy reaction cannot contend with change in war.

The vertical dimension of war—the intricate linkage of its political, strategic, operational and tactical levels—poses a more subtle danger in dealing with change. The urge to analyze change in the restricted isolation of just one level of war must be resisted. Henderson has drawn criticism for neglect of the vertical linkage between strategy and tactics. B. H. Liddell Hart, for example, has indicted Henderson for creating a filter over the American Civil War experience, an emphasis on the tactical and operational characteristics of Robert E. Lee and Jackson's Virginia campaigns rather than the strategic lessons of Ulysses S. Grant's operations in the Mississippi Valley.[33] That indictment might easily be overturned. Assessing the turnaround in the North's war fortunes, for example, Henderson's *Strategy and Its Teaching* relates that "it was not until the great strategists of the North, Grant and Sherman, were given absolute authority that the situation changed."[34] With many of his more developed strategic insights buried in his obscure post-Boer War writings, Henderson may well be a victim of the extreme popularity of *Stonewall Jackson*.

Henderson is nonetheless guilty of a related charge: failure to identify strategy's ultimate linkage to political aims. His strategic writings offer masterful insights in the operational and tactical direction, but generally avoid the political context—the uppermost boundary of war's vertical dimension.[35] Henderson's invocation

For years NATO has wagered its future on hopes of a perpetual qualitative superiority. Even before that superiority began to fade, however, we began to appreciate that "quantity has a quality all its own." A preoccupation with qualitative rather than quantitative factors is one potential pitfall in our encounter with change.

of Grant and William T. Sherman above was an attack on civilian (Abraham Lincoln's) interference in strategic planning. Henderson did not transcend his generation's general distaste for political intervention once matters were committed to resolution by "the sword." The primacy of military over political considerations proved to be a formula for disaster as the lights went out all over Europe in the fall of 1914.

Although political considerations assume a rightful dominance in this age of nuclear confrontation, the danger of assessing change in the convenient isolation of just one level of war is not diminished. The recent debate over the INF (Intermediate-Range Nuclear Forces) Treaty and the nuclear balance in Europe is an excellent demonstration of the challenge of assessing change throughout the various vertical dimensions of the levels of war. The political sensitivities of a nervous populace, the strategic linkage to intercontinental weapons, the ability to strike command and control centers at operational depth and the technical-tactical capabilities of conventional forces present multidimensional considerations of appalling complexity.

At the turn of the century, Henderson's opportunities to deal with change were fast drawing to a close. After incorporating the lessons of his Boer War experience into a revised draft of the British infantry drill regulation, Henderson returned to South Africa in 1901 to write the official war history. His tireless efforts led to a malaria relapse and subsequent convalescent transfer to Assouan (Aswān), Egypt. He died there in 1903 at the age of 49. His colleagues mourned the passing of a "British Moltke" and published a 1905 collection of his works under the title, *The Science of War*.[36]

Henderson produced an extraordinary volume of work in his 16 years of professional writing. His work exhibited a steady progression in sophistication and an evolution of focus to the higher levels of war. Given a longer career, it is probable that he would have corrected his neglect of the political-strategic interface. It is interesting to imagine the impact if Henderson had survived to witness the Russo-Japanese War and the "war to end all wars." Britain entered that war minus a valuable component of its intellectual armory. As Jay Luvaas has remarked, ". . . in the ferment of discussion in the years preceding the war, Henderson would have spoken out with vigor and authority. And he would have been heard."[37]

Today, Colonel George Francis Robert Henderson enjoys little name recognition outside the better-read Civil War enthusiasts. Luvaas has published several essays admirably documenting Henderson's impact on British military thought and modern interpretation of the Civil War experience. In 1986, the Army War College published a copy of Henderson's *Lessons from the Past for the Present*, annotated to illustrate its significance for the operational level of war. But Henderson is frequently victimized by his posthumous *The Science of War*. His well-meaning admirers mixed Henderson's pre- and post-Boer War writings, thereby introducing contradictions and leaving him vulnerable to selective citations, illustrating a blindness to the development of firepower on the 20th century battlefield. Many of Henderson's non-

Civil War writings are neglected—a valuable vein of military insight as yet unmined by modern military professionals.

What were the thoughts of Henderson in those final feverish nights at Assouan? Was it the mind of the Staff College sage or the young lieutenant of the York and Lancaster Regiment that wrestled with the darkness?

"The next war . . . firepower? . . . shock? . . . morale?—'but what will become of their morale?' . . . my Lord, they're all firing . . . let's move for God's sake . . ."

Henderson's contest with change is at an end. We can censure his failures or admire his successes. Perhaps we should simply consider how we ourselves will be judged. A merciful God may spare us Henderson's ordeal of a night assault on an entrenched position. But we will not escape the challenge of change. MR

Henderson's pre-Boer War conjecture that an attacking line armed with magazine rifles could always deliver a devastating suppressive fire was fantastic in its neglect of the horizontal dimension. The defenders' own magazine fire—delivered from static and protected positions—was significantly more devastating . . . NATO should not be surprised and frustrated, therefore, that the Soviet Union has fielded reactive armor to counter the shaped charge.

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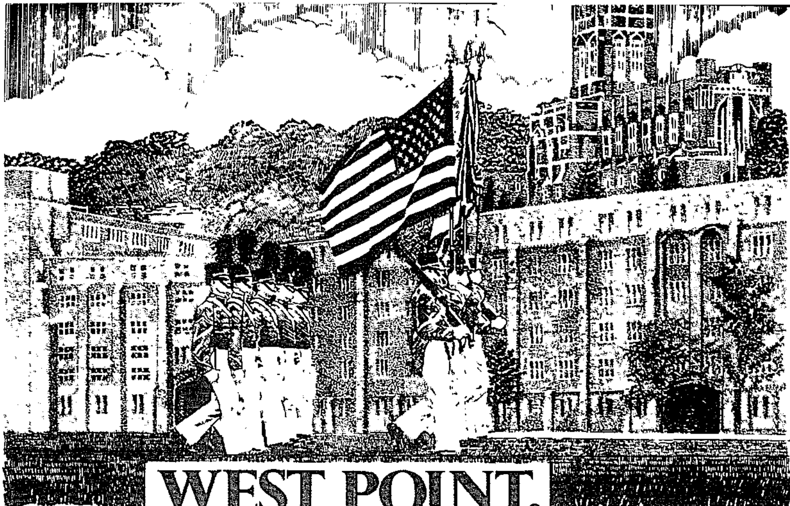


WEST POINT, THAYER & PARTRIDGE

Truman R. Strobridge

The prominent role played by West Point in the education of many of our greatest leaders is well documented. Not so well known are many of the fine officers who contributed to the tradition and heritage of the academy. The lives and contributions of two of these officers are chronicled here. The author also tells of a longstanding feud which had influence on the academy and on the formation of the Reserve Officers' Training Corps.

IN 1985, the US Postal Service issued two commemorative stamps in its Great American Series. The 9-cent stamp honored Sylvanus Thayer, Father of West Point, while the 11-cent stamp paid tribute to Alden Partridge, founder of Norwich University in Vermont. Both were honorable men, both served their country faithfully as military officers, and both left their imprint upon their era. The nation was right in so honoring them.[1]

Few users of these stamps knew that a bitter controversy has persisted since 1818 over the roles played and the contributions made by these two "great Americans" during their respective tenures as Superintendent of West Point. Now, after they have both been officially honored on the 200th anniversaries of their birthdays, the time seems appropriate for a dispassionate look at the historical facts in an attempt to do full justice to the memories of both.

Born on 12 February 1785, Alden Partridge was reared in the pioneer environment of Norwich in Vermont, his schooling being confined to winter months at the village school. His hunger for knowledge prompted him to borrow the books available in the community and, "by the light from the fire in the huge fireplace," he became his own teacher, aided by the tutoring of a local minister, preparing himself well enough by his mid-teens to be accepted as a student at Dartmouth College.[2]

Then, "being actuated by an ardent desire to qualify himself to render service to his Country in the military capacity," he applied for an appointment as a cadet at the new US Military Academy, established in 1802 at West Point.[3] Receiving his appointment on 23 November 1805, he reported for duty on 5 February 1806, as an artillery cadet, being reappointed on 9 July as an engineering cadet. Because of his previous college training, he managed to graduate on 30 October 1806, the 15th to do so, less than nine months after his arrival. In March 1807, he was commissioned a first lieutenant in the Corps of Engineers, an honor shared by only one other West Point graduate.

Assigned to West Point as an assistant professor of mathematics, Partridge quickly demonstrated his leadership qualities, keen grasp of technical knowledge and skill as a teacher. In 1809, he "introduced into the Academy the French System for Tactics," which was subsequently adopted by the US Army.[4] Partridge also wrote the first general set of regulations for the academy, which were published on 31 March 1809. He also established a demerit system for handling infractions of the rules, and new classes in philosophy, astronomy and geography.

Promoted to captain in 1810, he became an acting professor of mathematics and also the acting superintendent. The first superintendent found his duties as chief of engineers required him to spend prolonged periods away from West Point. In his absence, he delegated his authority as superintendent to Partridge.

By 1812, the US Military Academy was still a very weak infant among American educational institutions. That year Colonel Joseph G. Swift, West Point's first graduate, became his alma mater's second superintendent. He succeeded in pushing a bill through Congress reorganizing the academy, which had graduated far too few cadets to lead the large numbers of troops needed in the anticipated war with Great Britain.

The 1812 reorganization provided for entrance examinations, additional professorships and increased the number of cadets. The most far-reaching change established a set of regulations for cadets, including one that required each cadet to "receive a regular degree from an academic staff."[5]

Under this reorganization, Partridge became professor of mathematics in early 1813, being transferred later to the newly created professorship of engineering, the first such engineering teaching position in America. In this new teaching role, Partridge made a contribution that had a lasting effect upon the West Point curriculum. After explaining a principle of engineering or a type of fortification, he demonstrated his point by describing some notable campaign where this technique had been used, making the course into a combination of engineering and military history. His successors followed his practice and the course was renamed Military Art and Engineering, the most popular one at the academy.

The war had demonstrated the value of professionally trained military leaders and, with the coming of peace, President James Madison recognized the importance of the academy by separating it from the Corps of Engineers.

Despite these organization changes, the war years were chaotic at West Point. At one point—July 1812, the national mobilization had stripped the academy of everyone except Partridge and one cadet. The one thing Partridge could rectify he did, by beginning construction of three new buildings.

The war had demonstrated the value of professionally trained military leaders and, with the coming of peace, President James Madison recognized the importance of the academy by separating it from the Corps of Engineers. The first officer to be selected solely for the position of superintendent, instead of the chief of engineers and the head of the academy incidentally, was Captain Alden Partridge.

This fascinating, yet enigmatic, officer proved to be the most controversial of all the superintendents in the history of West Point. This controversy has continued down to the present.

The 30-year-old Partridge enthusiastically set about using the new authority of the independent superintendency to reshape the academy on a true military basis. Many of the regulations and practices he initiated have become a part of West Point tradition and are still followed today. The legendary schedule, with virtually every minute of the day being strictly accounted for, began under Partridge.

Partridge's personal concern for his charges involved him in the daily life of the cadets. He ate with them in the mess hall, drilled them, made surprise inspections to the barracks and even gave a sermon in the chapel on Sunday. After obtaining a military band, the superintendent designed uniforms for it. He set up the first formal requirements for graduation and a commission. More buildings were constructed. He located funds for the purchase of military textbooks for the cadets. Partridge also designed a new uniform, the color being "Cadet Gray."

Described as having "the body of a penguin and the head of a hawk, with sharp, pointed nose, square jutting chin, and tightly set mouth," Partridge was never seen out of uniform.[6] He strolled about in a buttoned-up coat, wearing a cocked hat with a black silk cockade and yellow eagle on it and flashing his sword and sash. His entire life was marked by "strict propriety," his personal belongings and furniture being unostentatious, and his associates limited solely to academy personnel.[7]

Despite his many achievements and improvements, Partridge became embroiled in many controversies with his superiors in the War Department, his faculty and cadets. Some were brought about by outside causes, while others were brought on by himself.

Among other criticisms, Partridge has been described as being egotistical, revengeful, malevolent, vain and jealous. Called "Old Pewter" behind his back by the cadets who still respected him, he both disliked and distrusted his faculty, which reciprocated in kind. His disdain for bureaucratic regimentation caused him, when he believed it in the best interests of the academy or the cadets, to disregard orders of his superiors, to recommend cadets for graduation without an examination, and fail to hold the prescribed three-month summer encampment.

The frequently leveled accusations that he showed favored treatment to those cadets he liked and unusual punishment to those he did not could have been based on hard-to-fault personal judgments. Granted that, for extreme offenses, Partridge did confine the offending cadet to the "black hole," a cavelike hole in the ground about eight feet square that the offender invariably considered to be "filthy and uncomfortable," but he never left them there for more than a half hour.[8]

Unwisely, Partridge had also allowed several of his relatives to secure positions at West Point, thereby laying himself open to the charge of nepotism. In time, rumors began circulating that Partridge and his relatives were defrauding the government.

In February 1816, President Madison and General Swift came to West Point to investigate these rumors. After Swift decided that the superintendent had discharged his duties "honestly," the president accepted that conclusion.[9] Even the court of inquiry, convened after the faculty had made accusations, pronounced Partridge innocent of all counts, but did reprove him for the "black hole." It found that he had been "extremely attentive to and solicitous about the *Health, Morals and Improvements* of the youths under his charge."[10] The following year, a new faculty charge brought Swift back, along with the new president, James Monroe. Upon his arrival in June 1917, the president was handed a sealed letter from the entire faculty containing all the old charges against Partridge, but also accusing him of transforming the academy into a narrow military drill school.

President Monroe read the faculty's communication and flew into a rage, ordering Swift to court-martial the superintendent and find a new one. Swift offered Partridge the choice of either going on leave or accepting another assignment, and the superintendent selected leave.

Once alone after his superiors had departed, Partridge's anger and frustration at having his world shattered—his privacy invaded, his rights violated, his academy lost, his reputation blemished and all his labors undone—manifested in his lashing out at those he considered responsible. He had every professor on the post arrested for participating in a cabal, then began teaching all their classes himself. No leave for him, Partridge decided—instead, a holding action.

Thayer Enters the Scene

President Monroe had not been idle. On 17 July 1817, he appointed Captain Sylvanus Thayer, who held the brevet rank of major, as the new superintendent and instructed him to proceed to West Point and take charge of the academy.

This 32-year-old officer, destined to be Partridge's nemesis, was born on 9 June 1785, in Braintree, Massachusetts. Growing up in an old settled area near Boston, Thayer spent his impressionable years in a community with strong cultural ties to the former mother country. Like Partridge, he received little formal schooling but, being a quick study, he made the most of it.

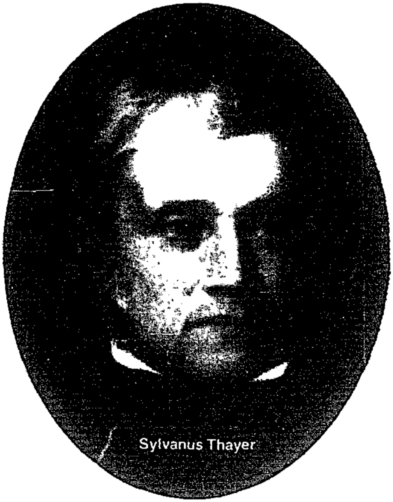
In 1803, financed by his earnings from odd jobs and with a little help from his father, Thayer entered Dartmouth College. While there, he stood at the top of his class, joined a debating society and, in his sophomore year, gave the Greek oration at commencement.

Graduating in 1807, he forfeited the honor of delivering the commencement address for the fulfillment of a greater dream—entering the newly founded military academy at West Point. As a college graduate, Thayer easily qualified for a commission in the Corps of Engineers in merely one year.

Alden Partridge

Following graduation, he assisted in designing and constructing fortifications along the coasts of New England and New York and served as an assistant professor of mathematics at West Point. When war came in 1812, he performed yeoman service on the Canadian frontier and in Virginia, being brevetted a major.

The behavior of the volunteers, who were



Sylvanus Thayer

often poorly trained, inadequately equipped and undisciplined, confirmed his conviction that only by the European military methods and practices could the American officer be adequately trained. The tiny library and small number of instructors at West Point could not correct the situation.

Since the best schools and teachers were in Europe, Thayer persuaded the president to let him and another officer study the latest military and technological developments abroad. Arriving in France in July 1815, they studied at the foremost French academies, examined numerous fortifications and purchased about 1,000 books, 400 charts and a few models of fortifications.

Thayer returned to the United States in May 1817, convinced that the French method of requiring a heavily scientific course for prospective officers was the best policy for the military academy at West Point to adopt. When President Monroe ordered him to assume the superintendency, Thayer had the once-in-a-lifetime opportunity to put his theories into practice and, in so doing, he put his personal stamp upon West Point education that has persisted to this day.

The Clash . . . Perhaps Mutiny?

On 28 July 1817, Thayer walked up the hill onto the plain at West Point. Although slim and possessing soft features, he stood close to six feet tall. Later, his careful dress and dignified manners would result in his personal appearance as superintendent being described as "majestic."[11]

Partridge, his senior in the Corps of Engineers, met him with the question: "You are reporting to me, Brevet Major Thayer?"[12] Silently, Thayer handed over a letter from Swift. After reading the orders dismissing him from the superintendency and command of West Point, the grim-faced Partridge stomped off. The man Thayer replaced would become his enemy for life. They had been fellow students at Dartmouth and Thayer was a cadet when Partridge was an assistant professor at West Point. Before departing the following day, Partridge requested—and ever after insisted he received—Thayer's promise to leave his quarters, filled with a nine-year accumulation of furniture and books, undisturbed until his return.

On 29 August, Partridge returned to prepare his defense for the court of inquiry. The cadets greeted him with cheers, tossed their hats in the air and escorted Partridge on his way to Thayer's headquarters, where he learned that his furniture and books had been removed and his old quarters assigned to another officer. Despite Partridge's spirited protests, Thayer refused to return them.

The following day, he repeated his demand to be given his old quarters back, but Thayer firmly refused. At issue was an old Army custom, a ruthless and vicious one that caused resentment, broken friendships and even hardships. On Army posts, the senior officer was given first choice of quarters, then the next senior and so on, with lieutenants being displaced by captains, captains by majors, majors by lieutenant colonels, and so on. Partridge argued his case on three points. First, he outranked the present occupant of his old quarters. Second, he insisted that Thayer had promised them to him prior to his departure. Third, he was senior to Thayer, who was merely a brevet major, his regular station was West Point and, by the rules of the Corps of Engineers, he was entitled to the command of the post. What actually transpired during this confrontation is unknown, but Partridge did not get his old quarters back, as he never ceased to point out.

As Partridge explained later, he had to assume command of the post and the superintendency, "though contrary to my wish," to obtain his old quarters—his "personal right"—otherwise he would have been "entitled to the contempt of the members of the Honorable Corps."[13] Thayer knew that resistance was useless, since the cadets would support Partridge, and their entire mutiny might lead to a public scandal that could have seriously—if not fatally—damaged the academy. Instead, he dashed off a letter to Swift reporting the situation and then departed West Point. Two days later, Swift's aide-de-camp came rushing to place Partridge under arrest, take away his sword, and reinstate Thayer.

Court-Martial and Court of Inquiry

The War Department ordered the convening of a general court-martial in October 1817 at West Point to try Partridge on four charges (one of which was mutiny) and 20 specifications under the charges. In perhaps "the strangest legal entanglement ever recorded in the annals of any army," the same officers sitting in judgment of Partridge were ordered to serve as a court of inquiry investigating the former superintendent's charges against the academic staff.[14] This body of officers, as a general court, listened to witnesses against Partridge on the four charges one day; then, on the following day, as a court of inquiry, they heard the testimony of Partridge against the academic staff.


Joseph G. Swift

The court of inquiry dealt favorably with Partridge. It sustained his charges against the academic staff, dismissed as "without foundation" the accusations that he had excited the cadets to mutiny, and decided that the former superintendent had exercised common sense and good judgment.[15]

Partridge did not fare as well with the same body of officers as a general court. Although acquitting him of three charges and 16 specifications, the general court-martial found Partridge guilty of one charge—disobedience of orders—and four specifications, all dealing with his assumption of command after his clash with Thayer. Significantly, the court-martial did not find him guilty of a single charge or specification concerning the academy. In fact, if the purely military aspect of the charges and specifications were disregarded, the findings of the court-martial completely exonerated Partridge. Even the officers serving as a general court concluded that some of the charges and specifications had been nothing "but frivolous

Thayer returned to the United States in May 1817, convinced that the French method of requiring a heavily scientific course for prospective officers was the best policy for the military academy at West Point to adopt.

and vexations."[16] The court sentenced Partridge to be cashiered, but recommended clemency, which President Monroe granted, thus allowing him to resign from the Army.

The Aftermath for Partridge

Feeling his trial unfair and wronged by its verdict, Partridge demanded the arrest and trial of Thayer to do justice not only to both men, but also to the US Army. When the secretary of war paid no attention, Partridge next made accusations against Swift. Again, the War Department ignored his request. After a personal appeal to the president failed, the officer tendered his resignation effective 15 April 1818.

Yet, the bitterness festered on. As he wrote in a prophetic letter to Swift later that same year, "the business will not rest . . . until the whole scene of iniquity . . . relative to West Point be fully developed . . . I am now thirty-three years of age, and should I live to be seventy, the subject shall never within that time be abandoned unless justice be done."[17] Partridge also mentioned his intent to form an academy to replace West Point as the chief American source of officers, since it would not be subjected to the whims of men who "are ignorant of the first requirements both of military and every other Science."[18]

For the rest of his life, Partridge remained a determined and vocal opponent of his successor and West Point. His observations during the War of 1812 had convinced him that a trained citizen-soldiery possessed greater intrinsic values than a large standing army; moreover, West Point alone could never turn out the large numbers of officers required to command a national army.

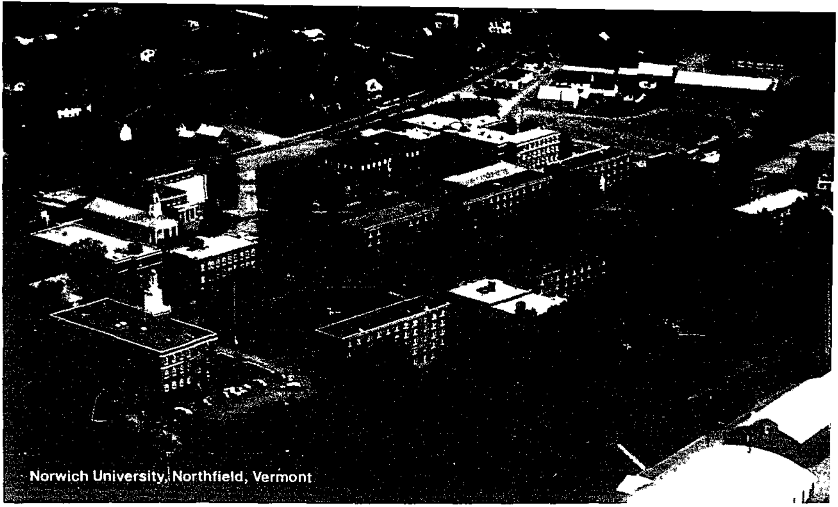
Returning to his hometown in 1819, he established an academy as a competitor and, he hoped, a replacement for the US Military Academy. It quickly became a success, becoming Norwich University in 1834. Aided by Norwich graduates, Partridge established short-lived academies in 16 cities in seven states. Although none lasted, his concept of a series of local military schools around the country did survive. Partridge deserves the credit for sparking the impulse that later led to the nationwide appearance of elementary and secondary military academies.[19]

Credit also goes to Partridge for first proposing large-scale federal aid to states for education. His 1841 plan called for using funds from land sales to endow institutions of higher learning to offer a broad curriculum, including courses in military science. Although he died before his dream was realized, Congress did pass similar legislation sponsored by Justin Morrill, a long-time Partridge associate. The Morrill Land Grant College Act of 1862 provided for college-level training of citizen soldiers. Because of his pioneering efforts for including citizen soldiers into the bulwark of national defense, Partridge has become widely regarded as the spiritual father of the Reserve Officers' Training Corps (ROTC) programs on college and university campuses nationwide.

Partridge was the first ballistician, one of the first geographers and meteorologists, and the first to hold a professorship in engineering. He also served for several years as state surveyor and in the legislature of Vermont prior to his death in Norwich in 1854.

Thayer's Later Years

As for Thayer, the years after his clash with Partridge proved to be his most productive and rewarding. He went on to shape the academy until his resignation from the superintendency in 1833 in such a way as to earn the title "Father



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of the Military Academy." The "methods and techniques he introduced are, for the most part, in effect today, the course of studies he outlined is still essentially the same, his disciplinary measures are the basis of those in use today, while his aims and goals are those of the present West Point."[20] Long after Thayer's death in 1872, his accomplishments even won him a place in the Hall of Fame as one of the founders of American technology.[21]

The historical evidence indicates that both Partridge and Thayer played a significant part in shaping the embryo West Point into the venerable institution that it has become, as well as leaving their impressive marks upon the nation. John P. Lovell had joint praise for both: "Indeed, what is often forgotten by present-day admirers of Thayer is that he succeeded where Partridge had failed in enlisting the support of his faculty largely because they saw that Thayer regarded discipline as but one means of realizing the broader educational goals of the seminary-academy that he hoped to create."[22]

Perhaps the continuing controversy over the Partridge-Thayer clash resides in the very nature of West Point itself. As an uneasy compromise between America's fear of a standing army and its need for skilled combat commanders in wartime, the US Military Academy has always been in the forefront of this still unresolved debate. It has long been accused of being an aristocratic institution, which churned out an elitist and privileged class of officers for a nation dedicated to equality, democracy and the common man. The point of view—first effectively advocated by Partridge—that the

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nation needed a large army officer corps made up of citizen soldiers rather than a small group of professionals is one half of an argument that has persisted down through the years. The slashing attack by Benjamin F. Schemmer in the 1 December 1985 issue of the *Washington Post* is but the latest echo of this enduring controversy.[23]

Another explanation for the clash and abiding controversy lies in the different way the two antagonists reacted to the challenge of the new nation being carved out of the wilderness. Partridge, frontier born and reared, naturally sought new solutions—those uniquely rooted in and suited to the conditions of the new world—for a proper defense. Thayer, raised in a more settled area that still retained its admiration and ties to the former mother country, naturally looked to guidance from the old world for an effective defense. America has long debated the wisdom of relying upon a small professional, albeit aristocratic, army or the broader-based and more democratic militia/reserve system. Both have their merits and disadvantages, as well as vocal supporters, in the past as in the present.

Since an honest difference of opinion on this issue still persists and the historical record reveals that both Partridge and Thayer have left their imprint on West Point and the nation, perhaps the time has come to pay equal honor to the memory of these worthy gentlemen. While Thayer has earned the title "father of the military academy," Partridge also played an important part in keeping the academy at West Point together during its difficult early years and earned a title of his own—"father of the ROTC."

NOTES

1 Unless otherwise cited, the material in this article is derived from Stephen E Ambrose, *Duty, Honor, Country A History of West Point* (Baltimore, MD The Johns Hopkins Press, 1966); Bennett H Berman and Michael E Monbeck, *West Point An Illustrated History of the United States Military Academy* (New York: New York Times Books, 1978) Major-General George W. Cullum, USA, *Biographical Register of the United States Military Academy* (New York, D van Nostrand, 1868); Colonel Ernest Dupuy, USA, *Where They Have Trod* (New York Frederick A. Stokes, 1940); R Ernest Dupuy, "Mutiny at West Point," *American Heritage*, vol XII, no 1 (December 1955), 22–27, Thomas J. Fleming, *West Point* (New York: William Morrow, 1969), Sidney Forman, *West Point* (New York, Columbia University Press, 1950), Roger J. Spiller, *Dictionary of American Military Biography* (Westport, CT Greenwood Press, 1984); and Lester A. Webb, *Captain Alden Partridge and the United States Military Academy 1806-1833* (Northport, AL. American Southern, 1965).
2 Webb, 13
3 Ibid., 15
4 Ibid., 18
5 Berman and Monbeck, 36
6 Ambrose, 44.
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8 Ibid., 52.
9 Ibid., 53
10 Webb, 87
11 Ambrose, 67
12 Dupuy, 122.
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14 Webb, 125–26
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16 Ibid., 141
17 Berman and Monbeck, 43
18. Ambrose, 61
19 Bradford H Denny's articles, "Alden Partridge, Military Educator and Spiritual Father of ROTC" and "Alden Partridge, Advocate of the Citizen Soldier," and his and Professor Lord's handwritten comments on draft manuscript, attached to ltr, Director of Public Relations, Norwich University, to author, 15 August 1986.
20 Ambrose, 63
21 Ltr, General Lyman L Lemnitzer, USA, Chief of Staff, to Dr Ralph W Sockman, Director, Hall of Fame New York University 23 September 1960, a reproduced copy in author's possession. Interview, General Lemnitzer with author, 2 July 1986.
22 John P Lovell, *Neither Athens nor Sparta?* (Bloomington Indiana University Press, 1979), 20
23. Benjamin F Schemmer, "Why Waste Money on West Point," *Washington Post*, 1 December 1985, C1

Truman R. Strobridge is the command historian, Headquarters, US European Command, Patch Barracks, Stuttgart-Vaihengen, West Germany. He has served as a military historian with the Joint Chiefs of Staff Historical Division; with the US Army, Alaska; and as senior historian, US Army Armament Materiel Readiness Command.

By Captain David K. Taggart, US Army

The Bright and Shining Future Behind Us

One intriguing promise in the business of research and development is the tendency to project technological advances into "operational" future roles. We read the glossy advertisements from defense contractors proclaiming their latest "breakthroughs" and find that they offer only marginal improvements, or worse, a reinvention of the wheel. Further, breakthroughs in technology do not translate directly to procurement and fielding of equipment.

What will the technological future of war look like? It will probably look a lot like the present, only with a lot more repair parts and maintenance downtime. There are two reasons for this:

- The "flattening of the curve" of technological advances.
- The lengthening of the procurement process.

If you divide the 20th century into two halves, 1900–1945 and 1945–1990, you find that the preponderance of *real* technological advances occurred in the former, while most of the research and development money was spent in the latter.

In 1900, the tank did not exist, even as a concept. By 1945, it was a full member of the combined arms team. The basic concept—track-laying, rotating turret, secondary machineguns, sloped armor, radio contact between vehicles—has not changed since. The differences between 1945 and 1990 are all marginal improvements to existing developments. Parts of the tank—guns, armor, engines, fire controls—have all gotten bigger, faster and more efficient, but technology has not changed the concept.

In 1900, the infantry had bolt-action rifles, revolvers and machineguns. By 1945, it had carbines, Tommy guns, Browning automatic rifles (BARs), automatic pistols and improved machineguns. What will be on hand in 1990 will be only a marginal improvement over what was used in 1970. The M16 replaced the carbine. The 9mm pistol is slowly replacing the .45, which has been with us since 1911. The squad automatic weapon (SAW) is slowly filling the gap caused by the loss of the BAR. Everybody likes the M60 and .50 caliber machineguns, but where have we gone since then?

Trucks have gotten bigger, artillery more accurate and radios more reliable. Computers replaced adding machines, typewriters and file cabinets. Apart from improving helicopters and adapting rocket technology to shoot at tanks and airplanes, there have really been very few technological breakthroughs in the past 45 years.

The Army is not alone in gazing into the past at the remnants of the future. In 1900, the Navy depended on the battleship. By 1945, the primary weapons were the aircraft carrier and submarine. In 1990, battleships have returned "back to the future," and carriers and submarines are nuclear-powered. Improvements are still on the margin. The *Arleigh Burke*-class destroyers are only slightly faster than those Admiral "Thirty-One Knot" Burke took into action in World War II. Aside from putting missiles on submarines, technology has not changed war-fighting ability.

The end of World War II saw the US Army Air Corps with fleets of long-range bombers and the German *Luftwaffe* with operational jet fighters. Germany also had developed cruise missiles (the V-1) and rockets (the V-2). The United States had the atomic bomb. Improvements shown in 1990 are in speed, payload, target acquisition, accuracy and firepower. With the possible exception of Stealth technology, improvements have been on the margin.

We are making things smaller, more efficient and more powerful, but the key is that we are still making the *same* things. The curve of technological advancement has leveled out. If the 101st Airborne Division were to refight the battle for Hamburger Hill today, it would be with platoon weapons identical to those the division used in 1969. The M79 grenade launcher has become the M203 and the SAW might be available, if the 101st has priority for issue. The Dragon would be a poor replacement for the 90mm recoilless rifle in a jungle fight.

In addition to the slowdown in technological advancement, the procurement process is taking ever longer to get new weapons and equipment to the field. By the time the last Bradley Fighting Vehicle rolls off the assembly line, the first Bradley will

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be older than its gunner, maybe even older than its squad leader or platoon sergeant. Less than 10 percent of the total SAW purchase has been completed; *years* go by without buying any weapons. The politics of the 9mm pistol have ensured that some of the force will be carrying the .45s into the next century.

The Sergeant York was the weapon of the future for a generation of air defenders. The other services have done no better. The Air Force's B1 bomber program has been thudding along for decades and the "600-ship" Navy is dead in the water. The politics of procurement dictate a slow rate of advance. This does not seem limited to major end-items; it took five years for battle dress uniforms to become generally available all of the time in all sizes.

In conclusion, the future is not what it used to be. Major technological breakthroughs do not happen that often. The improvements that are made only marginally increase performance. Things take a long time to get to the field, and full fielding of an item can become a political football. Do not even ask about how much repair parts will cost—just hope that they will be available. We need to be prepared to make do with what we have. The future is now.

MR SUMMARIES

Our Burgeoning Linguistics Gap

By Colonel Wesley A. Groesbeck

***ARMY*, December 1988**

The problems facing the US Army's foreign language program (AFLP) are so complex and wide-ranging they prompt Colonel Wesley A. Groesbeck to write in this December 1988 *ARMY* article that "we wonder if the issues with which we are dealing are so big and complicated that we will be unable to make a difference regardless of how hard we try."

Simply put, Groesbeck says "we do not have a pool of fully qualified, professional linguists to meet our mission requirements." And it is getting worse. The US Army has no nonresident foreign language training program—it is serviced only by the Defense Language Institute (DLI)—and also "is experiencing great difficulty in retaining first-term linguists." Moreover, only 30 percent of active duty linguists, according to Groesbeck, have proficiency levels that qualify them to accomplish their mission.

The author calls "language interoperability" a combat force multiplier and "the foundation on which any cooperation with our allies can be established." Skilled linguists are essential to conduct activities such as civil-military operations, intelligence-gathering and psychological operations. But Groesbeck identifies a host of issues that he says impedes "the successful implementation and integration of the AFLP."

The program is fragmented; there is no nonresident training; it lacks command emphasis and support below major command level; the Army staff "has no clear picture of the total Army linguist requirement to support major war plans," linguist training is not integrated into exercises, and war plans have no linguist annexes.

What is needed, according to Groesbeck, is an AFLP that is "integrated, has direction and takes into account the regional CINC's war-fighting linguist requirements." Put the program under the direction of the chairman of the Joint Chiefs of Staff, he suggests. In addition, he recommends developing a Department of Defense linguist master plan and reorganizing the Army's linguist capabilities so this program, too, has focus.

From the Army perspective, Groesbeck sees a number of constructive steps the leadership could take to deal with the issues affecting the AFLP. Besides those already mentioned, Groesbeck recommends:

- Providing central direction by putting the program under the deputy chief of staff for operations and plans
- Clearly stating the leadership's interest in and support for the AFLP.
- Developing an Army foreign language master plan.
- Putting trained Army linguist managers at all levels of command.
- Facing up to the problem of linguist retention rates.
- Finding alternatives to DLI and taking steps "to recruit foreign language-speaking immigrants . . to help fill . . . linguist requirements."
- Creating a task force to determine the direction language management, instruction and training should take.

Groesbeck acknowledges that being a language manager in today's Army is "a real challenge," but adds that "we owe it to our soldiers who are linguists to create a command and training environment that will allow them to 'be all they can be.' "—**ELH**

West Germany: NATO's Key European Member

By Stanley R. Sloan
The Washington Times, April 1989

The Disaffection of NATO's Lynchpin

By Richard Sale
Defense & Foreign Affairs, March 1989

These two articles focus on West Germany's role in NATO and argue that the Federal Republic of Germany (FRG) is "the most important European ally of the United States," according to Stanley R. Sloan, who writes in the World & I section of *The Washington Times*.

Richard Sale concedes this is likewise true from his perpective, but also draws attention to the difficult political issues facing the West German government with regard to its position in NATO. Sale says in his *Defense & Foreign Affairs* article that for West German Chancellor Helmut Kohl, "the question of NATO nuclear modernization . . . is probably going to continue to be the toughest problem."

Sloan writes in his article that it is "not surprising that the FRG accounts for such a substantial share of NATO active-duty forces"—enough to defend almost four of the 10 corps areas along NATO's front—because in the early stages of a war, West Germans would be defending not only the NATO front but their own national territory, too.

The West Germans, according to Sloan, believe their forces are among the best-trained and equipped in NATO and will probably operate in a familiar environment and speak the language of the people they are defending. As a result, "West Germany has moved to a position of considerable political weight and leadership in NATO," he writes.

But he asks, even though West Germany may be our most important European ally, "is it the most reliable?" He says this is being asked more than ever lately as the the Soviet Union "dangles the promise of fundamental change in front of West German eyes, and resource constraints exert downward pressures on the FRG's defense efforts."

He describes several trends at work in the German state and concludes that "perhaps" they could spell an end to the alliance. But Sloan thinks it is "more likely the alliance will find a way through this thicket" because the country's governing parties and public opinion "agree that Germany is firmly part of the West and that the alliance with the United States remains the ultimate guarantee of West German security."

Sale, on the other hand, highlights recent disputes between Americans and Germans. He writes: "US haste over the modernization [of NATO's short-range nuclear weapons] demonstrates once again what [the West Germans] feel is US tactlessness when it comes to recognizing what Kohl and his partners must do to remain in power."

There are other factors affecting German-American cooperation as well—West German resentment over NATO military exercises, military aircraft crashes and "a tendency to view the Soviet threat as something that should already be on the scrap heap of history." All of these "are placing Bonn at loggerheads with Washington," according to Sale.

The author acknowledges that nuclear modernization is Kohl's most difficult issue and concludes that "the biggest pressure on [the Chancellor] is his political precariousness." Moreover, the arrival of what the West Germans perceive as détente has led to the feeling that the US military presence in West Germany is "almost superfluous," Sale says.

He concludes by warning that the West Germans will continue to be very sensitive to "any policy which indicates an Allied willingness to use Germany as a battleground" and are likely to regard, as they already have, any pressure to deploy new short-range weapons as an "anti-German policy."—**ELH**

Strategic Deployment Training Courses Announced

Courses in air and surface deployment planning have begun at the Fort Eustis, Virginia-based Joint Strategic Deployment Training Center. The center provides training for officers, civilians and non-commissioned officers charged with planning and executing operations plans. The Air Deployment Planning Course and the Surface Deployment Planning Course began late last year. A strategic deployment planning course is set for introduction during fiscal year 1990. Point of contact at TRADOC for these courses is Ms. Janice Neff, AUTOVON 280-2161.

MR LETTERS

Close Air Support

In his article, "Close Air Support" (*Military Review*, June 1989), Lieutenant Colonel Bruce Carlson skirts a few issues in his advocacy of A-16s and modified A-7s for the close air support (CAS) mission. The first misconception is that the A-10 is "aging." The A-10 is not that old, and it has years of good flying left. Maybe "aging" is the latest Pentagon euphemism for "we don't want it any more."

One argument for keeping the A-10 is the type of war we are most likely to fight. If we consider low-intensity conflict (LIC) instead of focusing on war in Central Europe, the A-10 looks better. The rugged A-10 can operate from forward airstrips, close to the action, while the A-16 depends on a long, very clean, modern runway. The A-10 is really a modern version of the A-1, which was undoubtedly the plane the ground soldier wanted to see in Vietnam—lots of ordnance, hours of loiter time and deadly accuracy. In a LIC scenario, the A-10 may be the best aircraft for the job. As Carlson points out, however, the A-10's survivability in a high-threat environment is questionable.

The major factor left out of the CAS equation is the overdependence of the Air Force on large, modern airfields. The F/A-16, with its low-slung intake, is very sensitive to scooping up loose gravel and bolts and damaging its engine. It requires long, reinforced, clean, concrete or asphalt runways. Yet in many war-fighting scenarios, these runways will be far from the area where ground troops need CAS. For flexibility and mobility of air power worldwide, we need aircraft for CAS that can operate from primitive airstrips, such as the A-10 and the AV-8B.

A key characteristic of World War II fighter-bombers was their ability to operate from short, rough, easy-to-build runways. The official Air Force history noted, "To be truly effective a tactical air force must operate from airfields as close to the front lines as it can get." With the introduction of jet aircraft into combat in Korea, the need for long, reinforced concrete runways had a major impact on air operations.

The reason we had to recall F-51s to active duty early in the war was the limited range and payload of jets operating from the only suitable airfields—in Japan. The F-51s could operate out of primitive airfields in Korea, and they could carry much of the load early in the fighting. That they had twice the attrition rate, as Carlson points out, was due to many factors, including their longer loiter time over enemy positions. Additionally, the F-51 was not as suited as the rugged P-47 to the ground attack mission, but P-47s were no longer available in sufficient numbers.

An example of the lack of flexibility due to airfield requirements occurred in January 1951, when we lost the large jet air bases we built at Kimp'o and Suwŏn. Due to their loss and anticipated evacuation of Korea by all US forces, all jets were moved back to Japan. The only aircraft available for CAS and interdiction were F-51s, B-25s and B-26s, operating out of Korean fields.

Today, dependence on airfields still restricts our flexibility and mobility. Even in NATO, the dependence on a few fixed fields is airpower's Achilles heel. Indeed, the Soviets believe a key factor in defeating the US Air Force in Europe is to attack and neutralize our airfields. Regardless of the theater of war, the increased flying time from large airfields to the troops in contact means fewer sorties, less loiter time and longer response times to CAS and battlefield air interdiction (BAI) missions. A-10s or AV-8Bs operating from forward locations can sit on ground alert and still be very responsive to requests for air support.

Finally, the AV-8B is always brushed off for the CAS/BAI mission. The Harrier has surprisingly good performance, although it is not as fast or maneuverable as the F-16. Its shorter range and loiter time compared to the F-16 is offset by its increased flexibility and mobility of forward basing. The common complaints about logistics need further examination. The Marines seem sold on the aircraft, and the Air Force should be able to piggyback on their existing logistics and training infrastructure to minimize the impact of introducing a new aircraft to the inventory.

In summary, Carlson slighted a key area—the Air Force's loss of flexibility and mobility resulting from its overdependence on modern airfield facilities. If this is factored into the equation, other aircraft such as the A-10 and AV-8B appear in a better light in their capability to provide timely air support to the Army.

MAJ Roger F. Kropf, *USAF*,
Maxwell Air Force Base, Alabama

A New Generation?

Major Douglas A. Campbell's article "Will the Army IPB Itself to Defeat?" (*Military Review*, June 1989) was excellent. Recently, I ran across an item that I believe lends some credence to Campbell's second point that "many US officers tend to underestimate the initiative and flexibility of Soviet commanders."

In March 1989, Soviet Lieutenant General Boris Gromov, the last commander of Soviet troops in Afghanistan and current commander of the Kievan Military District, appeared on the Soviet television program "View." The following is an excerpt from the interview with Gromov:

(FIRST CORRESPONDENT): One of the persistent rumors I happened to hear from many people and for many years is that Afghan military commanders underwent military training here, as early as in the prerevolutionary days, and then they became commanders of some of the gangs. Is this true?

(GROMOV): Yes, unfortunately such cases took place.

(FIRST CORRESPONDENT): Did this complicate your work? I mean from the point of view that they knew the strategy and tactics of our Armed Forces?

(GROMOV): Not really. After all, neither strategy or tactics are inviolable. In fact, perhaps this made things even easier for us.

(FIRST CORRESPONDENT): It was easier to second guess them?

(GROMOV): Yes, of course. We knew of these people. Admittedly, there were not that many of them. But there were some.

Gromov's interview is also suggestive of a change in the Soviets' willingness to pay a high butcher's bill in order to achieve victory on the battlefield:

(FIRST CORRESPONDENT): As a person, how did you feel when you had to send some detachment—living humans—to their certain destruction for some important strategic purpose?

(GROMOV): It is a difficult question, insofar as we are talking about people's lives. We did not send people to their certain death.

(FIRST CORRESPONDENT): But it was a war.

(GROMOV): What I am saying is that we did not plan combat actions whose results were clearly known to us to have a final and irrevocable outcome—the death of our people.

These statements by Gromov suggest that the perception widely held in the US Army that Soviet commanders follow their doctrine in an unthinking, lock-step manner may be unfounded. It also suggests that the perception that the Soviets are not particularly concerned about the waste of human life on the battlefield may no longer be valid.

Gromov is a part of a new generation of Soviet officers. His star is on the rise as evidenced by his recent appointment to command the Kievan Military District. He is young and did not serve in World War II. Indeed, his combat experience was confined to Afghanistan—three tours total. To the degree that his statements accurately reflect reality among the new, younger breed of military commander, the Soviet military is undergoing significant changes of attitude toward tactical methods and doctrine.

CPT Paul H. Vivian, *NCARNG, Fort Bragg, North Carolina*

Half-Hearted Effort?

In his article, "War Plan *Orange* and the Maritime Strategy," (*Military Review*, May 1989), Major John R. Martin faults General Douglas MacArthur for his allegedly "sad execution" of War Plan *Orange* for the defense of the Philippines, "his half-hearted defense of the beaches" at Manila Bay, and claims in footnote 30 that for this MacArthur should have received the same treatment as Admiral Husband E. Kimmel and General Walter C. Short for their unsatisfactory defense of Pearl Harbor on 7 December 1941.

Martin is rather unfair to MacArthur. At the beginning of the Japanese invasion of the Philippines, Lieutenant General Masaharu Homma made minor landings at Aparri in northern Luzon, at Legaspi in southeastern Luzon and at Vigan in western Luzon. MacArthur did not respond to these landings, not because he was half-hearted, but because he interpreted them as attempts by Homma to get him to spread his forces too thin. MacArthur believed correctly that Homma's main thrust would be made at Lingayen.

MacArthur boldly stationed forces, many of them Filipinos, at Lingayen to repel the anticipated invasion. Even though the chances of successfully stopping the Japanese there may not have been great, MacArthur did take the chance. I do not think this could be rightly called half-hearted.

When the main Japanese invasion came on 22 December 1941, the inadequately trained and badly disciplined Filipino troops broke ranks and melted away. The poor performance of the Filipino troops should not be blamed on MacArthur and used to assert, as Martin does, that MacArthur was "half-hearted" in his attempt to stop the Japanese at the beaches.

Joseph Forbes, *Pittsburgh, Pennsylvania*

MR CALL FORUM

The Center for Army Lessons Learned (CALL) provides combat-relevant lessons learned and acts as an agent of change for the Total Army, as outlined in US Army Regulation 11—33, *Army Lessons Learned Program System Development and Application*. A subordinate agency of the Combined Arms Training Activity and the Combined Arms Center under the executive direction of the US Army Training and Doctrine Command, CALL collects, analyzes and disseminates lessons learned from a variety of sources, including training exercises, combat training center rotations, historical sources and doctrinal research. CALL FORUM will assist in the dissemination process by periodically presenting recent lessons learned in one or more of the seven battlefield operating systems.

Counterreconnaissance

Experience at the combat training centers—National Training Center (NTC), Fort Irwin, California; Joint Readiness Training Center, Fort Chaffee, Arkansas; and Combat Maneuver Training Center, Hohenfels, Federal Republic of Germany—has shown that reconnaissance is a major challenge to our task force and brigade commanders. To put it bluntly, we are not doing well in training our troops to fight the counterreconnaissance battle. Whether the force is heavy or light, US Army Forces Command or US Army, Europe, the opposing forces (OPFOR) are penetrating our screens and killing our scouts with mind-numbing regularity. It is clear both from doctrine and experience that Soviet-type forces require thorough and detailed intelligence of our positions; it is essential that US forces deny them this need. Conversely, BLUEFOR (Blue force) commanders often have the mind-set that intelligence is a "nice-to-have" item, but that attacks or defenses can be successful without it. This has proved to be a dangerous and false assumption.

Lieutenant Colonel Doug MacFarlane recently completed a tour as an OPFOR motorized rifle regiment commander at the NTC. In a CALL interview at the end of his tour there, MacFarlane related some of the problems encountered and offered recommendations relevant to counterreconnaissance:

"There's a high level of motivation within the [OPFOR] scout platoons to do well and to accomplish the mission because they know that the Soviets live and die by intelligence."

"We've [OPFOR] been uniformly successful in regards to reconnaissance I think, in determining where the enemy [BLUEFOR] is defending, to determine how they are planning to conduct their defense and to ensure our deep reconnaissance teams get situated in the positions they need to get to."

BLUEFOR units often have only a thin, shallow counterreconnaissance shield. The front elements are alert, but "the remainder of the task force oftentimes becomes very complacent with that and . . . they tend to be lax in their local security. So that means that once we [OPFOR] get through the crust of the counterreconnaissance screen, there's no one there deep to stop us . . . Once we're in the rear, the soft underbelly, we can travel about wherever we need to go . . . We're oftentimes discovered moving through. The counterreconnaissance screen has the thermal sights and has the ability to see us as we come in, but unless they shoot us and kill us as we're going through that screen, they may not have the ability to find us once we get deep within the sector."

After the OPFOR penetrates· "Then they're [BLUEFOR] faced with the choice of do we chase the scouts or do we hold the screen? Uniformly they will hold the screen and be aware of the fact that we have penetrated. So I think that one of the good lessons we are learning out here . . . is that a light screen forward that merely identifies the fact that they're being penetrated by division reconnaissance or the regimental reconnaissance company is what's needed. That's tied together by an individual, perhaps the S2, who controls the scouts, controls the GSR [ground surveillance radar], controls any other elements that are there to beef up the screen . . . Once he's done that, he notifies the elements that are in the battle positions to be aware of the fact that we are coming and they should be able to track us right into the company area. We can be killed close in, I think, by people who are up pulling security."

"Our scout platoon leaders are the most aggressive guys in the battalion. They want to go out there and kill things, just as the BLUEFOR scout platoon leader wants to . . . The trouble is that they are very precious resources. You only get one scout platoon leader and you only get one platoon and when they are gone, yes we can reconstitute them from among our assets, but they will not be as skilled as those guys who have been killed. That is the battle I fight every day—to ensure that the scout platoon leader knows when he can go ahead and kill things. In other words, for example, when we're [OPFOR] on a regimental attack, the regimental reconnaissance goes in to try and determine the actual locations and verify my templates. There are many missions [the scout platoon leader] must accomplish: mission 1, mission 2, mission 3 and perhaps mission 4. When mission 4 is complete, then he is free to go ahead and attempt to find the TOC [tactical operations center], attempt to find the artillery battalion, those other things that are probably less well defended that he can kill with his on-board system. But before then he cannot be released to do that. He cannot get involved in the fire fight. Modernized scouts [BLUEFOR] have the ability to kill . . . but if they go ahead and do that they are at risk of giving up what that task force commander needs . . . [the] eyes and ears of his task force to protect his positions."

MR BOOK REVIEWS

TECHNOLOGY AND WAR: From 2000 B.C. to the Present by Martin van Creveld. 342 pages. Macmillan Publishing Co., New York. 1988. $22.95.

Martin van Creveld is an important writer in the field of military history. His book on logistics, *Supplying War*, is without peer, while his *Command in War* is also quite good. However, *Technology and War* is much better. It is an excellent summary of the secondary literature and an overview of the subject. Van Creveld presents numerous insights and provides a framework for further study. There is adequate detail to make the point, yet not excessive detail to lose the reader. The author's excellent bibliography is, and will be, of particular interest and use to students of military history. For those who have read van Creveld's other two excellent, but slow-moving, books, *Technology and War* is relatively easy reading.

The author correctly goes beyond "purely" military technology and shows the importance of "civilian" technology to warfare. Another commendable aspect of this work is that it includes naval warfare. Showing both of these relationships so clearly over such a period of time with so many examples is, in itself, a major accomplishment.

As good as this book is, it is not without its faults; or, better put, it could have been better. First, while there are illustrations, they often result in ornamentation rather than clarification. Van Creveld mentions a number of different weapons, most of which will be known to *Military Review* readers, but he also mentions other weapons not as well known. This book would have been greatly enhanced had it included more and better pictures, coordinated with the text to demonstrate the author's points and to illustrate the lesser known military devices. Second, the last section covering the period 1945 to present is somewhat disappointing, especially after the excellent earlier coverage. Perhaps this is because there is less secondary literature covering this period, or that we lack the proper distance from it to give us the necessary perspective. It may even be that by living through this period, we have more knowledge of it and are less willing to take the author's word for it.

This significant and important book inevitably will be compared to an earlier and similar book by William McNeil, *Pursuit of Power*. I prefer van Creveld's effort mainly because he is a military historian, and McNeil is not. This is clearly evident in their works.

Technology and War is highly recommended. I would expect it to become a standard text in many military history courses. Van Creveld has made an important contribution to military history and has written a book that will be considered among the best about this important topic.

Kenneth P. Werrell, ***Radford University, Radford, Virginia***

OUTPOSTS AND ALLIES: U. S. Army Logistics in the Cold War, 1945–1953 by James A. Huston. 349 pages. Susquehanna University Press, Cranbury, NJ. 1988. $39.50

Those who liked James A. Huston's *Sinews of War* or who are generally interested in logistics will want to read his latest work. *Outposts and Allies* opens a chapter in military history that few have studied: the US Army's transition from full mobilization in wartime to peacetime support of overseas forces and allies in an effort to maintain peace and security. The result is a fascinating story of a nation and its military coming to grips with global responsibilities following World War II.

Huston remarks early in his study, "Military problems that followed in the wake of World War II combat operations were, in some ways, even more difficult than those of warfare itself." He cites two essential reasons for this: the abrupt change from all-out mobilization and buildup to all-out demobilization and liquidation; and the concurrent necessity of backing up foreign policy in times of rapidly changing conditions and opposing pressures. In terms of logistics, this meant a seemingly easy task of liquidating resources in some areas of the world, as the United States embarked upon new programs of mutual defense, base agreements and military assistance. Unfortunately, matters were not that simple.

Logistics operations were complicated by the sheer volume of stocks located throughout the world and the constraints on redistributing them. Huston estimates that 24 million tons of surplus existed in the European Theater of Operations at the close of the war and that European ports could handle only a million tons per month. Planners also faced a point system that prioritized which soldiers went home after war and, in the process, disintegrated essential service units.

How military planners orchestrated all this, while accommodating joint and allied interests, becomes Huston's focus. After reviewing demobilization and rebuilding of forces and bases in Europe and North Africa, he provides detailed explanation of what evolved logistically in the Near East, Far East and Western Hemisphere. (He purposely excludes discussion of the Korean War since he is writing a separate study of US Army logistics for that period.) What emerges is not just a history of US Army logistics, but a meticulously documented account of bold imagination and remarkable military achievement.

Outposts and Allies is a splendid study. Regrettably, it went to press with many typographical errors. Those oversights mar the real quality of the work and may frustrate some readers, particularly those who pay the handsome price for their own copy.

LTC Kenneth L. Privratsky, *USA,*
2d Armored Division, Fort Hood, Texas

THE SIGINT SECRETS: The Signals Intelligence War, 1900 to Today by Nigel West. 347 pages. William Morrow & Co., New York. 1988. $22.95.

This is an authoritative work on the important events that contributed to the evolution of the British signals intelligence (SIGINT) organization we know today as the Government Communications Headquarters. In light of recent breaches of security in both the US and British intelligence communities and the spate of books on the contributions made by the Allies using the ULTRA and MAGIC intercepts, the book's theme is even more important.

Contrary to popular belief, most of the German military ENIGMA message traffic was not broken through cryptological skills (although many low-grade codes were), but mainly through human carelessness and procedural errors on the German side. This operator tendency to "bend the rules" or "cut corners" to circumvent the safe, but supposedly cumbersome security procedures continues to contribute to the undoing of communications security and the breaking down of military traffic analysis systems.

Since Marconi's invention of the wireless, governments have experimented, tested, developed and continue to invest scientific resources and money to perfect and expand their SIGINT collection capabilities. Britain's SIGINT organization began operations in the early 1900s, using postal and clear message interception mostly in the British Isles. The onset of the Cold War in 1946, the revelations of communist subversion and the Soviet intelligence service's recruitment of several high-level "moles" within British intelligence organizations accelerated the decision to establish a permanent British SIGINT agency.

Additionally, inadvertent disclosures by former members of the foreign service (and MI-5 and MI-6) caused significant security damage to the British government and its intelligence community. These disclosures confirmed the suspicions of several foreign governments—that their secure communications systems were not that secure. This was usually followed by investigations, trials, imprisonment and public scandals on the British side, and a tightening of communications security, changing codes and producing more sophisticated secure equipment on the other side. But worse, these actions resulted in denying the British government access to sensitive information affecting Britain's foreign policy and internal security.

Nigel West's book emphasizes detection, location and monitoring. They remain important to US military forces today because SIGINT collection (intelligence and electronic warfare) is the prime source of battlefield intelligence on the Soviet military threat. Even well-trained and deployed military forces and the best strategic and operational doctrines could meet defeat when the enemy can accurately forecast when, where and how our forces will be used during conflict. I highly recommend adding this book to the professional military reader's list.

Michael S. Evancevich, *Combat Developments Directorate, US Army Intelligence Center and School, Fort Huachuca, Arizona*

GOLDWATER by Barry M. Goldwater with Jack Casserly. 414 pages. Doubleday & Co., Inc., New York. 1988. $21.95.

Goldwater is a gold mine for military readers and a rich resource for those interested in recent US history, politics and political science. Barry Goldwater was born in the Arizona Territory on New Year's Day, 1909. He served in the US Senate from 1953 to 1964, was President Lyndon Johnson's opponent in the 1964 presidential election and served again in the Senate from 1969 to 1986. He was a member of the US Army Air Corps during World War II, formed the Arizona Air National Guard in 1945 and retired in 1967 as a major general in the Air Force Reserve.

The Senator's well-earned reputation for candor and outspokenness makes the book interesting to read. Georgia Senator Sam Nunn once noted, "Barry Goldwater's motto has never changed: Ready! Fire! Aim!" And fire he does. He calls former Secretary of Defense Robert S. McNamara a "technocrat" and "a dishonest man," and President Lyndon Johnson "treacherous" and "the epitome of the unprincipled politician." His greatest contempt is reserved for President Richard Nixon. He repeatedly calls Nixon "a liar" and describes him as "the most dishonest individual I have ever met in my life."

In recalling the 1964 presidential race, he discusses the deplorable television "bomb" commercial that was designed to depict Goldwater as a man who would get the nation involved in an atomic war. Surprisingly, he reports that he and Johnson agreed not to attack each other on Vietnam or civil rights, even though those were two of the most important issues of the day.

Goldwater now describes Vietnam as a war lost "at home" because "our hands were tied behind our backs," because too many restrictions were placed on American commanders and because policy determinations prohibited attacking the enemy's "sources of waging war." He now accuses Johnson of "playing the war by ear."

In an important and enlightening chapter on the Defense Reorganization Act, Goldwater stresses the legislative purpose of having "U.S. air, sea, and ground forces fight as a team through a series of organizational and command changes within the services." He quotes President Dwight Eisenhower's statement, "We must free ourselves of emotional attachments to service systems of an era that is no more," calling it "important." He then cites historic reasons and military problems as demonstrating the need for result-oriented joint training and joint command. To make his point, he expounds upon Pearl Harbor, the Battle of Leyte Gulf, the Iran hostage rescue mission and the Grenada mission.

Goldwater has high praise for Lady Bird Johnson, Ronald Reagan, Hubert Humphrey and others. He speaks forcefully about Soviet spying as a continuing threat to our security, despite détente and *glasnost*. He has a lot to tell us about many topics, and his opinions are well worth reading.

LTC Paul Brickner, *USAR, Willoughby, Ohio*

THE OTHER ITALY: The Italian Resistance in World War II by Maria de Blasio Wilhelm. 272 pages. W. W. Norton & Company, New York. 1988. $18.95.

I differ with more than one reviewer of this book on its relative merits and overall value to the history of World War II. It is a contribution, but not an overly valuable one. *The Other Italy* is neither a scholarly nor purely military history book, and by the author's admission, was not meant to be. Instead, the work is a social history—a study of the fabric of Italian society, told through a series of anecdotes.

The book addresses the role that society played in the guerrilla war against German occupiers and Italian fascist troops from the September 1943 armistice to the end of the war in Europe in May 1945. Structured accordingly, it views the Italian resistance from a variety of perspectives, including that of the Jews, the Catholic clergy and the women of Italy. In this regard, the work is interesting reading.

However, even though *The Other Italy* does well explaining the unique nature of the Italian experience and the complexities of social and political conditions in Italy during World War II, it does not address, in any real detail, the relationship between the resistance and Allied forces. Historically speaking, nothing of great import is introduced. It also does not elaborate on tactics and operations of the partisan brigades and their overall effects upon Allied operations during the campaign (except for the occupation of several northern Italian cities in the closing months of the war).

Nevertheless, the book does attack the many myths surrounding the Italian fighting spirit and ideas that the resistance movement was purely an act of self-preservation in the postwar political interests of the Italian nation. It may have been to a degree, but it is clear that it was primarily based on the genuine contempt, anger and frustration the Italian people had for both the German Nazis and Italian fascist oppressors.

Those interested in learning more about this particular element of the Italian Campaign, or in the resistance movement behind Axis lines in World War II in general, will benefit from reading *The Other Italy*. I would not recommend the book to those interested in World War II in general, the Mediterranean Campaign or, specifically, the battle in Italy.

LTC Gary B. Griffin, *USA, Anspach, West Germany*

WARFARE IN THE TWENTIETH CENTURY: Theory and Practice. Edited by Colin McInnes and G. D Sheffield. 239 pages. Unwin Hyman, Inc., Boston, MA. 1988. $9.95.

This excellent collection of essays examines the dichotomy between the theory and practice of war. Topics such as the impact of war upon society, theories of insurgency and counterinsurgency, nuclear strategy, strategy and tactics on land, the role of sea power and the evolution of strategic bombing are discussed. Each chapter uses the time period from World War I to the post-World War II era in forming a theory, relating recent research and arriving at a conclusion on the application of the theory to future warfare.

The work examines the concept of total war, tracing its historical development to the present day, and evaluates its impact on society. One conclusion is that warfare has become more technologically based and is more total and less manageable. Two different styles of warfare have evolved—attrition and maneuver. In spite of these varying styles, continuity rather than change is characteristic of warfare at the tactical and operational levels. Another conclusion is that wartime change and development must be placed within the context of long-term social trends, suggesting change is evolutionary rather than revolutionary.

The consensus among leaders of nuclear states is that prudence requires caution and some form of insurance against a nuclear attack. The solution has been to build nuclear weapons and maintain conventional forces as a deterrent to nuclear aggressors. Accordingly, an axiom evolved that implies there can be no guarantee that future leaders will hesitate launching a war. Hence, war is likely to continue to prove an attractive instrument, since ideas and national self-interest conflict.

This work should be essential reading for all students and teachers of strategic and war studies. Political scientists and military historians will find interesting discussions of international relations and the history of major conflicts in this century. The work is definitive in its revelation of how we got where we are today and where we may be headed militarily in the future.

LTC John P. Farr, *USAR, Retired, Chattanooga, Tennessee*

THE PRESIDENCY AND THE MANAGEMENT OF NATIONAL SECURITY by Carnes Lord. 207 pages. The Free Press, New York. 1988. $22.50.

Carnes Lord, the former director of International Communications and Information Policy on the National Security Council (NSC), provides an incisive analysis of the inner workings of the NSC system and argues persuasively for major changes in the organization, staffing, procedures and responsibilities of the entire national security apparatus.

The book is not easy reading; some prior knowledge of the US national security system is necessary to follow the arguments presented. Lord traces the history of the NSC and its policy-making process from its creation in the postwar period to today, highlighting its use and misuse by eight presidential administrations. Throughout, Lord demonstrates how the NSC—originally conceived as a constraint on presidential power—has come to be used as an instrument, allowing the president greater control of the policy-making process in national security matters.

Lord argues that "the most fundamental intellectual qualification in a National Security Adviser is strategic expertise." He says that the national security adviser should have "a sense of history and the ability to look beyond the events of the day, the ability to assimilate and integrate large amounts of very diverse information, the mental discipline to identify fundamental objectives and pursue them tenaciously, and the mental flexibility to adjust to foreign ways of thinking and anticipate an adversary's moves."

The book is well worth reading for both civilian and military personnel who are concerned with the formation of governmental policy. National security management is a demanding problem, and the author has made a significant contribution to not only understanding the system, but improving it as well.

COL Robert F. Collins, *USA, Retired, Fort Collins, Colorado*

CENTER FOR ARMY LESSONS LEARNED

The Center for Army Lessons Learned (CALL), part of the Combined Arms Training Activity, was established in 1985 to be an agent for change for the Total Army. Historically, the US Army has always created an organization during wartime to capture, analyze and disseminate battlefield experience. Unfortunately, this has always been done after the start of a war. The Army has also invariably disbanded such an organization as soon as peace is restored. CALL is thus the first peacetime Army organization created specifically to capture combat-relevant experience from a number of different sources and pass it along to the Army to improve how we fight

CALL collects data from a wide variety of sources Some critical sources are the combat training centers the National Training Center at Fort Irwin, California, the Joint Readiness Training Center at Fort Chaffee, Arkansas, the Combat Maneuver Training Center, Hohenfels, Federal Republic of Germany; and the Battle Command Training Program, Fort Leavenworth, Kansas These new developments in training produce dramatic quantities of high-quality data on problems of command and control, intelligence, maneuver, fire support, mobility/countermobility, air defense and combat service support. CALL also collects data from unit after-action reports, observers' reports, history, war game simulations, actual operations (both US and foreign) and Army, combined and joint exercises in order to assemble the best evidence for problems and potential solutions.

Information from all these sources is collected, analyzed, compared with other sources and used as the empirical basis for recommending changes in Army doctrine, organization, training, materiel or leadership To aid in collating and using all of this data, CALL is developing an Army automated system, of which the Army Lessons Learned Management Information System (ALLMIS) is a primary part. ALLMIS stores lessons learned and new issues and makes them accessible to virtually any Department of Defense agency or sponsored activity. This data base system will assist CALL and Army analysts in comparing data over time and provides a basis for creating lessons learned.

CALL disseminates lessons learned throughout the Army by a variety of means, it publishes CALL bulletins and newsletters and produces videotapes In addition, CALL writes articles in several Army training publications, sends out messages and special reports on important issues, conducts briefings and workshops and generates action plans to assist proponent schools within US Army Training and Doctrine Command in identifying and solving battlefield problems.

CALL has taken on a big job—providing combat-relevant lessons learned and acting as a catalyst for change. Simply by articulating issues, proposing possible solutions and distributing them as widely as possible, CALL can help create a climate for deliberate change backed up by validated battlefield experience. Change comes slowly to any army, but the more thought we give to future war and doctrine now, the more we can help the Army be prepared for that war

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