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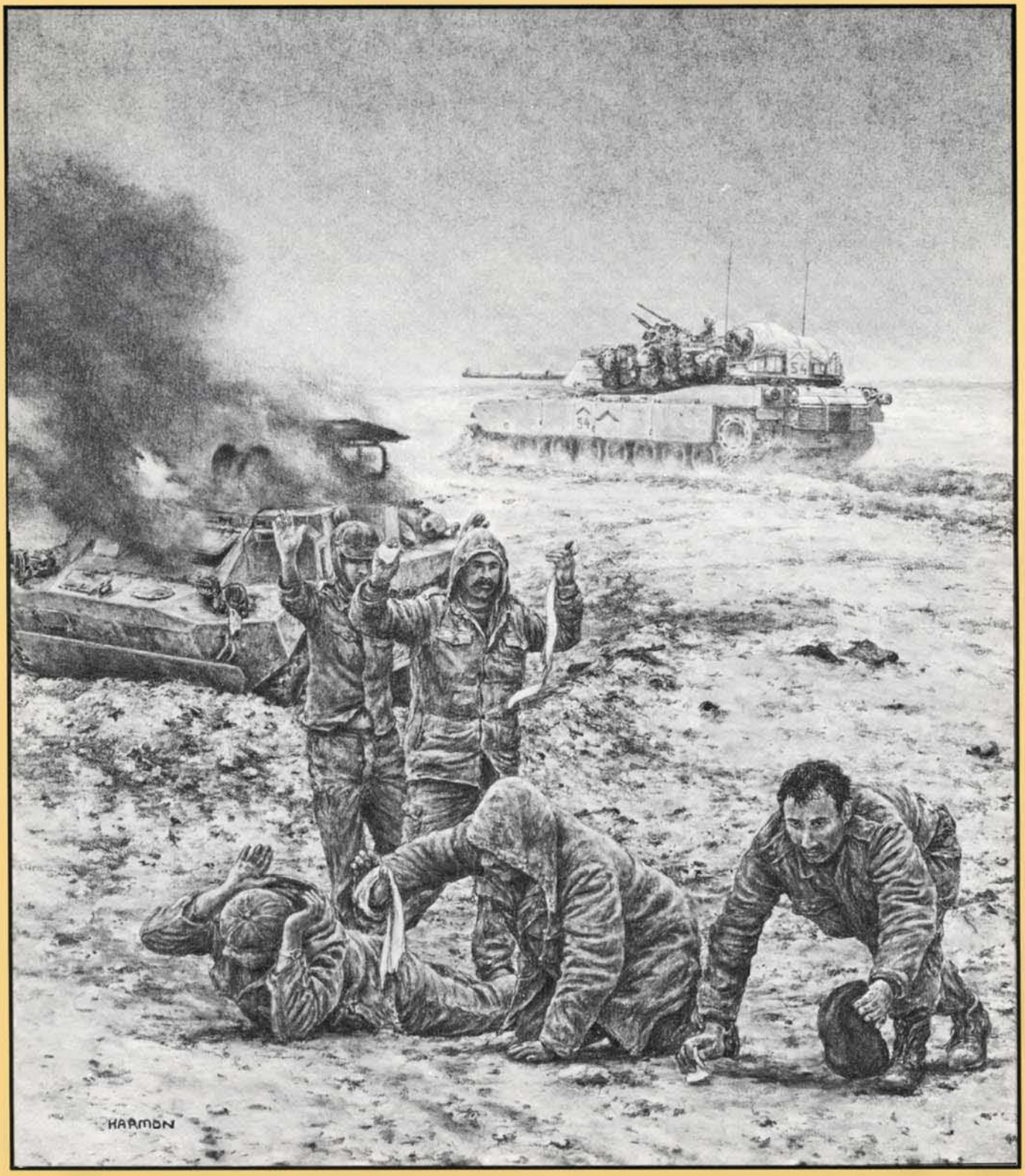

Points of Attack: Lessons from the Breach

PB 17-98-1

January-February 1998

Will there still be tanks and tankers, scouts and cavalry troopers, or are we soon to be replaced with precision-guided weapons? What does our future look like? These questions reverberate within almost every card and letter we receive, nearly all of the e-mail we are "cc'ed," and within the pages of every military magazine, journal, and newspaper that we read. These two questions also weave their way through much of what you will read in the following pages of this issue of *ARMOR* and in the next couple of issues. They are what is running through everyone's minds. They deserve print time.

The answer to the first question is the easiest one to derive and can most quickly be proven by an example. A look at the latest crisis that Saddam Hussein has fomented amply demonstrates that, while the bad guys pay attention when you threaten them with cruise missiles and PGWs, they can only be counted on to change their behavior when the threats also include boots and tracks on the ground. That is us.

The latter question, about our future, is more problematical. "We don't fight our M1-equipped battalions any differently than I fought my M60A3-equipped battalion some years ago." This statement by an ex-commander who knows both types of units should cause lots of us to stop. If we have not designed today's organizations and the doctrine which governs their actions to take full advantage of what our equipment is capable of, what says that we are capable of doing so for the next force? The situational awareness that the not-too-distant digitized force will have available at the push of a few keystrokes, on almost all parts of the battlefield, is revolutionary. However, are we up to the task? Are we willing to go ahead with the 60- or 70-percent solution? Are we willing to relinquish the centralized control of fires (direct and indirect) and the lock-step adherence to phases and graphic control measures in order to keep our foes rocked back on their heels until they can do nothing but surrender or die? I know a lot of guys, good men who want everything to work, who are nevertheless doubtful.

Some senior folks might be inclined to say these are the understandable, yet ultimately unfounded fears of junior people who don't know any better. Those same folks will also argue that the changes to our training base don't have to be so revolutionary — hey, we're getting more computers all of the time, aren't we? They will say that the training for a lot of the new tasks that future systems will require our soldiers to perform will be handled by requiring that embedded training be built into the systems. And, if the next war points out some shortfalls in individual or collective training, well, the guys will have to learn in theater. It worked in World War II (see *Closing with the Enemy* by Micheal Doubler) and with Desert Storm, didn't it (see "Points of Attack" this issue)? Those of us who were in the battalions and squadrons need only think back to the breach training complexes "somewhere in the desert" in Saudi Arabia to appreciate the point. One need only to recall all of the many things you did in the desert that would have got you killed at a CTC to also appreciate that even the best hands-on training isn't ironclad — some of the lessons we learn at the CTCs (hopefully, a small number) are things we have to unlearn when real bad guys, with real death loaded into their bullet launchers, are opposing your operation. If we have capabilities that we aren't using because our soldiers and junior leaders can't handle them — change the training, radically.

Make no mistake about it. Change is what has to happen for us to get the most out of our digitized force, and change is what we must wholeheartedly embrace if we are to keep ourselves relevant as a branch in the eyes of the CINCs who must ask for us, and the congressmen and representatives who have little experience with us, but must fund us. With the digitized force, large-scale battles against large, well-armed foes are still quite possible, but even in those situations, no enemy's center of gravity is going to be safe from the situationally-aware 21st century armored task force, brigade combat team, or cavalry regiment, or maneuver groups, or what ever you want to call them. These organizations will be capable of maneuvering right to the enemy's most valuable, sensitive, vulnerable spots, and like the character Billy Jack in the 1970's movie said, "there isn't a damn thing you can do about it." That is the force I want to be a part of. It sounds exciting and dynamic and should capture the imagination of anyone who hears about it. However, are we going to have the men trained in a manner that will let them do it?

Sitting here today, not many of us do know what the next force is going to look like exactly. We do have a good idea on how it will be equipped. We are even beginning to grapple with how we are going to employ it by writing its doctrine. We still have a long, long journey ahead of us to understand how much it can do. Until we are no longer prisoners of attrition warfare steeped over decades of face-off on the Cold War's borders, we will underemploy our formations and make it easier for the budget hackers to use our roadwheels as the bargaining chips to buy ever more manless weapons to fight the mythical, sterile, casulty-free war found on TV.

— TAB

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04091

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LETTERS

Down-sizing Tank Battalions Also Has a Down Side

Dear Sir:

In his thought-provoking essay entitled "The Armor Battalion After Next: A Modest Proposal," in the Sep-Oct issue of *ARMOR,* LTC Benson proposes that tank battalions be reduced in size from 58 MBTs to 35. He also proposes that battalions should change from 4 to 3 companies and reduce their personnel to 164 soldiers. I would hardly call these "modest" changes.

From my perspective, there are two major considerations against such a proposal. First; this belief is predicated on the result of a flawed experiment — the Armored Warfighting Experiment. We have come to believe that the information systems on which we rely to formulate our logistical and operational estimates provide us perfect information. LTC Benson's proposal and the Army's growing over-reliance on artificial intelligence and information management systems might have merit if this was the case. Unfortunately, that is simply not so. Those enamored with the idea of perfect tactical information and our ability to apply combat power perfectly discount the enemy's ability to counter our systems. We assume the enemy is incapable of using deception, jamming, or other countermeasures. This is a dangerous assumption. From my position as a corps and division C2 and maneuver O/C at BCTP, I have seen too many senior tactical leaders led down a primrose path by believing unconfirmed information provided by JSTARS and other national assets that might not otherwise be at their personal disposal. An even more dangerous notion is that the enemy, much as the OPFOR at the NTC, JRTC, or the CMTC, is restricted in the way he can attack you. In a word, over-reliance on information management systems to determine course of action development and logistics operations can only lead to inflexibility.

The second tenet of LTC Benson's proposal, the idea that reducing our tank battalions from 58 to 35 tanks would not decrease a battalion's combat effectiveness, also makes me uncomfortable. To this proposal, I ask the following question — why? If a serious answer is that by reducing the number of tanks in our present battalions we can buy more tank battalions, I say we are treading dangerous grounds indeed. So doing has the dangerous potential to lead us down the same path our light infantry brethren took to create their two light divisions. For those of us who do not realize it, to have slots available to create two more light divisions without going over mandated manning levels, a decision was made to reduce the light infantry squad from 11 to 9 personnel. Today these squads are being filled at a level of 7 infantrymen per squad. Most of our infantry brothers will tell you that taking one casualty in each squad will render that squad combat ineffective because it loses the ability to fire and maneuver. Taking a tank platoon down to three tanks would have the same effect. Let's look at a modern tank battalion. Today's battalions have 58 tanks. If you take away the battalion commander's, S3's, company commanders', and XOs' tanks due to the need to C2 their respective elements, 10 main guns are not really in the fight. This leaves a total of 48 main guns engaged, if, of course, you have a battalion on line as you might in the desert of Saudi Arabia or NTC. These numbers discount maintenance or kill downs and the inability to unmask all tanks at the same time.

If you reduce the number of tanks to 35, you effectively reduce the number of main guns from 35 to 28. You have effectively reduced the number of tanks available for the fight by 20 (again discounting maintenance and combat downs). It would take very few losses to make a company combat ineffective. Besides the reduction of tank platoons and main guns available, the reduction of one company would make the battalion that much more inflexible. When the lead company of that battalion is engaged, decisive combat ensues because the battalion has neither the flexibility nor the ability to overwhelm the enemy with fire to give the unengaged force the ability to maneuver to find an assailable flank.

It seems to me that LTC Benson is basing his proposal on the Soviet/Russian model of 33 tanks per battalion. The problem is that Soviet/Russians do not maneuver battalions. That is, their battalion and even regimental commanders exercise great control but have very little flexibility and initiative. The information systems such as IVIS, applique, and ATCCS allow the division, corps, and army commanders to exercise great control over their subordinate formations — perhaps that is what LTC Benson proposes. If so, then I agree that battalion commanders, like company commanders, need no staffs. We will just go where we are told and execute battle drills.

In short, I believe reducing the number of tanks and functional staffs in a battalion just to buy more battalions and provide more command slots is a bad idea.

No doubt my views probably make me sound like a computer-phobic anachronism that belongs in the realms of antiquity. I also know that there are a lot of good systems out there that make information-gathering and processing easier. While these new systems may eventually lead to new warfighting doctrine and TTPs, let's not be so enamored with them that we let the tail of technology wag the dog of common sense.

I look forward to more discussions on this topic on SABRENET.

HANK ST-PIERRE
LTC, Armor
Ft. Lewis, Wash.

Units Stripped of Support Lack Robustness for Combat

Dear Sir:

LTC Benson, in his Modest Proposal, "The Armor Battalion After Next," September/October 1997 issue, "staked out an extreme position in the hopes it will raise blood pressure...." To that end he was successful; however, insofar as proposing a viable Armor Battalion After Next, with removal of all the CS and CSS functions from the battalion, he is proposing an organization that was tried and failed in WWII.

Let me recount the story for you. On 21 March 1945, Third Army headquarters issued an order through XII Corps to the crack 4th Armored Division at Rosdorf, about 20 miles southeast of Frankfurt, Germany. The order was to organize a task force to attack the town of Hammelburg, some 60 miles to the northeast behind enemy lines. The operation had three objectives: feint the enemy away from the direction of the next major thrust; create confusion in the enemy's rear; and free American and Allied prisoners of war (POWs) being held in a camp near Hammelburg.

Upon receipt of the order, the reluctant Lieutenant Colonel Creighton Abrams, commanding Combat Command B of the division, ordered the formation of an armored column of not more than 300 men and 53 vehicles. The division had been hard-pressed and the operation would be lean. The plan was to cross the river Main and drive 60 miles behind the enemy line to the camp. On reaching the camp, as many of the 5,000 prisoners as possible were to be liberated and returned to the division.

Abrams picked his best men for the job — men tested in battle, men with courage and tactical skills. He selected a young captain, Abraham J. Baum — who had earned a pocketful of medals and the admiration of the division — to lead the raid.

Within the 300-man ceiling placed on the force, Baum selected the cream of an infantry battalion, the best of a tank battalion, and an assault gun platoon. To ensure speed and firepower, no ammunition, supply, or maintenance vehicles would accompany the task force. Extra fuel was carried in jerry cans strapped to vehicles. For the next two days, the captain was on the move, fighting, bypassing strongpoints, and reconfiguring his force as more men and vehicles became disabled. Some vehicles were destroyed by small-arms fire igniting the jerry cans of fuel strapped to them. Others were abandoned for mechanical malfunctions. Still others had to be abandoned because they simply ran out of gas.

This small but gallant force continued to strike deep, feint, and bypass, using all the battle tricks Baum knew. Finally, with a force of just over 100 men left of the 293 who began the mission, Baum's tanks burst through the barbed wire surrounding the prison. Taking as many of the newly freed POWs as he possibly could, he started his column on its return toward friendly lines. Only a few miles from the camp, he was surrounded. He ordered most of his men to filter through the encirclement back to the POW camp or to friendly lines. A few remained with the captain and fought until the last vehicle was destroyed. The captain and his small cadre themselves became POWs at Hammelburg.

In an article published later in the *Saturday Evening Post,* General Patton said, "I can say this — that throughout the campaign in Europe, I know of no error I made except that of failing to send a combat command to take Hammelburg."

Just nine days later, on 6 April, that "error" was corrected when tanks of Combat Command B, 14th Armored Division, took Hammelburg and liberated the 4,000 Allied prisoners that remained in the nearby camp.

A combat command in World War II was a measure of military strength, similar to our current brigade. It usually included a medium tank battalion, an armored infantry battalion, an armored field artillery battalion, and combat support and combat service support units. The combat command represented a powerful, self-sustaining force.

What are the two enduring lessons to be learned from this story?

One: Send an adequate combat force to do the job.

Two: Provide adequate logistics to support the force.

To assume we can achieve maintenance situational awareness and just-in-time supply, and remove the maintenance, supply and medical platoons from the battalion, is to disregard the realities of war, and carries a high degree of risk in terms of lives and mission success. Before we cut force structure out of the forward elements, it will be essential that the external CS and CSS support systems required to sustain the battalion have not only a developed and integrated concept, but a concept and support doctrine that is fully resourced and tested under combat conditions. To do otherwise would be to place our Armor battalions up the proverbial creek without a paddle. We may find that the CS/CSS goal is unattainable, rendering the entire concept unfeasible.

ERIC A. ORSINI
Deputy Assistant Secretary of the Army
(Logistics)
OASA (I, L&E)

Eric A. Orsini served as an armored officer in Combat Command B, 14th Armored Division, and in the Ordnance Corps from 1953 to 1971, retiring as a colonel.

Tanks Offer Shock Effect That Missiles Miss

Dear Sir:

Mr. Stanley C. Crist's article, "The M1A1 Abrams: The Last Main Battle Tank?," in the Jul-Aug 97 issue of *ARMOR*, lacks in research and is written from the perspective of someone without any first-hand knowledge of armored warfare. The article conveniently ignores the three distinguishing characteristics of tank warfare: Speed, Firepower, and Shock Effect. His proposed replacements offer none of these in a comparable measure to what we now possess.

The speed of armored warfare is achieved and maintained by a fast, durable tank, with the capability to shoot on the move, maintaining the rapid momentum of the fight. I do not know how fast a missile-armed vehicle might be able to travel, but I do know that the electronically-guided missile system, with all of the necessary computer components, that is able to withstand the rigors of cross-country travel at the speeds currently enjoyed by the MBT, has yet to be developed. In the unlikely case that it was in existence, it could not maintain the existing battle tempo of the tank due to the need for halts to fire and frequently reload (the latter of which would expose crew members, who might often then need to be in MOPP-4).

The firepower advantages offered by the proposed replacement are unlikely, unreliable, and non-cost-effective. They are unlikely because of the ease of thwarting such a threat. Missile countermeasures have continually been developed and improved since the advent of the missile itself. Relying on electronic signals and signatures to guide weapons in what is now direct-fire warfare is tantamount to needlessly wasting the lives of soldiers and the combat effectiveness of our divisions. Having your television picture distorted by a passing trucker's CB radio is a minor irritation. Having one half of your company's basic load miss their mark from electronic interference is a situation more grim.

They are unreliable due to target acquisition. While a radar's ability to see through certain conditions can be beneficial, any system soon available will be unable to distinguish friend from foe with the necessary certainty. IFF? Sure, just produce enough for every single vehicle in the inventory. And since the proposal relies on all crew members being enclosed in the hull, we'll have to ensure our imaging software is constantly updated. Degraded gunnery will also become a thing of the past. By relying on the fragile electronics of this proposed missile system, we will have to resign ourselves to losing from the fight every single system that experiences a breakdown in the vehicle's air conditioner, etc...

(The proposal is also) non-cost-effective because of training. We cannot build confidence in a radar/electronic guided missile system without fielding and gunnery. Short of destroying actual, full-up enemy vehicles, sophisticated target simulators, destroyed on impact, will have to be developed. Current ballistic missile practice target systems being developed cost millions of dollars. And once the system gets validated, how often will our budget allow the soldiers to actually fire the system, building their necessary confidence preparing for combat?

Shock effect is completely absent in a picture that has this missile system remaining some minimum arming distance away from the enemy tanks and troops on the objective that needs to be seized, enroute to the next objective. How would this "Hellfire vehicle" fare in the close fight to seize the objective? How would its weapon systems complement the other members of the combined arms team in that fight?

From my experiences in a divisional cavalry squadron, I know that the Hellfire is a missile mounted on a 'vehicle' that is swarmed by maintenance personnel, with technical experts standing by every hour it is not in the air. Should the tank follow it into the future? Sure, once we find a way to swarm it with maintenance assets and personnel, assign each a dedicated crew chief, keep it in a clean hangar, and make the crew sleep at least eight hours per day. But the tank is NOT a helicopter, and tankers don't WANT to be aviators. They want and need a system they can know will have the speed, durability, and reliability to keep them in the fight 24 and 7! They need first-hand knowledge it will hit its targets and destroy them. They need a vehicle they KNOW will have the necessary shock effect and ability to work closely with the infantry IN THE CLOSE FIGHT!!!

As a former company commander in an M1A2-equipped battalion, I know and welcome the advantages technology can offer us tankers. But I also know it will be a very long time before technology will effectively displace the MBT, a trained crew, and a basic load of 829A1 on the battlefield.

MICHAEL E. EVANCHO
CPT, Armor
Washington, D.C.

No, Thanks I'll Stick with the MBT

Dear Sir:

The unfounded comparison between the proponent of the main battle tank (MBT) and the horse cavalryman who refused to acknowledge the necessity to "stack sabers," is one we are accustomed to hearing. I refer to this argument as "unfounded" because unlike the experiences of the First World War, which clearly signaled the end of the horse and saber on the battlefield, there is no recent or foreseeable experience which signals the end of the main battle tank.

To the comparison of the tank and the horse cavalry, however, we must now add the dubious comparison between the tank and the battleship ("The M1A2 Abrams: The Last Main Battle Tank?," Stanley C. Crist, *ARMOR*, July-August 1997). While I am not willing to compare the apples and oranges of tanks and ships, I would like to address some of the concepts Mr. Crist espouses in his article.

The article begins with a discussion of "The Missile Option" as the armament of the future. Mr. Crist cites the fact that missiles have improved greatly since the days of Yom Kippur. He exhorts the merits of electronic guidance of modern missile systems, asserting they are free from the distractions (fear, nearby shellbursts) which hampered the tracking of earlier, human-operated missile systems. While I concede his point in reference to fear and shellbursts, I would not bet the lives of my tankers on the superiority of electronic guidance systems in a direct-fire fight. Electronic systems, by their very nature, are susceptible to interference by other electronic systems. Any individual who has an electronic garage

Continued on Page 54

MG George H. Harmeyer
Commanding General
U.S. Army Armor Center

Educating the Officer Leaders

The Armor School remains committed to forging the finest mounted combat force in the world. In previous articles, I've discussed how emerging changes in organization, equipment, and doctrine will have a dramatic effect on mounted warfare in the future. Our leaders must be capable of effectively integrating and using these innovations. This requires that training methodologies keep pace. A key component of this is our Officer Education System. This "Commander's Hatch" will discuss where the Armor School is headed in the next few years in achieving excellence in training the Total Armor Force. I'll first discuss where the Armor Officer Basic Course (AOB) and Armor Officer Advanced Course (AOAC) are now, and where they are headed in the near future. Then I'll provide a vision for a University of Mounted Warfare for the 21st century.

The AOB course provides the force with tactically and technically competent lieutenants, imbued with the warrior spirit, who are prepared to assume command of a tank platoon immediately upon graduation. It focuses on the basics of platoon tactics, gunnery, maintenance, and soldier/leader skills. Lieutenants learn through a combination of classroom instruction, tactical exercises without troops, and hands-on experience, culminating in a gunnery exercise midway through the course and a six-day STX at the end. They use the entire suite of TADDS available to the force, including SIMNET (CCTT when it becomes available), TWGGS, COFT, and PGT. Lieutenants use TWGSS to facilitate the transition from the COFT to the gunnery ranges, and in conjunction with gunnery. They conduct multiple exercises transitioning from TEWTS to PGT, and eventually to SIMNET. The lieutenants go through a planning, preparation, execution, and AAR sequence during each phase. Staff sergeants and sergeants first class with a wealth of field, CTC, and combat experience do the majority of the instruction.

FY98 will see two major initiatives. In the third quarter, AOB will expand from its current 15 weeks, 2 days (currently the shortest basic course) to 17 weeks. These additional 8 days will include job specific equipment and other instruction tailored to the lieutenant's follow-on assignment in a light or heavy cavalry unit or in one of the M1A1 or A2 variant units. Cavalry instruction will focus on equipment and complement the Scout Platoon Leader Course POI that focuses exclusively on tactics. The second initiative will embed an M1A2 track in AOB, also beginning the third quarter, to keep pace with the current fielding effort. This will initially involve only one of the four AOB platoons in a class and will expand as fielding expands.

The Armor Officer Advanced Course prepares mounted officers to command at the company level and to serve in a battalion or brigade staff with an emphasis on their role as a battle captain. Over 80% of the course is focused on combined arms warfighting, roughly balanced between company, battalion, and brigade operations, along with some instruction on stability and support operations. AOAC students plan and execute offensive and defensive operations using both SIMNET and Janus at the company/team, battalion/task force, and brigade echelons. In the remaining 20 percent of the POI, students receive instruction on logistics, maintenance, counseling, leadership skills, TTPs on taking command, and some basic staff skills. Students also receive instruction on Battle Focused Training (FM 25-101), including how to conduct training meetings and how to develop and execute a comprehensive maneuver and gunnery training strategy that achieves the proper balance between live, virtual, and constructive simulations. The overwhelming amount of instruction is in small groups, led by some of the mounted force's best and brightest branch-qualified captains. Following AOAC, students go TDY to Fort Leavenworth for the 6-week CAS3, then return to Fort Knox and PCS. In FY99, all advanced courses will be reduced from 20 to 18 weeks in accordance with CPT-PME.

AOAC is also changing to meet the needs of the mounted force in the 21st century. As the mounted force transitions from analog to digital, our leaders will have to develop a solid understanding and working knowledge of the Force XXI Battle Command Brigade and Below (FBCB2) system, and will have to acquire some basic user competencies with the five ATCCS systems. For maneuver leaders, this will require a working knowledge of MCS Phoenix and a familiarization with the remainder of Sigma Star. Currently, AOAC students receive an introductory block of instruc-

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Branch Certification and Career Progression

by CSM David L. Lady, Command Sergeant Major, U.S. Army Armor Center

For some time now, our enlisted branch managers have used the phrase "branch qualification" when discussing assignments and career development. Visiting the force, I find that many tankers and scouts feel that this phrase is an "officer thing," which should not be applied to NCOs. Most say that, under the "select, train, promote" system, an NCO is "qualified" for a rank upon promotion to the rank.

I say, look beyond the phrase, and look at the need.

As much as our force is shrinking, restructuring, and changing, we need a system to give consistent focus to the fourth step in leadership development; the step following "select, train, promote." That step is "certify." Assign the newly promoted NCO into the critical leadership position for his grade, and allow him enough time to gain experience and to demonstrate success before shifting him to staff or other special assignments. Branch leadership certification is as critical to developing the NCO as "branch qualification" is to developing the officer. A branch-certified NCO has fulfilled the first, critical requirement which prepares him for promotion and greater responsibility. The need for branch-certified NCOs will guide Armor branch as they assign and reassign, will guide me as I advise centralized promotion boards, and should guide commanders and enlisted leaders as they develop NCOs.

The branch-certifying positions are: tank gunner and scout squad leader; tank commander and scout section leader; platoon sergeant; first sergeant. The certifying period is between 18 and 24 months, enough time to go through at least one and possibly two annual training cycles and enough time to receive two or three NCOERs, and to show a pattern of success and to have potential for greater responsibility assessed by two different leaders. Special credit may still have to be given to 12-month Korea tours, for many will leave Korea leadership tours for special assignments. Leaders must not assume that Korea is enough, they should return to the line as soon as possible to recertify as a leader, and continue to excel.

At Armor Branch, SFCs Perez and Morris must fill the special assignments: drill sergeant, recruiter, instructor, active component supporting reserve component (AC/RC), and observer/controller (O/C). These assignments have priority over line units (due to DA policy or congressional mandate), and duty on these special assignments lasts between two and three years. In all cases but recruiter, the NCO must be branch-certified as a tank gunner/commander, scout squad/section leader, or tank/scout platoon sergeant before he can be assigned to such duty. Take an uncertified NCO, send him into any of these assignments, and we place that NCO well behind his peers in professional development. We are assigning some uncertified E5(P)s and E6s to recruiting duty, for lack of anyone else to send. Our force is that short of certified E6 leaders, and the need to fill special assignments is that great. I do not like it one bit, but cannot do anything about it but try to reduce the number of Armor NCOs required to go on recruiting duty (not the fault of DA Armor Branch; these decisions are made echelons above them).

Even in the best circumstances, NCOs will often leave their branch-certifying positions after the minimum time to go into special assignments. I expect our branch managers to ensure that as many soldiers as possible have had the time to certify, and I expect the soldiers to go on these assignments proudly and to do the job well. There will be no ranking of these special assignments as "best" to "worst," as I advise the centralized boards. All special assignments are critical to maintaining a healthy force. All will be given the same emphasis in centralized board instructions. NCOs, do the best you can to maintain branch proficiency (easier for an O/C than a recruiter) and return to the line to certify or recertify as a leader of scouts and tankers. Unit leaders, do not assign soldiers coming off special assignments to the staff; put them back into the line and insist that they succeed as leaders.

The Armor School has begun to develop distance-learning aids to assist in maintaining MOS proficiency. That is the most valuable use for the distance-learning materials in NCOES.

As I brief the centralized boards, I am insisting that only branch-certified leaders be considered as ready for promotion. The Master Gunner Course is an excellent career enhancer for a promotable sergeant or staff sergeant, but they must serve as a platoon sergeant before going on to be the battalion "mike golf." Staff work is important, but NCOs must certify as a leader first and then show their versatility. Don't avoid first sergeant; it is the only job that shows the ability to be an excellent sergeant major or command sergeant major. No uncertified E8 is being considered for a special assignment. MSG Brantley, at branch, is making sure of that.

As the career professional development program is rewritten, "branch certification" will assume even greater importance. Units must manage their sergeants to enable as many as possible to have success in the critical leadership positions. Soldiers must do their best in whatever positions they are placed, but they must eagerly seek the branch-certifying leadership positions. I must ensure that the certified leaders are considered first by the promotion boards. The armored force will have the leaders that our soldiers require and deserve.

"SERGEANT TAKE THE LEAD"

Points of Attack: Lessons From the Breach

by Major James K. Morningstar

"Once more unto the breach, dear friends, once more..."

William Shakespeare
The Life of King Henry the Fifth, III i

As the plans officer for a naval-based joint staff, I don't often spot Armor issues on my horizon. However, a recent Advanced Technology Concept Demonstration (ATCD) brief on breaching minefields in a joint exercise raised some tanker concerns. Like a dog responding to its master's voice, my ears went up. The subject sounded faint echoes of my past life as the commander of Delta Company, 3d Battalion, 37th Armor, in the First Infantry Division, one of the units that breached the Iraqi defenses at the point of the VII Corps attack. Subsequently, the briefers and I engaged in a discussion arising from the thoughts, lessons, and opinions of my experience and, for what its worth, I would like to share some of them in the following paragraphs.

The ATCD briefing presented information on new systems designed to breach minefields that reminded me of old misconceptions I held. As a tank platoon leader in Germany, my training on breaching complex obstacles was almost nonexistent. I did learn three rules: (1) find a bypass; (2) call for engineers; or (3) improvise. In those days of "active defense," I don't think NATO expected to face an enemy defending behind complex obstacles. The ATCD brief focused on systems that could: (1) locate a bypass; (2) be used by engineers to clear mines; or (3) improvise. As we move into FORCE XXI, it doesn't seem like we expect to face an enemy defending behind complex obstacles. Is it any wonder that some people believe "deja vu" is an Army acronym?

Many of us in the Big Red One followed the August 1990 Iraqi invasion of Kuwait with great interest, but our focus was elsewhere. While the XVIII Airborne Corps was deploying to the Arabian desert, my brigade was preparing for a December deployment to the National Training Center (NTC) in the Mojave desert. By Halloween, rumors were already swirling about a possible change of plans when our battalion leaders went on a reconnaissance visit to the NTC. Upon our arrival, members of the Cobra Team asked us, "Why are you here? Your rotation is going to be canceled because you're deploying to the Gulf."

During our reconnaissance, the battalion commander, LTC David Gross, began to focus our attention on the "Global Training Center." When told to avoid the area between Siberian Ridge and the Whale Gap because engineers were conducting a demonstration breach of an Iraqi-style obstacle, we stealthily infiltrated to the top of the Whale to watch. The obstacle had wire, mines, obstacles, and ditches. The breach was impressive, daunting, successful — and unopposed. I found myself thinking more about how much easier it would be to defend the obstacle than to breach it. When we noticed two tank plows near a warehouse, I went through the gates and took a dozen pictures to show my company. When later I passed the pictures around to my officers, my XO, LT Keonig, asked if we were going to breach pictures of mines.

In our "ramp-up" for the NTC, we trained to avoid obstacles. One company field exercise included an easily by-passable patch of mines and wire. Upon finding the obstacle, it seemed each company went to great lengths to avoid a by-pass and conduct a hasty breach. This caused our engineers to remark, "If you build it, they will come." The lesson: (1) find a bypass; (2) call for engineers; or (3) improvise.

On 8 November, we learned from Wolf Blitzer on CNN that we were indeed to deploy to the Gulf. Now we found most of our time absorbed in the effort to pick up and move an entire armor-heavy mechanized division half way around the world. Still, our leadership took every opportunity to get some gunnery and maneuver training in between vehicle maintenance, personnel preparations, and intelligence briefs. When the trains, with our tanks, departed for the port in early December, however, we had not trained for breaching operations.

Our brigade commander was Colonel Anthony Moreno, a great leader with combat infantry experience from Vietnam. In mid-November, he summoned all the company commanders and presented the first cut of the brigade plan. My company would conduct the breach for VII Corps but we would do it as part of the 2-16 Infantry Battalion Task Force. This contradicted a long standing exchange of Bravo companies between our battalion task forces. When Alpha 3-37 was also chopped to Task Force 2-16, I could see that the two highest scoring gunnery companies in 3-37 Amor were now part of the breaching task force. It seemed the brigade was building a strong team, but a team that would not work together until we arrived in theater.

The plan included cross-attaching platoons to form a breach company team of two tank platoons, one mech (Bradley) platoon, and an engineer platoon. My company would later receive an ITV platoon and a COLT (to augment my FIST), greatly extending our range of fires. I liked that idea. The plan dictated that the breach team commander would turn his unit over to an engineer captain at the breach and then resume command on the other side of the breach. That idea I didn't like. Fortunately, the engineer captain in question supported my whining against such a violation of unity of command and the brigade dropped the idea.

Each company would mount six tank plows and breach two lanes. Three tanks with plows would advance in echelon, the following tank slightly overlapping the path of the tank before it, to create a lane at least two tank widths wide (this disastrous method is still taught in the current FM 17-15 *Tank Platoon,* Apr 96). A fourth tank with a roller would

follow and "proof" the lane. An engineer friend pointed out that, according to doctrine, the roller should lead, and that neither the roller nor the plows would survive the first mine hit. This bothered me: what would the following plow tanks do if the lead tank stopped? What if the middle plow hit the first mine? In echelon, the following tanks would have their fields of fire blocked by the tanks before them. I knew the brigade plan was subject to refinement (and nit-picking by dozens of would-be Rommels like me), but I began to feel there was a better way. The only problem was that this company commander didn't have a better idea at that time.

Another topic of concern was wire. What happened if the enemy strung thick bands of relatively cheap concertina wire in front of his minefields? Would the plows bog-down? Would they be immobilized by wire spooling around the drive sprockets? I thought of an answer: napalm. Get the Air Force to drop napalm on the obstacles to fry the wire and make it brittle (it might also uncover the mines); but the Air Force didn't have napalm any more. OK, what about white phosphorus (WP) rounds? We had 105mm guns and someone had heard the Marine tankers had WP in their inventory. Hell, while we're at it, see if we can get some "beehive" anti-personnel rounds. That was also a no-go. Maybe, when the need arose, we could get indirect fires to place WP on the wire.

Ft. Riley had a Simulation Center with a great terrain board, a wide variety of micro-armor, and a number of guys working there who loved to research and assist training. With intel from division and a $50 purchase of mine, *Lessons in Modern Warfare, Vol II, The Iran-Iraq Conflict* , they worked up a model of the triangular defense we thought the Iraqis would use. Utilizing Iraqi and U.S. force combat tables, my platoon leaders and I spent hours wargaming an attack against a well defended Iraqi position.

One thing we learned: artillery and air would play a major role. If supporting fires didn't reduce a selected point in the enemy defense, we would not get through. If we failed to exploit the effects of indirect fires before the enemy could reposition, we would not get through. The model made us realize that to achieve success, our actions would have to be a well synchronized part of a combined arms effort. Complex obstacles require complex solutions.

Members of D Co., 3-37 Armor got their first look at mine plows at this exhibit at the NTC, while on a rotation there. The unit learned it would be called up for the Gulf War from CNN. Below, a demonstration of the MICLIC device that clears mines by overpressure...when it works.

In the months prior to deployment, Colonel Moreno and his S2 would often take me to the brigade intel vault and show me a large map of the Iraqi defenses. Day by day, I watched as the obstacles grew in width, depth, and complexity. I knew that no matter where the division attacked, my company would breach on the division's east flank where the defenses would be the thickest.

There was a bright spot; on the evening before Thanksgiving, we were told that when we arrived in theater we would turn in our dogged-out rebuilt M1s for new M1A1s. I really wanted those powerful transmissions of the M1A1s to power us through the expected obstacles. I should have known better: that same evening we were promised the holiday off, yet at 0530 hours Thanksgiving morning, I received the call to get the company in to paint the tanks. Needless to say on arriving in the Gulf, I found out we would "dance with the tanks that brung us."

There was a morally disturbing aspect to keeping the old tanks. For years, we had been told we would never go to war with these tanks because we would draw on our POMCUS stocks. Now we had intel folks telling us that from many angles our 105mm guns could not penetrate Soviet armor (we would prove this to be false). In theater, we found we were going to be the only battalion of 105mm M1s in the Gulf. Were we expendable? (These thoughts were reinforced when a week before the ground attack, we were told to turn in our issued series-833 rounds for the lesser series-700!)

After the war, the Task Force 2-16 chaplain told me how the headquarters expected us to take up to 80% casualties in the breach. The message was clear: to

the planners at least, we were a throw-away unit.

We dripped into theater. Ships failed to show up and heavy transports broke down. We arrived with nine tanks, knee deep in mud in pitch black darkness around 0300, 17 January, in time to watch the first air attacks scream overhead on their way into Iraq. At dawn, the division commander, MG Rhames, arrived to tell us we were all he had between the division headquarters and the Egyptian positions to our front and that we would attack in *six days*. Meanwhile, we were to assume a defensive position oriented north (with miles of empty trackless desert on both flanks). I also dropped off six tanks to receive plows. A lesson learned: never plan to conduct essential training upon arrival in theater; missions get in the way.

Over the next month, while the coalition air forces pounded the enemy, we gradually pulled our forces out of the ports and into the field. We learned to use new equipment and were attached to our new task forces. I gave up my third platoon (whose members never forgave me) and picked up my attachments, none of whom had ever worked with my company before. I also received a large smoke platoon which had no ammo, no maps, and no mission. I had no use for them. I gave them back to higher headquarters, which used them for EPW control, much to the smokers' resentment. The engineer platoon consisted of two squads in M113s, and two AVLMs (Armor Vehicle Launch MICLIC). This was the first time I had seen these particular vehicles.

In the following weeks, I discussed my concerns about the echelon breaching technique with a number of people. On 20 January, Task Force 2-16 S-3, Major Rachmeler, suggested we test the concept, and so we did the following day. We constructed a mock minefield, using half-filled sandbags as mines. We learned that as the first tanks plowed the field, it pushed dirt and mines to the left and right. The second tank, following behind and to the left of the first, would consistently catch the right side of its plow in the dirt pile the first had plowed aside. This would cause the right side of the plow to dig in and down and lift the left side up a few inches. Invariably, the following tank ran over "mines." Not good. The result of our test? We received word to give up three plows. We would breach two lanes, each with a plow followed by a roller, followed by an AVLM. The company's third plow would be in reserve. The rest of the plows would go to a follow-on task force so that if we got stuck in the breach, they would conduct a new breach somewhere else. Plan B: the first breach gets stuck and fixes the enemy, the follow-on forces conducts a bypass breach.

On 22 January, we went to our first MICLIC demonstration. We were blessed with outstanding engineers in the First Infantry Division who created a mind-boggling practice breach area. In a section of wire, dummy mines, and trenches, a MICLIC blew an impressive lane through the obstacles. Everyone gathered in the scorched breach lane and nodded approvingly. The second MICLIC rocket broke its tether and fell inertly on the ground. Everyone held their breaths awaiting the explosion, but none came. In my journal, I noted that by 26 January, we had witnessed 7 MICLIC firings, two of which worked properly. Nothing stops an operation faster than that explosive cord laying on the ground. The fastest successful launch and detonation was 50 seconds. During that time no one could key a mike for fear of a static-related detonation, and all the buttoned-up crews were left to wonder what was going on. No one wanted to be in front of a MICLIC that may misfire or break free.

Although the misfires were later found to be caused by a bad lot of explosive cords, these demonstrations raised some doubts and led us to decide only to use the MICLICs if the plows ran into trouble. When they worked, they made wonderful flat scorched lanes through wire obstacles and did major damage to trenches. I was certain they would clear mines, except for the Iraqis' 9 million, Italian-made, MICLIC-proof overpressure-resistant mines. But those were probably in some other sector of the Iraqi defenses.

Our plan began to crystallize. My second platoon, under LT Steve Miller, volunteered to take the plows. By now we believed the breach area had minimal wire, possible mines, and a manned trench, but bad weather prevented aerial reconnaissance. I, like the entire chain of command, wanted to put as much firepower as possible on the enemy while two breach teams cut the lanes. Each team would lead with a plow, followed by a roller, followed by an AVLM with MICLIC, followed by an engineer squad in an M113. Although some in the battalion still argued for infantry to clear the trenches, the decision was to give that role to the tanks. The lead plow would push through the obstacles then turn east and crush the first trench. The roller would proof the lane, then face west at the trench and suppress that section. The AVLM would stand by to fire over the obstacles if the tanks got stuck. The engineers would get out of the trail M113, emplace two 10-foot high panels, one each side of the lane opening, then drive through the lane throwing out water bottles containing glow stick solution to mark the sides of the lane. They had originally planned to mark the lanes with "tippy-toms," but found them inadequate.

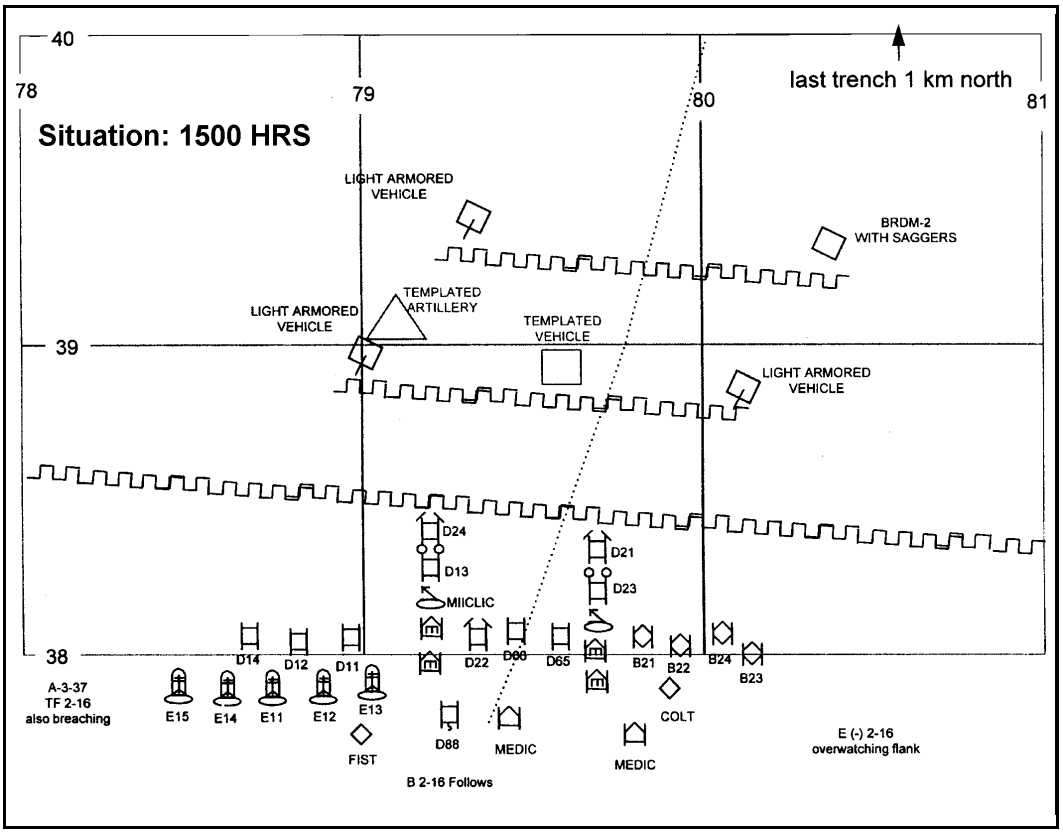
I was more worried about the exposed engineers than anything else. We did not know what kind of fire to expect from the Iraqi trenches. I wanted to get some Vulcans to suppress the trenches, but that proved unfeasible. I placed my first platoon, under LT Dan Redden, on left flank and LT Hubb (2/B/2-16) and his Bradley platoon on my right to suppress the trenches. We carefully selected main gun and machine gun angles to ensure maximum interlocking fires. If they were not needed for the obstacles, I intended to fire the MICLICs down the enemy trenches if necessary. It is not enough to place tanks in the overwatch; you must orchestrate sectors of fire and weapons selection for the expected targets.

We had other missions beyond the breach: destroy the trenches in vicinity of the breach, penetrate to and destroy the farthest enemy trench line (approximately three kilometers away), and protect the task force's northern flank from counterattack as it turned east. We knew we had to conserve ammo and quickly complete the breach.

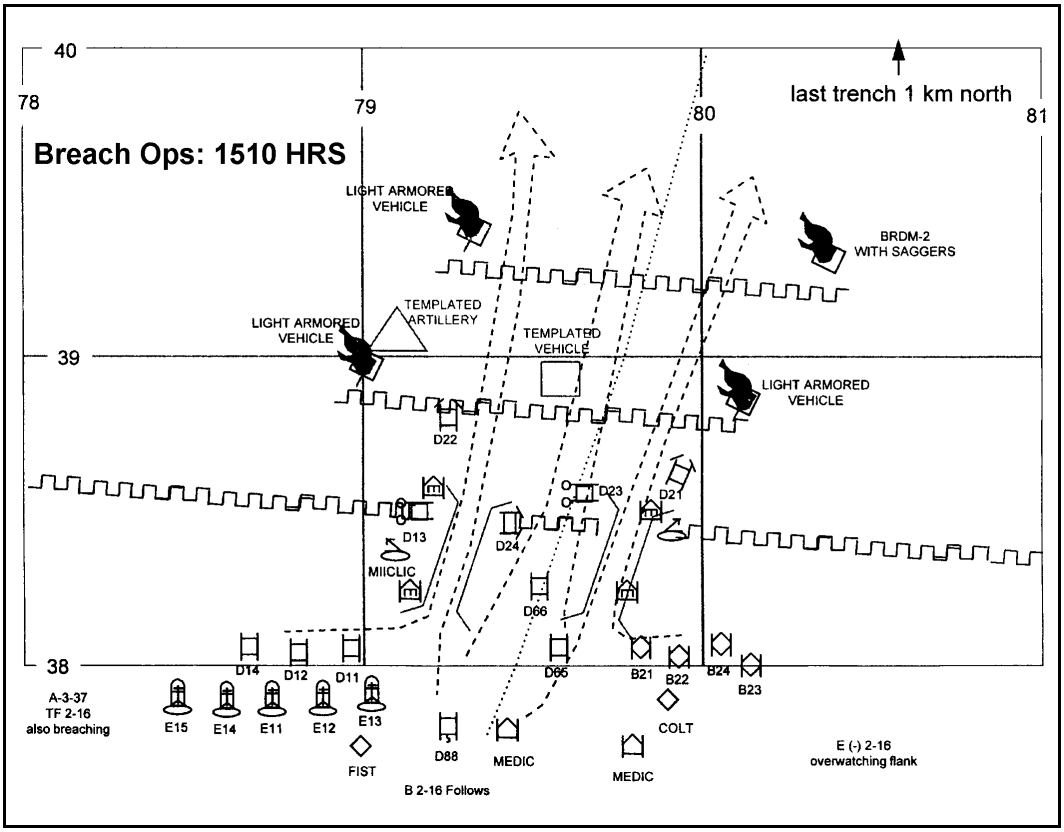
At 0900, January 29, we began a series of mounted, brigade-level rehearsals. We practiced a rate of advance of 10 minutes per kilometer to keep us just behind a steady advance of artillery fire. I was afraid this was too slow and would allow enemy reserves to reposition before we hit the third trench, but the division and brigade believed supporting air power would negate that threat. After the first rehearsal, Colonel Moreno put an end to further changes. He said we were all now "signed to the contract." The time for "great ideas" was over.

Our rehearsals on 1 February, especially at night, revealed an unexpected problem. The task force had so many vehicles pouring through the breach lanes

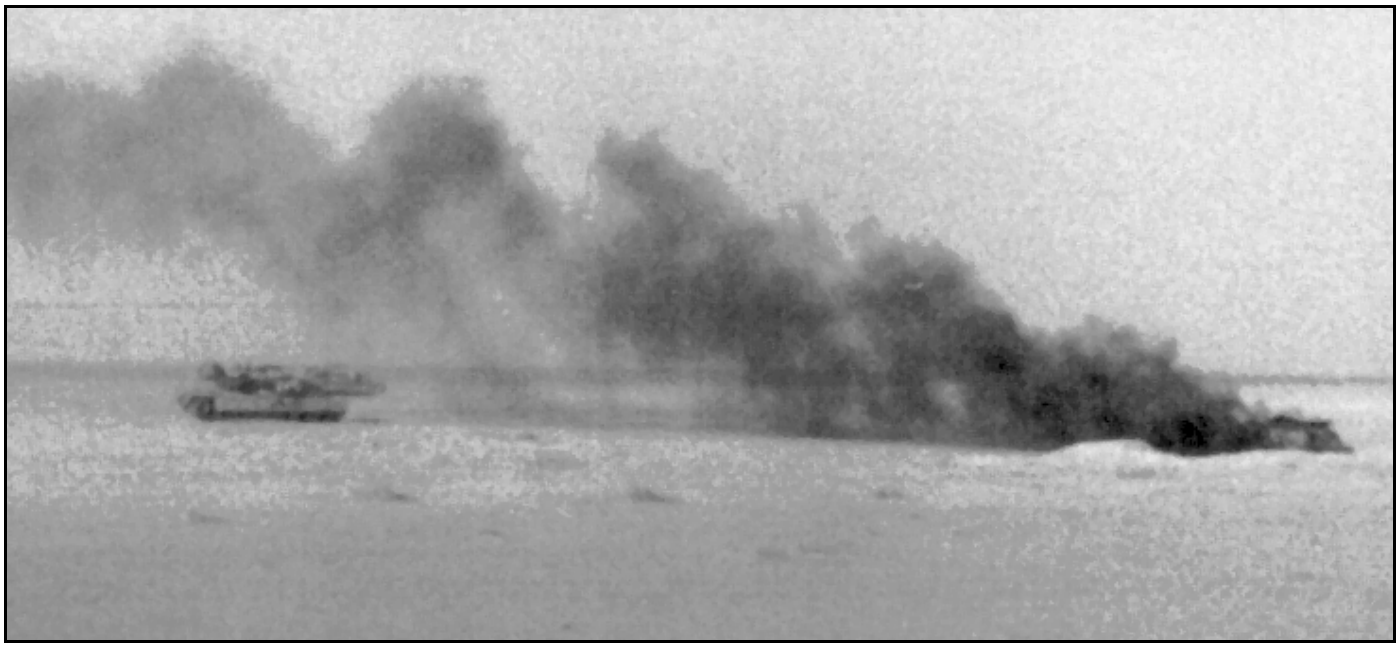
BREACH OPERATIONS



SITUATION:
1500 HRS



BREACH OPS:
1510 Hrs.



that individuals became confused and intermingled. Expecting that this would be worse with battle dust and smoke, we decided to fly yellow flags on every vehicle in the Delta team. It didn't help matters that every GPS in my company shorted out in the rain and had to be turned in for maintenance.

We moved to the division practice breach site prior to sunset on 4 February. Before sunrise, after watching a nearby M109 blow up and burn, we conducted a rehearsal in which we breached the wrong berm and got our asses chewed for it. In four subsequent mounted, and one walk-through rehearsal, the ITV platoon leader nearly broke his ribs, two plows broke while crossing trenches, and a lot of people lost their tempers. Still, we kept at it, got the kinks out of our task force, and learned valuable lessons. CPT Tony Schwalm of Alpha Company demonstrated how to drive an M1 without a plow astride a trench, steer a little left and a little right, and cave in the sides. I wondered if a brave enemy with an RPG round would be able to fire into the underbelly of a tank performing such a maneuver, but we agreed they would probably have other things on their mind at such a time.

The most important lesson of our breach site rehearsals was this: no one system conducts a breach. It is the truest form of synergy on the battlefield. Some systems can clear mines. Some can reduce wire. Others can suppress the enemy. Some kill. But you can't get from here to there unless they all work together. There was not a crew and not a man in our outfit who did not understand how their piece of the operation fit into the whole. Weapons orientations, ammo selection, sequences through the breach, and operations on the other side were items of particular importance and training. When we finished with the mock site, we constructed a company walk-through terrain board (finding adequate space was never a problem) and rehearsed each crew through the operation. We were lucky to have the time to drill this operation to perfection.

On 14 February, we repositioned 70 miles west as part of the "Hail Mary" maneuver. The plows and rollers were transported on flat bed trailers and remounted after the move. We occupied Battle Position 22, overwatching cuts 13, 14, and 15 in the 12-foot high and 12-foot wide berm dividing the neutral zone. There we conducted counterrecon, watched the counterartillery fight, defended, and prepared to attack. Breach practice was over.

At a meeting at TF headquarters at 1800 on 21 February, we received orders that the ground attack would commence on the 24th. We conducted two more walk-through rehearsals that simply confirmed we were ready.

On the night prior to the attack, I visited my engineers. It is hard to express the feelings you go through when you look at men that you know may be killed the next day while under your command. I could only think, "God bless the engineers." They were upbeat, confident, and only expressed worries about us DATs and grunts.

We moved out at 0328, 24 February. Fifteen hours earlier, we received orders changing the lane we were to take through the berm. We had been forbidden from practicing the maneuver through the berm so as to prevent the Iraqis from getting suspicious about our direction of attack. In the absolute darkness, things quickly bogged down and when I walked forward to straighten things out, I was surprised that someone nearby fired a main gun round. I ran around asking who fired and why, but no one claimed responsibility. It was my FIST who later told me that it was an incoming mortar round.

The approach to the breach was slow. At 1200 hours, two kilometers south of Phase Line Wisconsin, we took our first prisoners. This caused us to go into EPW drills, which meant detaching infantry squads. This almost disrupted our breach organization. Another lesson learned: expect to conduct such actions on the way to the breach and plan accordingly. Be ready to deal with enemy OPs, ambushes, and deserters. We should have passed the EPWs to a follow-on company.

By 1430, we were on line in sight of the Iraqi trenches and watched the division artillery pound the enemy. Overhead, flights of Apaches hovered, dropped their tails, and fired their rockets as indirect artillery. After about 30 minutes, we waited to collect more prisoners and then attacked.

We received some small arms fire and mortar rounds, so we knew not all the enemy had surrendered or deserted. My gunner spotted what he thought was a tank overwatching the breach area. We fired and with the fireball that went up, I realized we had hit a fuel pod. However, the armored vehicle next to the pod returned fire. That was his last mistake. About five of my tanks immediately re-

SGT Balladad, in D24, turns right to begin plowing the Iraqi trench system as SSG Daniel Eckert in D22, carrying the reserve plow, moves forward. Note the Iraqi soldier exiting the trench system behind D24.

Below, D21 and D66 pass an Iraqi wheeled armored vehicle that had been set up in an overwatch position. Its cannon fired only once.

turned fire and struck the Iraqi vehicle. A few more Iraqi armored vehicles made similar fatal errors. The ITVs, assigned to look deep, spotted a T-55 to the northwest more than three kilometers away. After taking the time to ask one tank to move out of their field of fire, they engaged. Although I didn't think so at the time, by comparing the way that target burned to what I later saw, I am now convinced they destroyed that tank.

There was no wire. The plows went down, almost. I had taken the position in between the two breach lanes and on my left, second platoon sergeant, SSG Balladad, got out of his tank and jumped up and down on his plow to get it to drop into position. Despite the distraction of sporadic enemy small arms fire, he got the plow into position, and his tank spent the rest of the day plowing up desert wherever he went.

When the breach teams reached the trenches, it was clear there were no mines. Higher command had indeed outflanked the Iraqi obstacle belt. I told my driver move out, and we drove between the two plowed lanes into Iraq. The rest of the company team moved exactly as rehearsed. Vehicles positioned quickly to overwatch every square inch of the enemy defense. D24, working from west to east, crushed our assigned section of the first trench. Some Iraqis jumped out of the trenches and surrendered; others remain there to this day. We never fired the MICLICs. The engineers were never touched.

We went on to the final trench about three kilometers to the north. It turned out to be the fourth trench. One company failed to destroy their assigned trench to our south, so we went back and destroyed that one also. First Sergeant Morrow, a Vietnam combat veteran, got into the fight and destroyed enemy positions with the M88. Our tanks rolled up the trenches from the 75 grid line to the 88 grid line, all the while positioned to defend the right flank against a counterattack that never came. We destroyed five vehicles, three of which had engaged us. We took over 350 prisoners that day and suffered not one casualty (we would later).

I later questioned many of our prisoners about how they prepared to defend against our attack. They said they were prepared to defend against what they were told would be a dismounted attack by Egyptian infantry. When they looked out and saw tanks, Bradleys, and Apaches it looked exactly like the pictures on the leaflets dropped on their po-

sitions. If the leaflets correctly foretold of the attack, they reasoned, then the end was also foretold. More than half had surrendered or deserted before we conducted the breach.

In the years since, I have often thought our success was due more to the unique conditions we enjoyed than to anything else. We did not see the equipment or units with which we were to accomplish the breach until we arrived in the field only weeks before the ground attack. Still, we were lucky. We had the luxury of time, materials, and leadership that allowed us to assemble and train. We had generals at the highest levels who maneuvered us to face the weakest spot in the enemy's line. We also had an obliging enemy whose military incompetence allowed us to overcome deficiencies in our doctrine and pre-war training. Would our procedures work under different conditions? As an OC at the NTC, I saw enough failed breach attempts to answer, "probably not."

The major deficiency in our peacetime approach was brought home to me in the ATCD brief. We develop systems that can remove mines without designing them in conjunction with breaching forces. While several of these systems could no doubt remove mines from an area, they could not breach a field defended by anti-armor systems.

The simple removal of mines is a "mine-clearing" operation. "Breaching" occurs when your create a lane for maneuver through a minefield against opposition. If no one is firing at me, I can clear a minefield with a butter knife and snow shoes. It may take a while, but it can be done. A billion dollar light-skinned vehicle with a complex bulldozer blade, GPS systems, and comms can also clear a minefield, but it cannot breach a defense.

As an aside, I believe the roller tanks were a waste of tanks. They are very cumbersome, limited the abilities of the tank, and were not going to find anything the lead plow wouldn't have discovered. An engineer vehicle could do better. Interestingly, General Starry had reported the same observations from Vietnam some 30 years earlier.

Rollers were first tested by the 11th ACR in Vietnam in 1969 and then again by the 5th ID and, in both instances, were found insufficient. Only in a third test, when the 4th ID placed them on engineer vehicles, were they deemed acceptable.[1]

The biggest obstacle to maneuver is an enemy opposing efforts to breach an obstacle. The most critical element of breaching is to neutralize that enemy. As the Gulf war proved, airpower, though effective, will not accomplish this task alone. Concentrating vehicles to force one or two breach lanes out ahead of the killing forces makes it easy for the enemy to concentrate fires on the breaching vehicles. One or two accurate shots from the defenders can stop a corps attack. In a future where accuracy can be bought at the local Radio Shack, current tactics will be obsolete.

D Company's infantry platoon processes Iraqi prisoners of war. Many told intelligence officers they were expecting an infantry assault by Egyptian troops.

The solution is to first kill the enemy and then conduct a breach. Tank plows are not designed to clear lanes but they can get single tanks through the obstacles. Instead of six plows for two lanes, the breaching company should have plows on each and every tank. After the indirect systems prepare the breach area, let the lead tanks get themselves through the obstacles and get on top of the enemy positions. The most effective way to suppress an enemy is to get on top of them and kill them. Guderian stated a similar sentiment in regards to breach operations when he said, "...within the tanks' own combat zone nothing short of the destruction of the defense will do, if we are to develop the attack into a successful breakthrough. ...The attacking forces must therefore penetrate the defensive zone in great force and at great speed...."[2] A following engineer platoon could then select the paths of the successful plow tanks; clear, proof, and mark those lanes; and pass other forces through.

The key to a deliberate breach is achieving the synergy between systems of differing abilities to accomplish the essential parts of the mission at the proper moments. We were able to achieve such synergy through constant practice. Future units may not have that opportunity once in theater. Therefore doctrine, TO&E, and training must pick up the slack.

A final observation: choose only your best troops to conduct the breach. As General Fred Franks observed, "Breaching a complex obstacle covered by enemy fire is the toughest attack mission a unit can get."[3] Only the best units can be expected to confidently conduct breach operations. Sending forth anything less is just plain stupid. The breach is the seed of the attack: all success grows from the breach. Choose your best men, give them the best equipment, train them hard, and support them all the way. They risk their lives so that the attack will succeed. Maybe it is time we risk a little brain power and sweat to develop doctrine that will ensure their success the next time we send them "once more unto the breach."

Or we can hope to be lucky again.

Notes

[1]See General Donn A. Starry's *Armored Combat In Vietnam* (Arno Press, NY: 1980), p. 82.

[2]Major General Heinz Guderian, *Achtung Panzer* (Arms and Armour Press, London: 1993) p. 179.

[3]General Fred Franks and Tom Clancy, *Into the Storm: A Study In Command* (G.P. Putnam & Sons, NY: 1997) p. 268.

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SHOCK
And the Digital Battlefield

by Captain Robert L. Bateman

SHOCK (shôk) v. intr. Archaic. To come into contact violently, as in battle; collide. [Old French choc, from choquer, to strike (with fear)[1]

Shock is a common term in the military lexicon of Western armed forces. It is generally considered as an asset, something one wishes would happen to the enemy and is often stated as a goal in a tactical operation. Yet, how many have considered exactly what they mean by "shock action"? Shock has the potential to be a terrible and effective weapon in its own right. An understanding of the phenomena of shock is critical for the commander hoping to effectively employ it as a component of his plan, or as the objective result of his actions. Does the potential for shock exist on the modern battlefield? Today, many professionals differentiate between "shock" and "firepower." The implication here is that shock only refers to actual physical contact weapons, of which we have one, the

bayonet (discounting the more imaginative uses of the treads on some armored vehicles.) However, in the same breath many professionals also discuss the potential of "breaking" a unit. Is this not the classic definition of shock action? This apparent dichotomy in definitions is not resolved by our doctrine. This article examines shock, not only so that we might utilize it more effectively, but also so that we might better understand how it might be used against us.

Reviewing Shock

So long as men have attempted to better one another in physical matches, there has been shock. Currently, United States Army doctrine is silent on the topic. One finds neither a definition or a broad use of the term within FM 100-5 (*Operations*) or the subordinate tactical manuals. Failing a definition from these sources, one turns to the dictionary, where we find the definition above. So, for this article and for general military purposes, we will define shock as having two components: physical force (expressed as F=MxA) and fear. Physical force is the enabling component; fear is the active and primary component. This definition will be the basis of our discussion. Yet this definition did not appear from whole cloth; shock is a recognized aspect of combat, one that has been widely documented, if less often defined.

The mounted knights of the Middle Ages rode war horses, which made them a potent combination of mass and acceleration and produced a fearsome visual impetus for shock. In the 15th century, the European *destrier*, or war horse, was a genetically refined and well trained complement to the mounted knight's basic style of fighting. Just as size and endurance might be bred into a mount, so might other psychological characteristics, such as aggression. Reinforced with training to accentuate its natural tendencies, the war horse of the Middle Ages was a fearsome beast in its own right. Trained from a colt to obey the subtle commands given by leg pressures from its rider, it was also trained in more violent actions. Biting opposing horses, kicking dismounted warriors in the melee, each of these 2,000 pounds of directed mass could impart a mighty impact by themselves.

When coupled with the knight and his intelligent mass, at a velocity of nine meters per second, which might be converted into a rapid deceleration upon impact, the mounted war horse was a weapon custom-made for producing shock. There was one major problem, however: mounted knights were not inclined by training or culture to act in a truly concerted manner. Each knight was an individual warrior, and for a long time this was enough. They stood dominant against all but similarly equipped foes throughout the Middle Ages until they ran into an even more efficient weapon, the Swiss phalanx of the 14th and 15th Centuries.

Success for the Swiss relied upon the phenomena of shock. At the time of the Swiss ascension, shock had been the sole purview of the mounted heavy cavalryman and his steed. The infantry had been relegated to a supporting, largely defensive role on the battlefield. The Swiss changed this equation with their attacks in massed columnar formation wielding 18 foot-long pikes. In their attacks upon their opponents, the Swiss were helped not only by the physical component of shock, but also by the psychological aspect, upon which they capitalized. By taking no prisoners and bowling over their opponents in near-fanatical attacks, the Swiss *Eidgenossen*[2] embodied the very essence of both components which create shock in an opponent.

Key battles fought by the Swiss demonstrate both elements of shock in operation. At the battle of Sempach in 1386 the Swiss attacked in a deep column formation, sometimes described as a "wedge" due to its unusual depth-to-frontage ratio.[3] This formation permitted the Eidgenossen to literally bowl their opponents over. Later, in what might be their ultimate example of the power of fear as a weapon, the Swiss attacked a numerically superior combined arms force at Grandson in 1476. Faced with the sudden onslaught of opponents that had never retreated, never accepted a surrender, and never lost while there was still a man among them alive, the Burgundians and their allies literally dissolved before the Swiss ever had the chance to make contact with the opposing infantry.

Moving forward into the age of gunpowder, Napoleon's attacks with *L'Ordre Mixte*[4] again demonstrated the power of shock when a mass of combatants attacked in a "columnar" formation. Even this far into the gunpowder era, the threat of "cold steel" could and did break many formations facing the charge of a French formation in column. The visible physical mass and combined will of the French formations were often enough to cause others to break, despite their inherent lack of firepower (due to a reduced frontage relative to a defender "in line"). Later, in the American Civil War, similar tactics were used. By then. the increasing range of artillery and rifled musketry created prohibitively high casualties before most bayonet charges could be run home. Recent studies involving the medical records of the Union Army reveal that even in those fights that did contain a successful bayonet charge, there were surprisingly few actual wounds inflicted by the bayonet. Units apparently broke before the attacking ranks collided with the defenders. A mass process appears to occur in which the defenders continually evaluate the chances for success of the attackers. If the attackers begin a final assault which the defenders did not feel they could stop with firepower, the defenders would often break. The level at which they broke would appear to be a function of the discipline and training of the unit. Similarly, in the attack, there could occur the "culminating moment" when the attackers individually and collectively conducted a similar analysis. If, in their minds they had passed the point where they believed they might succeed, attackers too might quickly dissolve. Classic examples of this are the "High Water Mark of the Confederacy" at Gettysburg[5] and the failed attack of Napoleon's *Grognards* (The Imperial Old Guard) at Waterloo. In the case of Waterloo, the cry of *Les Guard recule* set in motion the dissolution of the entire Grande Armee.[6]

The First Component: Force

Force equals Mass times Acceleration. It is a simple equation, one that is repeatedly demonstrated every fall weekend in stadiums across the United States. While the mechanical method that deliv-

ers the force may differ from the Eidgenossen, to the Big Ten linebacker, to a battalion task force at the National Training Center (NTC), the same formula applies. That force has a large role in warfare is obvious; what is not quite so evident is the role of force as a component of shock.

Shock, as we hope to inflict it, is not an individual phenomenon. This is where some of the confusion in definition appears. Shock, as defined here, affects the actions of large bodies of men, causing the retreat or surrender not of scattered individuals but of entire units. The shock we would like to inflict upon our opponents (and prevent from occurring to us) affects whole companies and battalions, perhaps even brigades at a time. The disintegration of Naploeon's Grand Armee is what we are aiming for as a goal. How then does force apply within this context?

First, force must be demonstrable. The cause of the effect (hopefully, friendly forces) must be present and visible for force to develop any psychological impetus, as we will see later. Further, the effects of force, whether from a single weapon or the massed effects of many weapons, must be visible to numerous members of the opposition. For shock to develop, both of these elements must be present when the physical process of force application occurs. This partially explains why so few units in the past century have ever surrendered due to the pummeling received from airpower alone.[7] Similarly artillery, while it may contribute to the effects upon morale, also remains (by itself) less than decisive. Attack aviation, while meeting the criteria of visibility and presence, also fails for the same reason as conventional fixed-wing aircraft. It may attack and infuse shock, but any opponent facing an attack helicopter knows that it cannot drive home its attack. It is also impractical to surrender to a helicopter, though the Iraqis set records in this department for trying.

To fully understand this we must turn again to the historical record. Military history is rife with examples; it remains only to choose one for an analysis to demonstrate the components. For example, how did physical force affect the recipient of the Eidgenossen attack? The Swiss pikemen with their long weapons faced armored knights fighting both on horseback and later on foot. How did they develop the force required to defeat the armor of the knights, and was this physical force sufficient to explain their long series of one-sided victories?

Simply stated, it is doubtful that most Eidgenossen pike tips actually penetrated the armor of a knight standing ready to accept the rushing charge of the Swiss phalanx.[8] The Swiss pike was not an Armor Piercing Fin Stabilized Discarding Sabot munition with sufficient kinetic energy to slice through plate mail. What they did do was bowl over their opponents, killing some in the initial rush, stabbing others as they lay on the ground as the Eidgenossen walked over them, continuing their attack. The result was literally a wake of dead bodies trailing in a path behind the Eidgenossen phalanx. Their deep formations permitted them to accumulate sufficient kinetic energy through additional mass to make up for what they lacked in acceleration, but this kinetic energy was used in maintaining the momentum, not acceleration. The results were visible, gruesome, and apparently (to their opponents) inevitable for any that stood up to the charge of the Swiss.

For a similar reason, some of the attacks of the British tanks at Amiens in 1917 met with unprecedented success for the time. The physical presence of an impenetrable object, rolling over German trenches and destroying those machine-gunners that did stay by their guns at ranges of as little as four to eight feet, combined with the visible presence of mass (represented by the tank itself) and with the undeniable power of its numerous machine guns or cannon[9] amply demonstrates the point. As examples of the power of force in ground combat, these stand alone. ***Force is the physical component; it may be relayed by manpower, or explosives, or projectiles or a combination of all three.*** Yet, as stated, shock has a second element, one which is prompted by Force.

Shock's Second Component: Fear

We need to dissect fear to understand how we might use it as a weapon. Fear is the basis of mass shock, yet it cannot be replicated in training and is one of the great imponderables of warfare. By what physical process may fear be conveyed, and how is fear transmitted after that?

Fear may be conveyed by a variety of methods. On a strictly physical level, the senses which transmit messages which might induce fear are obvious, primarily what the defender sees and hears. Fear is not directly transmitted, of course, but here we'll examine a series of sensory inputs which, when combined with knowledge inside a human animal, create the emotion of fear. It is that combination which the Eidgenossen and other successful forces since their day capitalized on to great effect. Placing visual and audible sensory signals upon the battlefield, combined with their opponents' "knowledge" of their reputation, created fear. This is a worthy goal for our forces.

What are some examples of these "signals"? Audible inputs are easiest to demonstrate. The feeling of power conveyed by sound alone is obvious to anyone who has ever been near a large body of marching or jogging troops, let alone the roar of a large diesel engine or the reverberations of a tank main gun discharge. Massed rifle fire in volley is especially impressive, even if the smoothbore muskets that first used massed volley fire were not. The Swiss were known to use drums as their primary instrument. Today, it is not known if these drums were used to help the Eidgenossen stay in step, or merely to convey some rudimentary messages (such as "Speed up"), but their emotional effect was surely intentional. The drums helped hearten the Eidgenossen and helped strike fear into their opponents.

In our own century, we can see that mere sound still retains a place upon the battlefield. The physical force of the Luftwaffe's JU-87 Stuka dive bomber was not increased by the addition of the famous screaming dive sirens that were added to the aircraft. Yet many of the men that suffered through a Stuka attack would attest that the siren was a weapon, a psychological weapon designed to increase fear.

Fear is also generated through the sense of sight. The mass of the Swiss phalanx itself might be considered a weapon. Mass, organized personnel are considered dangerous, sometimes out of all proportion to their actual size. Consider recent examples, such as events which occurred during the U.S. involvement in Somalia in 1993. By experience, the soldiers and officers of the 1st and 2nd Battalions, 87th Infantry of the 10th Mountain Division (Light) learned similar lessons. Somalian rioters, when faced by small contingents of U.S. troops, barely paused in their activities. The U.S. troops acted in dispersed elements so as not to appear "confrontational" to the "peaceful" Somalians. When these U.S. troops were initially dispersed throughout a troublesome area in squad and fire-team sized groupings, their effect was negligible. However, when the same number of troops combined into a platoon or company-sized "riot" formation, their effect was sudden and visible upon the Somalians. On more than one

occasion, the simple act of "forming ranks" by the U.S. troops was enough to convince the rioters to cease their activities and cause some to disperse. (That is, until they learned that the U.S. forces would not resort to physical or deadly force unless attacked directly or fired upon. This discovery lessened the effectiveness of U.S. troops considerably.) From this we see that the visual stimulus of a compact, massed, and coherent force has more effect than the same number of troops in a loose or open formation. Sound and visual cues combined would be useless without some "knowledge" of what these stimuli might mean. It is the interpretation of the stimuli, and the human imagination acting upon that interpretation, which creates that thing we call fear.

One is not afraid until you have something to be afraid of, be it bogeymen or Eidgenossen. Further, even when given an object, one still needs an imagination. Fear appears to affect reality when input stimulus and mental object combine and the human mind imagines what the effect of the object of his fear might be upon him. From their very beginning as a unified and cohesive force at Morgarten in 1315, the Swiss created for themselves a reputation of invincibility and utter contempt for the human lives of those that opposed them. Later, they would add to this an apparent disregard for their own lives by their actions at St. Jacob-en-Birs, which further reinforced their reputation.[10]

From this we discern that fear requires a stimulus. This stimulus is most often visual or audible. The stimulus acts upon a preconceived notion regarding the force which the enemy will impart upon the subject. In other words, "What will happen to *me* when that tank that I hear/see decides to attack me?" If the threat is sufficient, and the message clear, then that *individual* will likely "break." He will become combat ineffective. However, that is but one individual. Shock, as we hope to see and understand it, refers to entire units. How does this occur? Surely different men have differing tolerances affecting their behavior. Societal norms, personal upbringing, and institutional forces combine within each man to create a unique point at which he will decide, "enough is enough" and try to escape the arena of combat as an individual. This is the essence of the military definition of "shock."

Fear and Dissolution

Simply put, the Swiss 18-foot pike was a fearsome individual weapon. In order for the Swiss to experience the success which they enjoyed so often in the earlier years of their primacy (1338 to approximately 1450, for purposes of this discussion), they must have faced irresolute opponents. When stopped, the invariable Swiss response was to bring forward their true killing weapons, the halberd. But when an enemy was not so inflexible and gave way, the pike could be very effective. Its force would carry men off their feet, there to be trampled over by the onrushing impetus of the Swiss formation and likely crushed or stabbed to death while on the ground by the swords or halberds of those in the sixth, seventh or following ranks of the Eidgenossen formation. This is how their opponents died. The process could be accelerated by the presence of fear in the enemy ranks.

Facing the initial onrush of the Swiss attack, many men in the front ranks arrayed against the Swiss would pull back from the hedge of pikes. Some, of course, would die in the initial thrust, while others might be wounded and fall to the ground. Still more would trip as they backed away, and their falling could create a "shock-wave" of its own. Imagine a tightly packed crowd. Knock down a man in the leading edge of this crowd and literally dozens will be carried to the ground with him. None within the crowd have the room to catch their balance, which causes them to fall into others in the same predicament. Prone opponents are easier to kill than standing ones, if you are Eidgenossen and have no qualms about this minor breach of protocol, then you can take advantage of this event. But this scenario is not complete. Even given the self-perpetuating nature of what is described above, and adding in the continuing impetus of the Eidgenossen themselves, there is just not enough damage inflicted to explain the crushing defeats handed out by the Eidgenossen in their early years of dominance.

It is a military truism, first advanced in its present form by Ardent DuPicq, that more men are killed in the retreat than are killed while facing the enemy.[11] It is also an observed fact from the period under discussion, and later battles through the 19th century, that when a unit broke, the break started from the rear of the formation.[12] This would appear to be counter-intuitive, but the observations recorded by contemporaries are clear. This led to the "File Closer" role of the early noncommissioned officer. Stationed at the rear of the formation, with his sword (or pike) extended lengthwise, he "closed the files" and added strength to the most vulnerable location in the formation. Breaks in the rear of the formation were most likely due to the aforementioned "pyramid" effect which densely packed formations have upon the men within these formations, but with a message-bearing psychological force being the impetus, instead of a physical force. A message of impending assault passed from the front ranks (that can see the reality) to the rear ranks. The message may move like a sentence in a game of "I've Got a Secret," becoming amplified at each successive rank until the rear ranks receive a message of doom. If fear is the current, then massed formations served as excellent conduits. Which brings us forward in time to the twentieth century.

The Fading of Shock

If there has been one constant on the twentieth century battlefield since the First World War it has been the phenomena of the "empty battlefield." Today, we rarely consider during our tactical decision-making process that there might have been another way; every soldier and leader currently in service has served with this as a given. Yet the shock described up to this point relies upon a massed formation to efficiently and quickly transmit its message of terror. The implications of the modern characteristics of battle are similarly evident in the historical record. Shock faded.

Without a large body of men rapidly passing a defeatist message to each other, the classic effects of shock, though pursued, were seldom attained. Rarely in the twentieth century have entire battalions, divisions, or corps literally quit the battlefield when their reserves of courage had been expended. This is obviously not due to a lack of applied violence (force) or a greater level of courage possessed by the soldiers of this era compared to all human history. What has been missing is the ability for one soldier suffering from individual shock to pass his message of despair to a large number of other soldiers simultaneously. Dispersed, and fighting in increasingly smaller and more autonomous elements, the modern soldier's actions did not have relevance to the same number of personnel as they had previously. In those cases where troops were "shocked" and broken by the event, the troops in question were more often rear-echelon units attacked and surprised by an enemy conducting a breakthrough or deep penetration. They were not, as had been the

***"What do you suppose** the young men raised on Nintendo 64 will believe? The message conveyed by their eyes ("no enemy in sight yet" or "there is only one company attacking this platoon") or that of their "information warfare" machines ("there is an entire REGIMENT headed towards this exact location!!!")*

case earlier, front-line combat elements. This partially explains the greater significance of the "breakthrough" or "penetration" in modern tactical and operational thought. Rather, the common denominator for most apocryphal stories in this century refer to combat units that held out against improbable odds in separated pockets of resistance. The attack of the German Wehrmacht in the Ardennes in the winter of 1944 is rife with such accounts.

Anomalies occur, however, when the weapon itself is sufficient to convey the message to all that see the weapon, let alone encounter its effects. During the twentieth century, this has been the almost exclusive purview of the heavy tank in an offensive role. A single tank, unlike an entire company of infantry, is by comparison extremely visible. While the infantry relies upon the earth to serve as both protection and concealment, the tank with its massive bulk finds this much more difficult in the offense. As a result, the tank has had the potential to convey shock to ground units as has no other force. Its visible presence replicates the effects which an implacable formation of Eidgenossen might have had upon a defender. From this effect, no less than its actual ability to impart force upon the enemy, has Armor earned the sobriquet of the "Combat Arm of Decision." Fully understanding how armor affects an enemy, both physically and psychologically, what can we say about the future?

The Future of Shock

Does shock have a role to play upon the battlefield of the present and the future? For the present I would suggest that the Iraqi Army provided us a definitive answer. However, as most professionals will readily concede, the Gulf War was custom-made for the employment of United States heavy weapons and doctrine. What of those future "less than perfect" wars? How might we convey shock there? Shock will play a role in war so long as human animals continue to feel fear. Perhaps more importantly, and up until now unconsidered, how might we prevent our forces from being shocked? This last leads to one critical question to which the United States Army should devote more attention. Are we, with our new reliance and emphasis upon the "digital warrior" and total information dominance, opening ourselves to a new era of shock?

Let us review what it takes to be affected adversely by shock. First and foremost, there must be a threat. Some physical entity must be able to convey real force. This is firepower. Artillery, CAS (close air support), attack helicopters, the main gun of an M1A2, or the fires from an M60 machine gun all meet the requirements. Choosing the appropriate weapon and placing that weapon in a position where it may inflict real damage is the traditional definition of the art of war at the tactical level. These weapons are often most effective when used in combination, hence "combined arms" has been the byword of professional organizers of mass violence for several centuries. Following the impact of physical force, there must be a mental image of the attacker, some reputation which the force of the weapons being employed serves to reinforce in the mind's eye of those being attacked. This aspect has an obvious counter-force acting upon the subject, the counter being the combined elements of discipline and morale. Simply stated, there is an inverse relationship between the effectiveness of a threat upon a subject and that subject's morale/discipline**.** ***The higher the morale/discipline, the more firepower may be required to impart sufficient mental violence upon the subject to cause him to "break."*** Conversely, a defender with a low morale/discipline may require less firepower applied before he decides to quit the field of battle.

This is all very well and good, but what have these obvious statements about warfare have to do with our future?

Here, the third factor applies. In the above paragraphs, the actions and forces acting upon a single individual were considered. On the "empty battlefield" of the twentieth century, especially after the First World War, it was primarily only a single element which might be affected. Thus, more and more firepower was required to affect enough individuals in a single area so that a breakthrough might occur. The cumulative effect disappeared with the massed formations of the nineteenth century. Now, however, we are planning to place the ability to "see" the whole battlefield into the hands of every soldier in a way that they have not been able to since the nineteenth century!

Consider, in even the least visionary of these proposed technological schemes, that every soldier has at least a limited ability to "see" most of the battlefield over which his unit is operating. Graphical map displays embedded within a clear visor worn by the infantry private of the future will show the location and relative position of all of his fellow soldiers. The IVIS display which a sergeant may call upon within his M1A2 today will show to him how many friendly units remain...and how many have died. A lieutenant may examine the positions and strengths of the entire battalion task force. The Signal Corps is understandably concerned with protecting the integrity of our signal transmissions. This may become doubly important as the information conveyed by these transmissions may soon show our soldiers that they are under attack by a force ten times the reality of what faces them.

What do you suppose the young men raised on Nintendo 64 will believe? The message conveyed by their eyes ("no enemy in sight yet" or "there is only one company attacking this platoon") or that of their "information warfare" machines ("there is an entire REGIMENT headed towards this exact location!!!") These men of the future, many of them in diapers today, are growing up believing in the reality which might be displayed upon a screen by pixels of varied color. The reality of the information conveyed by icons has already been noted as a stumbling block for senior Army leaders. They were not raised on computer games, and apparently have difficulty placing their full trust in what they see on a screen. Younger leaders, raised with computers from grade-school, tend to accept the information in our new "Windows for War" digital displays more readily. In the future, computer-generated screen icons may very well define reality to these soldiers and leaders that will man the equipment we field this decade. What if those icons lie? What happens when enough icons "go dim"? Have we opened ourselves to a new era where true and massive shock might again become a tactical reality?

There is a lesson and a warning within this article which is beyond my simple ability to fathom. It may be that we have

inadvertently reopened a door once closed that will allow the most technologically gifted army in the world to react as though they were nineteenth century troops of the line. Shock is imparted by physical force, which acts upon not only the flesh but the minds of those on the receiving end. When other armies of the world follow our lead, as they inevitably will, perhaps the field might again level out. But until that day, some thought should be devoted towards blunting the effects which our own weapons of information might have upon our soldiers, leaders, and units. So far, we have identified one single factor which might counter shock; that factor is discipline. While we all admire discipline, would any that read this suggest that our current average level of discipline is equal to that of, say, the British 45th Regiment of the Line at Waterloo? More to the point, is our peacetime conception of discipline up to the wartime standards that appear when danger looms? This is one aspect of the digitization movement which we need to address. Discipline is often seen as the antithesis of individuality. What we are hoping to create with digitization is a synthetic environment which will allow all elements to act independently, yet in a coherent fashion, to create synergy of effects. Independent actions frequently require independently-minded leaders, ones that rarely fit the traditional mode of "disciplined." (Note that this does not mean that independence equals effective, merely that it is another route to effectiveness.) But with these competing forces at work in our military culture, we should be wary about the long-term effects that we might create. We do not want to find ourselves "shocked" in the future because someone has placed a bug in our computers, and we believe the icons before we believe our own eyes.

Notes

[1]*The American Heritage Dictionary*, Ed. William Morris (Boston: Houghton Mifflin Company, 1982) s.v. "Shock."

[2]C.W.C. Oman, *The Art of War in the Middle Ages*, (Oxford, U.K.: Oxford, 1885; Ithaca: Cornell University Press, 1993), 79 ; "Oath Brothers" This title for the Swiss derives from the fact that they did not swear fealty to any feudal rulers but rather to each other. Some see this as a primary motivational source for their high level of cohesion in combat.

[3]J.F. Verbruggen, *Art of Warfare in Western Europe in the Middle Ages*, Europe in the Middle Ages Selected Studies, vol.1, ed. Richard Vaughn, trans. Sumner Willard, S.C.M. Southern (Amsterdam: North-Holland Publishing Company, 1977), 60.

[4]Gunther Rothenburg, *The Art of Warfare in the Age of Napoleon*, (Bloomington: Indiana University Press, 1978) 117. It should be noted that though these formations might be described as "columns," they do not meet the modern description. They were still wider than deep, massing men across a front of up to 40 while only maintaining a depth of 12 ranks. However, 12 deep was still 4 times the norm of 3 deep in "line" formation. Also, "The Mixed Order" was a temporary solution to a specific problem of the early Napoleonic armies. There was a shortage of well trained and disciplined soldiers among the large conscript armies raised to defend early revolutionary France. To counter this shortage, the "Mixed Order" placed one regiment of trained professionals in linear formation in the center, flanked and trailed by two regiments of less well trained conscripts. The role of the "regulars" was important, as their discipline and position allowed the enemy to be "pinned." The flanking columns would then march around their base of regulars and attack in column. As Napoleon's forces became more experienced, this demi-brigade structure was abandoned.

[5]George R. Stewart, *Pickett's Charge*, (Boston: Houghton-Mifflin Company, 1959), 245-246. The "High Water Mark" was a closer thing than many realize. Opposing the charge of the Confederates at the "clump of trees" was but a single line of infantry. These Union regiments, though undamaged by the preceding cannonade, were nonetheless severely understrength. The Confederates actually for a brief period attained their objective as fierce fighting occurred at "The Angle," then something, nobody can say for sure what, motivated the 72nd Pennsylvania to countercharge. This desperate rush broke the will of the Confederates. Brutal hand-to-hand fighting occurred, men literally attempted to choke each other to death, but it lasted only seconds. Then the Confederates broke. One Sergeant Kimble stated, "For about a hundred yards I broke the land speed record." If a sergeant freely admitted this, one can guess how the lower enlisted had moved.

[6]John Keegan, *The Face of Battle*, (New York: Penguin Books, 1978), 178.

[7]*The Italian Campaign*, Ed. Robert Wallace (Alexandria, Va.: Time-Life Books, 1978), 23. In May 1943, the Italian garrison of the island fortress on Pantelleria surrendered after five weeks of continuous bombardment. This island stands between Northern Africa and Sicily; its capture was critical for the following invasion of Sicily. On 10 May 1943, British forces landed, the sole casualty was a Tommy bitten by an ass. The ass's name, rank, and unit were not recorded.

[8]The force of pike on armor = force of armor on pike. Therefore, the force applied by tip of pike = force to bring pike-bearing Eidgenossen to a stop. But over what distance (i.e.- recoil distance of armor wearing knight) or in what time? If armor cannot recoil, then let's assume pike bearing soldier must be stopped in 1 millisecond. Then acceleration (deceleration) from velocity of 3 m/sec (~9 ft/sec) to 0 m/sec in 0.001 sec = 3000 m/sec/sec and the force to stop an 80 kg Eidgenossen would be 240,000 Newtons. This is a significant force, sufficient to penetrate feudal armor. To reach that sort of deceleration, the armored knight must either be braced in place (by the mass of troops behind him most likely) or be moving forward himself. He need not move at near the same speed as the attacking Eidgenossen to develop the same kinetic energy because his increased mass (due to the armor) will compensate for his reduced speed. This is how an Eidgenossen pike point might penetrate armor. However, given the chance (or skill) to recoil with the tip of the pike over a distance of as little as 1.5 meters (approximately 1 sec required) the force is reduced at any one moment to 240 Newtons. Think of catching a football with "soft hands" versus "hard hands." These distances are easily calculated with the following formulas: F = m*a and d = 1/2*a*t*t.

[9]S.D. Rockenbach, Colonel, "Tanks in Battle of Amiens," *Infantry Journal*, Vol. XXI, No. 2: August 1922.

[10]Oman, *The Art of War in the Middle Ages*, 96. At St.-Jacob-En-Birs, a Swiss force between 1,000 and 1,500 men deliberately crossed the Birs river and assaulted a force of French troops numbering roughly 40,000! All the Swiss were killed, but not before the French lost over 2,000 of their own. This deliberate disregard for their own lives, coupled with the ferocity of their attack, convinced the French commander that further progress in his planned invasion would be suicidal. The Swiss attacking him had been merely the ADVANCE GUARD, not the main body he could later expect. The French returned to Alsace following this engagement and the Swiss reputation was sealed.

[11]Du Picq, Ardant, *Battle Studies: Ancient and Modern Battle*, trans. from French.

[12]Keegan, John, *The Face of Battle*, 174-175. Keegan provides a very short analysis of the effects of mental shock upon those soldiers in following ranks while describing the action between infantry units of the British and French at Waterloo in 1815. This two-page passage is the specific impetus which led to this article.

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Without the Proper Culture:

Why Our Army Cannot Practice Maneuver Warfare

by Major Donald E. Vandergriff

The doctrine which emerged from this perception of great lethality stressed what the French called the bataille conduite, or the "methodical battle." By this term they meant a rigidly controlled operation in which all units and weapons were carefully marshaled and then employed in combat. The French favored a step-by-step battle, with units obediently moving between phase lines and adhering to strictly scheduled timetables. Such methods, they believed, were essential for the coherent employment of the enormous amounts of men and material demanded by modern combat. A hastily prepared, impulsive fight was doomed to failure. The focus of decision-making was best kept at higher command levels, because centralized control was necessary to coordinate the actions of numerous subordinate units.

Robert Doughty,
Seeds of Disaster, p. 4-5

The U.S. Army's future doctrine, outlined in the dramatic documents, *TRADOC Pamphlet 525-5, Force XXI Operations*, and *Army Vision 2010*, envisions small, highly digitized, combined arms task forces operating over vast distances while maintaining flanks and gaps with surveillance equipment/personnel, such as satellites, sensors, and Special Operations teams. Inter-vehicular Information Systems (IVIS) and applique computer systems will establish information bridges between these well-balanced teams. This will enable *independent thinking* commanders at all levels to view their own units and the enemy in excruciating detail. They will provide U.S. forces a decided edge. *Agile* commanders will stay inside the enemy's decision cycle by controlling and shaping events throughout the entire battlefield. At our choice, we can then strike the enemy's centers of gravity with precision weapons. The writers of *525-5* and *Army 2010* state this with great confidence.[1]

There are two sides to the argument over the use of future information technology. On one side are the technocrats (hereafter known as technos); on the other, the maneuverists (let's call them the reformists). The technos theorize that they will see and control the entire battlefield with their sensors, fiber optics, and "thinking" weapons. They will take away what von Clausewitz called "friction." The big fear among many reformists — independent thinking officers and NCOs — is that this 'finger-tip' control of information will enable high-level commanders to control every action, thus stifling initiative. They feel this way because it is what they know; they and others experience similar control in today's Army bureaucracy.[2]

The reformists agree that, while advancing technology is good, we must practice maneuver warfare. We must use technology to enhance improved human factors, such as innovative doctrine and new unit organizations. They admit that technology will speed the observation-orientation-decision-action cycle (the OODA loop)[3] in the hands of experienced leaders. Many reformists maintain that the U.S. Army should practice German-style maneuver warfare, encompassing fancy terms like *Auftragstaktik* (mission tactics), *Schwerpunkt* (the point of energy or decisive action against an enemy), and *Commander's Intent* (what the commander deems decisive in form of avoiding enemy strengths and attacking his weaknesses).[4]

Most reformists fail to look beyond the intellectual ring associated with using these terms. They must study in depth the type of institution an army must have before it can even begin stating these terms in their correct cultural context. After examining the German military culture as the Germans wrote about it and practiced it daily, they will then understand why these practices cannot take place in our Army. The U.S. Army cannot exercise the type of warfare defined by the pre-World War II German Army because our Army does not possess a military culture that embraces the type of foundation needed to nurture the kinds of soldiers/leaders maneuver warfare calls for.[5]

The reformists state that the writers of *525-5* and *Army 2010* could learn much by comparing their situation today with the dilemmas facing the Germans in late 1914 through 1917 and the subsequent development of the panzer division and doctrine for its employment from 1919 to 1939.[6] In both cases, the prevailing offensive doctrine called for massive barrages preceding linear waves of infantry slogging forward to occupy what was destroyed by the artillery. These methodical sequential actions were controlled by senior officers making decisions far removed from the events taking place. Thus, by the time an actual decision was made and found its way back to the unit that was awaiting these orders, sometimes stalled in execution, events had drastically changed. When the unit finally went forward again with its now hours-old commander's orders, it did so with often disastrous results.[7]

In comparison, future brigade, division, corps, and theater commanders will have the means to gather up-to-date information regarding what is going on down at the platoon, and even crew level. There will be the ever-present temptation to control each aspect of the operation in the name of "synchronization."[8] This dilemma, in itself, though mentally and physically opposite to what the Germans were facing in World War I, can have an even more devastating effect if our current cultural trends continue. Our military culture advocates the kind of environment similar to that of the French Army between 1914-1940. This culture does not nurture the type of independence needed when the IVIS or applique bridges with "higher" fail,[9] as they will at inopportune times due to enemy action or mechanical wear and tear.

The Germans countered their dilemma by pushing tactical decision-making down to the lowest level throughout the ranks of their entire army, thus creating tactical flexibility. Ironically, this is the very same type of agility actually needed on the future high-tempo battlefield and called for by the writers of *525-5* and *Army 2010*.[10] Tomorrow's forces will be far more dispersed, smaller, and more potent. The Germans' reaction was revolutionary in concept and only came about because

they possessed a military culture which allowed change. They dramatically reversed the then-current practices in military discipline and decision-making.[11] They had already started the reversal under the reforms of Field Marshal Helmuth von Moltke during the German Wars of Unification with the introduction of *Auftragstaktik*.[12]

These changes came about through the observations of *junior* officers of a totally new concept of warfare which had evolved on the Eastern front in Russia (the Brusilov Offensive in 1916), at Riga in the Baltic States (von Hutier's seizure of Riga in 1917), and in Italy (the Caporetto offensive in 1917). Called "Hutier" or "infiltration" tactics, the new combined arms operations overcame technology, the overabundance of men and supplies of the Allies, and antiquated over-control, factors that had eliminated battlefield mobility and operational envelopment.[13]

Our current culture, in contrast, stifles subordinate decision-making. This despite technology fieldings which allow units to disperse at heretofore incredible distances to avoid precision strikes and thus often physically separates the junior leaders from their controlling superiors. Like the French doctrine developed between World War I and II, our doctrine advocates the use of massive firepower, calling for a strictly controlled battlefield outlined by detailed graphics. For example, both the divisional and corps graphics in Desert Storm, and our emphasis on teaching checklists and lock-step procedures at our branch schools and combat training centers, confirm this fact.[14]

Our peacetime military environment, which tacitly practices "zero-defects" based on our corporate "up-or-out" system, certainly reinforces the point. Officers are forced to compete with one another to continually get the right jobs and must possess courtier skills to get those right jobs to then get promoted.

Moreover, our personnel system stresses the importance of the individual, versus the institution. We have built our entire Army around an individual personnel system, versus a unit system.

These negative practices will result in defeat on tomorrow's battlefield. For example, imagine a subordinate suddenly faced with the need to act independently because his links to higher have been cut; he may not act because he has not acted autonomously in peacetime.[15] Transfer this individual example to an isolated combined arms task force or company team. The future unit possesses more firepower and mobility than we have ever seen before, power enough to change the tide of a battle or even a campaign. Instead, awaiting guidance and orders, its commander and subordinates suddenly grind to a halt instead of exploiting a fleeting opportunity presented by the enemy.[16]

Recent rotations at the National Training Center confirm these observations with numerous examples of companies and battalions coming to a complete stop in the midst of an attack. Leaders of these units and higher have become more concerned with crossing the line of departure in the right formation than moving rapidly to exploit a perceived enemy weakness. When communications are lost with higher, units stop, or when a situation changes with the enemy gaining surprise, attacks stall. We have become a checklist Army, but officers are not to blame. This is what has been expected of them in their daily dealings within the bureaucracy, habits which easily transfer to how they operate in the field.[17]

In contrast to our technological approach at solving prospective tactical problems, the victories the Germans achieved in the Spring of 1918, during their *Peace Offensive*, were not made possible by any secret weapon, but by an adoption of new combined arms tactics merged with unprecedented application of leadership and its inherent responsibilities. For the first time in World War I, the stalemate of positional warfare was broken. Their culture had been practicing the principles of *Commander's Intent*, *Schwerpunkt*, and *Auftragstaktik* as the foundation for combined arms operations for a quarter of a century prior to the First World War, so it was easy to decentralize even more.[18]

Before continuing this exploration of the of the two cultures further, we must define maneuver warfare and its three components: *Commander's Intent*, *Schwerpunkt*, and *Auftragstaktik*, to truly highlight the inability of our culture to employ these theories. While explaining each term, we must compare the way the Germans defined and practiced it to the way we attempt to define the terms in our attrition-oriented culture. The maneuver warfare army focuses on the enemy and his disruption. Instead of smashing and bludgeoning, it penetrates and infiltrates, goes around, gets behind, and isolates enemy units. If maneuver warfare is executed well, it can paralyze the enemy force, shattering its cohesion, and render it unable to keep up with rapidly unfolding events. The events that rapidly unfold are violent and deadly, inflicting desperation.[19]

Our Army has practiced maneuver warfare on occasion. In the Mexican War, Winfield Scott and a small army landed on the Mexican coast, and marched directly to the center of Mexican power, Mexico City, and captured it, ending the war. General Ulysses S. Grant was also a practitioner of maneuver warfare. He exemplified it during his campaigns against Fort Donelson, Tennessee and Vicksburg, Mississippi.[20]

But overall, our Army must practice attrition warfare. The traditions of the individualistic and anti-militaristic attitudes of the past among our society will not allow the level of professionalism required to conduct maneuver-style warfare. The attrition form of warfare, linear and French in origin, which we employed as recently as the Gulf War, relies on fire and movement, interfacing tactics with massed supporting fires. The aim of this warfare is tying in flanks and adhering to detailed graphics, while centrally controlling every aspect of the operation to be "synchronized."[21]

This form of warfare also focuses inward on checklists and procedures, versus outwardly toward an enemy's weaknesses. Our training is focused on process, versus mission accomplishment. The same occurs in our dealings with the bureaucracy. In a bureaucracy, procedures, rules, and plans become more important than the desired outcome. By employing the bureaucratic organizational model, our culture ensures that someone is accountable to someone by the use of these measurable objective standards, thus violating the very autonomy needed to practice maneuver-style warfare. In turn, this is a very comfortable setting for the bureaucratic type to succeed. Attrition style, methodical battlefields are the kind technos and bureaucrats envision. Another important factor is that attrition warfare is easier for the public to understand when it is explained on television.[22]

Several realistic factors influence our decision to adapt this simpler type of warfare. We have an inherent need to maintain close ties with the corporate side of the civilian world. This individualistic approach, enhanced by personnel policies that began, in 1946, with the results of the Doolittle Board, led to the Officer Personnel Act of 1947. That law established the primacy of the manager over the warrior. The trend continued in 1955, with the Officer Personnel Management Studies

(OPMS) and continued to the Defense Officer Personnel Act of 1980 (DOPMA), and advocated a business approach to the management and development of the officer corps (the "up-or-out" system). These policies haven't favored the kind of officer who will take the time to study and understand the complexities of warfare to the level required for employing maneuver warfare. They have reinforced the corporate organization man or the modern equivalent to the courtier.[23]

Economic reasons have also drawn us toward an attrition style of warfare. We possess and can produce enormous amounts of technology, arms, and munitions that make it easier for us to steamroll over our opponents. Technology allows us to fight "them" at a "safe" distance, leading the public to believe that wars can be fought with minimal casualties. This places extreme pressures on commanders to fight an enemy who is out of sight and mind, contrary to the risks of employing maneuver warfare, which mixes and closes with an enemy. We have come to rely, even wish, that "silver bullet" type weapons will save the day.[24]

With these factors in mind, why change, ask the technos, "Our very recent track record speaks for itself." Also, a firepower-intense doctrine is easier to teach and train to our volunteer army. Observing the linear approach to the Army's massive live-fire exercises at the NTC highlights this simplistic approach. Though maneuver warfare involves great rewards, it also takes great risks, risks that we are not willing to accept in an environment that promotes those who practice "risk aversion."[25]

With this larger cultural background in mind, let us explore maneuver warfare's first tenet, *Commander's Intent*. *Commander's Intent* is what keeps the maneuver warfare style of fighting from degenerating into a morass of disconnected little fights. Maneuver warfare is a style of fighting where a thousand independent minds are at work, instead of all waiting for the command of one centralized genius.[26] Instead of telling his subordinates how and what to do, the commander uses his intent to give them the end result desired. It emphasizes the "why," usually focusing on an enemy weakness. *Commander's Intent* involves the only rule in maneuver warfare, the need for subordinates to know the commander's intent two levels above his own.[27]

The United States Army has presented several versions of *Commander's Intent* since General William DePuy's attempt to emulate the Germans in the mid-1970s. This iteration of FM 100-5 followed our experiences in Vietnam and also reflected our observations of the results of the '73 Arab-Israeli war. Most doctrinal manuals direct that commanders write their own intent, but they rarely do so due to a lack of practice at the art of war.[28]

The present form, generated by the School of Advanced Military Studies or SAMS, is in three parts: purpose, method, and end state. First, just the organized manner speaks of its appeal to the technos' need for order. The "purpose" part is the commander repeating the mission statement or a facsimile of such. The "method," as most interpret it, is a small version of the scheme of maneuver, or how the operation is to be conducted. The "end state" is the closest component to the maneuver warfare version, but is usually stated in terms related inward, versus toward the strengths and weaknesses of the enemy.

Prior to this orderly version, *Commander's Intents* ranged from the prescribed schoolhouse length of five lines (no reason behind this decision) to as many pages as commanders felt like writing. It seemed to vary: the more egocentric the higher the commander, the longer the intent, sometimes up to two pages (the Germans found the opposite true).[29]

Closely related to the *Commander's Intent*, as a critical part of it, is the *Schwerpunkt*. The literal German translation is heavy point, but as applied in the German culture, and as our culture has failed to realize, there is no English-language equivalent. As the commander states his intent, he must also choose a *Schwerpunkt*. When the commander establishes his *Schwerpunkt* he determines the action that he believes will be decisive. The commander then assigns the *Schwerpunkt* to one of his units, and at that moment everyone else understands they must support the actions of the *Schwerpunkt*. The *Schwerpunkt* is always directed against an enemy weakness, where it is likely to succeed. If the original *Schwerpunkt* does not prove to be as successful as a supporting operation, the commander immediately shifts his *Schwerpunkt* to where success is occurring. It is decision that the commander seeks, and this likely involves risk. *Schwerpunkt* is about decision.[30]

We have taken *Schwerpunkt* to mean "main effort." We have translated it in a physical sense. When it is lined up on the graphics, it is the unit that is apportioned slightly more resources; sometimes the only difference between the unit designated the main effort and other units is that the main unit receives the priority for calling for supporting fires! The commander may never get these fires because they are normally controlled at much higher levels. The "weighted effort" or "commander's priority" is the slang used for the main effort, and it does not have the philosophical meaning that *Schwerpunkt* holds with soldiers who practice maneuver warfare. Under *Schwerpunkt*, everyone understands that they must do their utmost to support the unit designated as such, while also understanding that it may switch to them if conditions favor change (called flexibility).[31]

The final maneuver warfare tenant is *Auftragstaktik*. The Prussian Army institutionalized mission tactics *(Auftragstaktik*) in 1870, the year they decisively defeated the French.[32] *Auftragstaktik* implies decentralization, and it demands high initiative at the lowest level (as well as high levels of education and training). Even the individual rifleman is making independent decisions — deciding to bypass, deciding how to protect his buddy, finding the opportunity to sneak through enemy lines, all within the *Commander's Intent*, and with an explicit awareness of the *Schwerpunkt*. *High Tempo* is achieved in this way.[33]

We have the hardest time relating *Auftragstaktik*, or Mission Tactics, to mission accomplishment. In our culture, it is defined in physical terms, such as assigning a specific point on the ground. Or subordinates are told what form of tactics they will choose in accomplishing their mission, "TF 3-10 AR will envelop the enemy," or "TF 3-10 AR will attack down this axis frontally." Our application of mission tactics leaves little to chance to the commanders of these powerful and mobile formations. With our process, there is a small window of error for someone to fail or make a mistake, with graphics resembling an electrical schematic.[34]

Another way to present our confusion with mission tactics is our focus on the use of phone-book-thick "how-to" manuals and the focus on training formations. German manuals were short, well-written, and concise, leaving a lot to the imagination and innovation of their leaders. German storm units did not employ formations. There existed a mutual trust between each individual who employed the best method to support his fellow rifleman or squad leader, or tank and platoon leader.[35] In comparison, our individual rifleman's or tank's exact place and

specific reaction to a prescribed enemy action is the extent of mission tactics at their level.

The latter comment and trend is just as apparent as you advance to each higher tactical level. Our fictional TF 3-10 AR may assign a specific mission to each company/team, to include the route, axis (checkpoints and routes within), phase lines, and exact frontages that units will occupy in accomplishing its subordinate mission — all in the name of our translation of mission tactics. The only choice the company commander really has is the internal arrangement of his platoons and their vehicles (and even this may be limited with the use of target reference points directing exactly where to fire). Senior commanders will claim it is mission tactics! But, due to the short time leaders are in their positions, and due to our lack of unit cohesion, no other technique will suffice. If we left so much up to our subordinates, confusion and worse, fratricide, would result.[36]

There are a few other terms which must be defined when comparing the two cultures. The deceptive terms are *Time* and *Trust*. Unfortunately, they have completely different meanings to both cultures.

Time is everything in war. That is why soldiers who practice maneuver warfare do not wait for orders under the *atmosphere* of the *commander's intent*. There is no time for a commander to receive perfect information about the enemy, think, decide, and act. In maneuver warfare, soldiers think, decide, and act. The maneuver warfare commander wants to act so rapidly that everything the enemy does is irrelevant by the time he does it, because by then, the commander's units are already doing something different. Simply defined, *time* is being a step ahead. A step ahead is everything. The enemy who can never catch up in *time* feels the futility of his efforts.[37]

In our culture, *time* is divided in an organized manner. In some units, time equates to mission accomplishment. A small example equates to our every day control and management of soldiers. Instead of giving subordinate leaders and their soldiers missions to discharge, to prove themselves as worthy, to instill pride with the accomplishment of the mission relating to the end of the duty day, we hold accountability formations or make the leaders and soldiers waste time waiting for the end of the day. Holding small unit leaders to time lines, instead of mission accomplishment, also relates to the battlefield. These same leaders and soldiers will seize an objective and wait for orders, despite the opportunity to exploit their success. They will wait for orders partly because in peacetime, they had to request permission to leave early despite the successful completion of a mission. We like to relate our operations to rigid time schedules, versus in relation to the enemy. This translates to control and order in the bureaucratic world.[38]

Trust is the most important term in maneuver warfare, which depends on *trust*. If a tank company is part of a task force that is supporting the *Schwerpunkt* and suddenly reports success, but cannot get assistance out of the rest of his task force, trust now becomes the bond. Suddenly, based on numerous reports, the commander switches the *Schwerpunkt* to the successful company. Without waiting for orders, other companies move to support that company's success because it is now the *Schwerpunkt*. The other company commanders did not call to confirm with his task force commander, or question the successful company commander's request. There was trust, created in the atmosphere they operated in daily.[39]

In our culture, the "up-or-out" system and the supporting, subjective personnel evaluation system undercuts *trust*. It has created generations of officers who must compete for the right jobs to get promoted. Because officers are rated against their peers, and serve such short tours in a particular job, officers cannot afford to allow their subordinates to learn by making mistakes. Mistakes translate to less than perfect performance on highly inflated efficiency reports. We have still not learned to tell the difference between incompetence and mistakes. When subordinates are not allowed to learn through their mistakes, then they are not *bold* and *innovative*. Yet these latter traits will be needed on the future fluid battlefield.[40]

Our personnel system has focused, in the past fifty years, on promoting and fostering the career development of the individual. It is not oriented on the development and sustainment of an Army that can fight and win wars. We have succeeded in producing several generations of officers who can claim superficial knowledge of a wide range of subjects, with mastery of none of them. This has evolved and flourished due to a large number of complex factors already touched upon and some beyond the scope of this article. As long as we retain our current approach, we must continue to rely on attrition warfare, supported by high tech wonder weapons to replace critical human factors, such as unit cohesion and a deep level of experience gained by exposure to a few jobs over time.

Today, in Army professional journals, articles often appear in which officers urge the Army to adapt the German way of war. These articles highlight the maneuver warfare terms of *Commander's Intent*, *Schwerpunkt*, and *Auftragstakik*. Several heated discussions have been ignited on whether the Army practices German concepts which generate high tempo. Technos have even written rebuttals to these pleas for change, specifically using the overall German defeat in World War I and II as a shallow excuse not to adapt maneuver warfare. This is the easiest way to justify keeping things the way they are, to refuse change. They fail to address the cultural reasons for not being able to adopt maneuver warfare.[41] Technos point to the doctrine spelled out in FM 100-5, *Operations*, dated 1993, as being an effective replacement for maneuver warfare.[42] They claim, coupled with our technological edge over the rest of the world, there is little doubt that we can transition to an advanced version of attrition warfare, information warfare. The most important question they should address concerns our real ability to change for good. Stop and think a minute after reading the section on leadership in *525-5* and *Army 2010* as it applies to what they wish leaders would do on the battlefield. First ask yourself, "are these really facades for more centralized control as already exists in our daily culture? Then continue to ask if you feel they are sincere; "Does the United States Army possess and practice the culture to execute a form of warfare called for by *525-5* and *Army 2010*?" When one examines the focus on individualism and self promotion in today's military culture in order to survive, the answer is no.

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Notes

[1]U.S. Department of the Army, *TRADOC Pamphlet 525-5: Force XXI Operations* (Headquarters, U.S. Army Training and Doctrine Command, Ft. Monroe, Va., U.S. Government Printing Office, August, 1994). This dramatic document reads like the maneuver warfare handbook. Throughout the pages, the authors at TRADOC call for an innovative, and agile officer, capable of independent, innovative thought. Also see *Army Vision 2010* (U.S. Army Training and Doctrine Command, January 1997).

[2]Tim Challans, LTC, U.S. Army, "Autonomy and Leadership" *Military Review*, (Fort Leavenworth, Kan.: U.S. Command and General Staff College, Jan-Feb 1996), downloaded from the Internet.

[3]John Boyd, Colonel, U.S. Air Force, "Patterns of Conflict," excerpts from proceedings of seminar on air antitank warfare (Columbus, Ohio: Battele Columbus Laboratories Tactical Technology Center, May 1978). Colonel Boyd was revolutionary in creating the OODA loop or Orient, Observe, Decide and Act theory, based on the ability of F-86 pilots in Korea to outfly the technologically superior MiG-17. Colonel Boyd effectively translates this experience to ground warfare.

[4]William Lind, *Maneuver Warfare Handbook*, (Boulder, Colorado: Westview Press, 1985), pp. 18-23. An abbreviated, yet precise interpretation of German tactical processes translated for U.S. military use. The author attended the Amphibious Warfare School or AWS at the height of the U.S. Marine Corps' adoption of Maneuver Warfare.

[5]Lind, p.14; Cincinnatus, *Self Destruction, The Disintegration and Decay of the United States Army During the Vietnam Era*, (New York: W.W. Norton & Company, 1981), pp.131-137. Well researched and written book about the real demise of the Army in Vietnam: its corporate and individualist officer personnel policies in promotion and development.

[6]James S. Corum, *The Roots of Blitzkrieg: Hans von Seeckt and German Military Reform*, (Lawrence, Kan.: University of Kansas Press, 1992); for a thorough analysis of the German development of new doctrine, and the organizations, technology, and personnel changes required to execute the doctrine.

[7]Timothy T. Lupfer, CPT, U.S. Army, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War*, (Fort Leavenworth, Kan.: Combat Studies Institute, U.S. Command and General Staff College, 1984), pp. 4-11. An in-depth look at the German transformation from attrition-oriented tactics to infiltration tactics; Lind, pp. 9-11.

[8]James E. Sikes, LTC, U.S. Army, "Battle Command and Beyond: Leading at the Speed of Change in the 21st Century," *Parameters*, (Carlisle Barracks, Pa.: U.S. Army War College, Spring, 1995), downloaded from the Internet; Challans, "Autonomy and Leadership."

[9]Robert A. Doughty, *The Seeds of Disaster*, (Hamden, Conn.: Archon, 1985), pp. 22-31, 39, 44-53. Frightening, yet subtle comparison between the French Army and our Army today.

[10]*TRADOC Pamphlet, 525-5*, pp. 3-1 - 3-4.

[11]Michael Geyer, "German Strategy in the Age of Machine Warfare, 1914-1945," edited by Peter Paret in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, (Princeton: Princeton University Press, 1986), pp. 539-542.

[12]Hajo Holborn, "The Prusso-German School: Moltke and the Rise of the General Staff" in *Modern Strategy*, p. 296.

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[15]Challans, "Autonomy and Leadership."

[16]LTC John D. Rosenberger, U.S. Army, "Coaching the Art of Battle Command," *Military Review*, (Fort Leavenworth, Kan.: U.S. Command and General Staff College, May-June, 1996), downloaded from the Internet.

[17]LTC John D. Rosenberger, "The Burden Our Soldiers Bear: Observations of a Senior Trainer (OC)," Unpublished Paper (Carlisle: U.S. Army War College, 1 March 1995). The paper provides insight into the conflict caused by the Army's current personnel policies reflected in the performance of battalion commanders at the NTC; Vandergriff personal notes.

[18]Lupfer, pp. 12-13; 71-73.

[19]Lind, p. 24.

[20]Lind. p. 4-5.

[21]U.S. Army, *FM 100-5 Operations* (Fort Leavenworth, Kan.: U.S. Command and General Staff College, 1993), p. 2-8: "Synchronization is the arranging of activities in time and space to mass at the decisive point." There has been debate since the 1980s, when Mr. William Lind first published the Boyd Cycle or OODA Loop in the *Marine Corps Gazette*, over whether individual initiative is discouraged in order to achieve synchronization.

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[23]Dr. Donald D. Chipman, "The Military Courtier and the Illusion of Competence," *Air University Review*, (Maxwell Air Force Base, Alabama: The Air Force Air University, 1986).

[24]Harvey M. Sapolsky and Jeremy Shapiro, "Casualties, Technology, and America's Future Wars," *Parameters*, (Carlisle Barracks, Pa.: U.S. Army War College, Summer 1996), pp. 119-127. Excellent article talking about our true vulnerabilities in a war: our concerns and our society's obsession with even small numbers of casualties.

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[26]CPT Robert Bateman, "Shedding More Light on the Man in the Dark," in *Army* (Alexandria, Va.: Association of the United States Army, April 1997), p. 6.

[27]Lind, p. 13.

[28]DePuy was the force behind *FM 100-5, Operations*, dated 1976, and the 'Active Defense.'

[29]James F. Dunnigan and Raymond Macedonia, *American Reforms after Vietnam to the Gulf War and Beyond*, (New York: William Morrow and Company Inc., 1993), pp. 114-122.

[30]Lind, pp. 18-19.

[31]Dunnigan, pp. 120-121; Personal Notes of MAJ Donald E. Vandergriff. The author has extensive notes from participating in 52 rotations as an observer controller, OPFOR reconnaissance commander, BLUEFOR company commander, brigade staff and assistant to a heavy brigade commander; Lind, p. 109. Personal notes downloaded from rotation 97-07.

[32]Holborn, p. 296; Lind, p. 91.

[33]Lind, p. 13.

[34]Ibid, p. 94; Vandergriff personal notes from rotation 96-03 & 97-07.

[35]German Army, Chief of Staff of the Field Army, *Manual of Position Warfare for All Arms, Part 14 The Attack in Position Warfare*, (General Headquarters, January 1918).

[36]Jeffery N. Stowe, CPT, U.S. Army, "The Immediate Attack and the Attack of Opportunity," in *ARMOR* (Fort Knox, Ky.: U.S. Army Armor Center, March-April 1994), pp. 45-46.

[37]Lind, p. 14.

[38]Ibid, pp. 96, 124-125.

[39]Ibid, p. 80.

[40]Grandstaff, pp. 313-314.

[41]Daniel J. Hughes, "Abuses of German Military History," *Military Review*, (Fort Leavenworth, Kan.: U.S. Command and General Staff College, December 1986), pp. 67-76. Outstanding article dealing with the misinterpretations of German tactical terms in order to promote their use in our Army.

[42]*U.S. Army Field Manual 100-5, Operations* (Washington, D.C.: U.S. Government Printing Office, June 1993).

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HELLFIRE

Getting the Most from a Lethal Missile System

by Captain Adam W. Lange

At 0100 hours on 17 January 1991, eight AH-64 Apaches from the 101st Airborne Division (Air Assault) depart from a staging airfield in Western Saudi Arabia on a mission code-named "Normandy." The decisive point of the operation is the destruction of two key Iraqi radar sites located about 35 miles apart. Split into two teams of four in order to service both targets at once, both teams conduct a 90-minute, low-altitude, night-vision goggle flight into Western Iraq under strict radio listening silence. At exactly 0238 hours, the Apaches fire a volley of 27 Hellfire missiles, destroying critical targets at each radar site. Four and one-half minutes later, with the first shots of Operation Desert Storm successfully delivered, over one hundred Coalition jets begin streaking up a "blind" Iraqi air corridor approximately 20 miles wide enroute to multiple targets in Baghdad. Mission complete, the Apaches cautiously wheel around to begin their egress home, and the Persian Gulf War is on...

The mission described above is, by now, known by many to be the real-life, secretive start of Operation Desert Storm. It also provides an excellent example of the capabilities of the Army's Hellfire missile system; an extremely lethal and effective point weapon system capable of precision accuracy and destruction when properly employed. Currently, the Hellfire missile is an exclusively aviation-employed weapon system, launched by Army and Marine Corps aviation units from a variety of helicopter platforms, to include the AH-64A Apache, the AH-1W Super Cobra, the OH-58D Kiowa Warrior, and the Special Operations UH-60 variant. Why discuss an aviation weapon system in this forum, which is fundamentally dedicated to armored ground systems and training? The answer is simple. Ground maneuver commanders take note: the Hellfire missile system is your weapon system, too!

While it is true that the Hellfire missile is utilized by aviation forces conducting aviation missions, it is almost always done so in support of the *ground* maneuver commander's tactical plan. Thus, it is primarily used to achieve a desired effect for the ground maneuver commander at many levels, ranging from battalion/squadron to echelons above corps. In addition, aviation brigades will seldom, if ever, operate entirely independently of their sister units on the ground. Often, attack and armed reconnaissance aircraft are attached or OPCON to battalion- and brigade-sized units as part of an aviation task force. Our present combined arms doctrine supports this point of view, strongly emphasizing the need for close air/ground integration to exploit timely maneuver in all battlefield dimensions, and to allow for the massing of all destructive fires — both surface-to-surface and air-to-surface.[1]

Like any other battlefield weapon system which they employ, all commanders and operation planners, both air and ground, must have a basic understanding of how the system works, its capabilities, and, most importantly, its limitations. This, in turn, will help to ensure proper planning for use of the Hellfire missile as a contributor to the commander's tactical plan. That plan could very well see Hellfire-armed aircraft employed in a wide variety of missions, such as the anti-armor counterattack; in a reserve role, as part of a larger unit's deep fight against selected high value/high payoff targets; as part of a Joint Air Attack Team (JAAT); or in an engagement area in the close battle.

Missile Data and Specifications

Table 1 outlines some of the basic missile data and specifications of the Hellfire (Anti-Tank Guided Missile or AGM 114) system.

As indicated in Table 1, there are six different production models in the U.S. missile inventory, each with different design features and capabilities. These different models are:

- AGM-114A. This missile is the original design Hellfire missile with basic sub-components and a low-smoke rocket motor. It flies the highest trajectories of the six missile models.

- AGM-114B. This missile has an improved low visibility (ILV) capability; it flies lower trajectories than the AGM-114A, and contains a minimum-smoke rocket motor (less than the AGM-114A). The AGM 114-B contains a Safe and Arm Device (SAD) which provides an electrical and mechanical blockage in the rocket motor firing train, making it approved for U.S. Navy shipboard use by the Marines, as well as being compatible with Army aircraft.

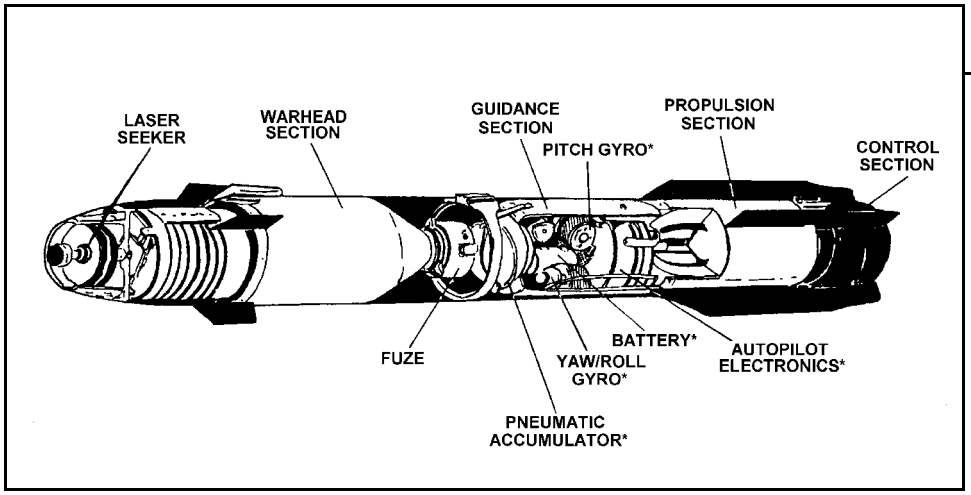

Figure 1. Hellfire Missile[5]

• AGM-114C and AGM-114F. These missiles have the same ILV capability as the AGM-114B. They fly the same lower trajectories with the same minimum smoke rocket motor, but do not contain the SAD.

• AGM-114K. This missile has the highest probability of re-acquiring a target if the missile flies into low clouds. It is the only missile produced with an internal guidance algorithm to account for this condition by design. If the missile loses laser lock after initial acquisition, the seeker section will continue to point at the target. Instead of continuing to climb and fly a normal profile, the missile is programmed to turn and point in the same direction as the seeker. This causes the missile to fly down (out of the clouds) toward the target and maximize the probability of re-acquiring the target.

• The AGM-114F and AGM-114K have an additional warhead for improved performance against reactive armor.[2]

Editor's Note: Martin Marietta Technologies is now building another version, the AGM-114L, for the Longbow Apache system. It is similar to the AGM-114K (Hellfire II) but has a millimeter wave, fire-and-forget guidance system.

Weight (each missile):	100.9 lbs (108 lbs - L Model)
Length:	64 inches (69 in. - L Model)
Diameter:	7 inches
Wingspan:	12.8 inches
Max. Velocity:	950 mph - 475m/sec - 1393 fps (1.4 mach)
Velocity required to Arm:	10 Gs (normally achieved 150-300m in front of the aircraft)
Warhead:	Copper-lined conical shape charge, High Explosive Anti-Tank (HEAT) - explosive force equivalent to 35 mach
Sub-components:	5 sections - Seeker; Warhead; Guidance; Propulsion; Control
Launch Motor:	Solid Fuel (2-3 seconds to motor burnout after launch)
Effective Range:	500m minimum range; 8000m maximum effective range
Missile Battery Life:	46 seconds +/- 2 seconds
Maximum Rate of Fire:	1 missile every two seconds
Number of models:	6; AGM-114A/B/C/F/K/L
Manufacturer(s):	Rockwell International Systems Division and Martin Marietta Inc.

Table 1. Missile Specifications

How the Hellfire Missile System Works

Originally designed for use in the anti-tank role, the Hellfire missile has also been used successfully to engage other targets as well. Point targets such as bunkers, radars, large antenna arrays and communications equipment, small buildings or towers, and even fast-moving boats can be effectively neutralized or destroyed. If needed, it can even be employed in the air-to-air role against slow-moving or hovering helicopters.

The name "Hellfire" is derived from an acronym for *Heliborne-launched, Fire and Forget*, but the name can be misleading.[3] Fire and forget gives the impression that the missile guides itself to the target autonomously without further input by the air crews after launch. This, however, is a misconception and only partially true. The Hellfire missile is a guided munition, much like the older TOW missile. It requires a coded laser beam to be placed on the target, and the missile will actually follow or "ride" the properly coded beam to the point of impact. Thus, the missile never actually acquires the target in question, but rather acquires the laser beam. The laser designator or "observer," either airborne or ground-mounted, must *always* positively control the missile after it is launched in order to bring it to bear on the target in question.

Regardless of specific model, each Hellfire missile has five basic sections or major sub-components that allow it to operate during the sequence from launch to detonation. These sub-components are: the propulsion section, laser seeker, guidance section, control section, and the warhead.

The propulsion section is located between the guidance and control section, near the aft end of the missile. It has a solid fuel propellant that burns approximately 2-3 seconds, depending on the outside air temperature. The purpose of the propulsion section is to generate enough thrust to separate the missile from the launcher, to attain the 10 Gs of thrust necessary for arming the missile, and powering it to the target. The relatively short burn time is more than sufficient to allow the missile to reach its maximum effective range of 8 kilometers. In fact, the missile is capable of destroying targets beyond 8 kilometers, but the overall probability of hit ratio (P^h) decreases as distance increases.

Located in the nose of the missile, the laser seeker is programmed from inside the aircraft to receive a specific laser code. When the missile recognizes this code being emitted from a designator and reflected off of the target, it "locks on" to this emission. After lock-on, the seeker then sends this information to the guidance section which directs the missile to the target. After receiving information from the laser seeker, the "brains of the missile," or guidance section, computes steering command data to stabilize the missile and then transmits this data to the control section.

The control section, located at the very aft end of the missile, contains a pneumatic actuation system that converts steering commands into mechanical fin movement. It is this fin movement that

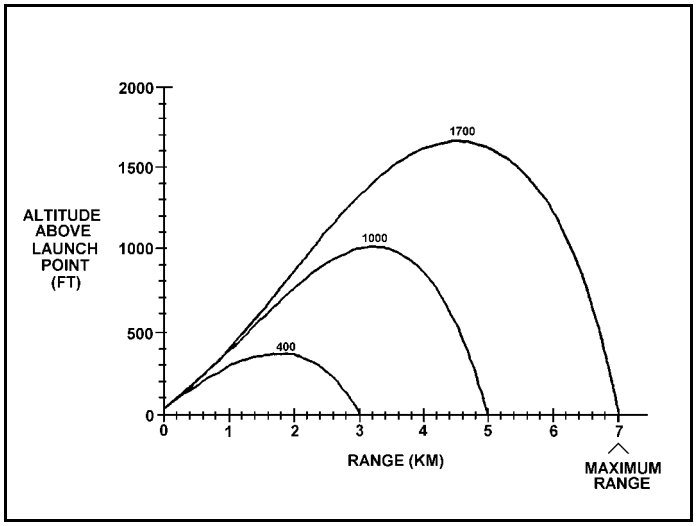

Figure 2. LOBL Trajectories (AGM-114A)[6]

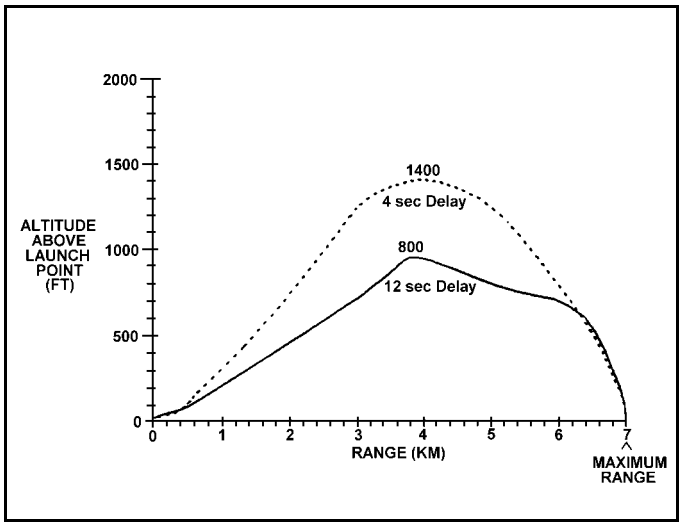

Figure 3. LOAL-DIR Trajectories (AGM-114A)[7]

directs air flow over the missile much like the wings on an airplane, allowing the missile to turn and maneuver toward the reflected laser energy of the target.

The warhead is the last section to contribute to the firing sequence. Upon collision with the target, an impact sensor sends an electrical signal to a fuse in the rear of a copper-lined shape charge, causing detonation. This charge provides the explosive and penetrating force necessary to defeat the armor of a tank or destroy "softer" targets. Only the AGM-114F/K/L models, however, possess the additional ability to defeat modern reactive armor systems.[4] Figure 1 shows a cutaway of the basic Hellfire missile and its sub-components.

Methods of Employment and Planning Considerations

There are different techniques for tactical employment of the Hellfire missile on the battlefield. These techniques are ultimately driven by the two engagement methods by which the missile can be controlled to the target: autonomous and remote. An autonomous engagement requires the aircraft launching the missile to guide it all the way to the target after the missile is away. In this method, a single aircraft and its crew will locate, identify, fire, and guide the missile until destruction of the target in the same way an M2/M3 Bradley crew employs its TOW missiles. In contrast, a remote engagement requires an aircraft to serve as a launch platform, providing a missile for another aircraft or a ground observer, designating with a laser, to guide the missile to its intended target. A ground designation station such as an FO or Combat Observation Lasing Team (COLT) accomplishes this with lasing devices like the G/VLLD or MULE. With a remote engagement, the air crew is responsible only for delivering the missile toward the general location of the target, but is no longer responsible for its guidance once it leaves the external launch rails. This allows remote engagements to provide one distinct advantage over autonomous engagements. *Using this technique, the launch aircraft is often able to remain masked behind terrain, greatly reducing its visible launch signature while delivering missiles toward the target array, thereby increasing aircraft survivability - a force protection consideration.*

Remote engagements, however, require a great deal more coordination and planning between the "shooter" and the "observer." This is especially true when aircraft and ground designators, such as the COLTs, are working together. Unimpeded radio communication and information transfer between these elements are a must for successful target destruction and to reduce the risk of fratricide. Ground commanders and operations planners wishing to utilize Hellfire missiles in this manner must be aware of this prerequisite. They must closely coordinate with supporting aviation units for the location of pre-planned aerial battle positions/attack-by-fire positions and ground remote designation positions/observation points to support this air and ground interaction. *On combined arms battlefields with limited terrain for both cover and concealment or observation/fields of fire, this can have serious planning implications concerning land management and clearance of fires.*

In addition to the two methods of engagement, there are four modes of *delivery* that aircrews can utilize when firing the Hellfire missile. These delivery modes are important to consider because they are driven by three important factors: distance to the target, the weather (primarily visibility and cloud ceiling height), and terrain conditions under which the missile will be fired. These conditions will always require careful planning consideration when attempting to integrate air and ground fires into the tactical plan because they affect the relative trajectories of Hellfire missiles when fired. Higher trajectories can have serious ramifications if an attack mission is planned or executed during a period of marginal weather with low cloud ceilings, especially if conducted at maximum standoff ranges. The reason for this revolves around the laser guidance system employed by the missile. *As a general rule of thumb, when a Hellfire missile flies through obscuration (fog, clouds, smoke) or if the designator fails to lase the target properly until impact, the missile loses laser lock and will be lost for good. It will not regain sight of the target, even if designated again.* As previously mentioned, only one model of Hellfire missile, the AGM-114K, has a built-in system to assist in the reacquisition of the target after laser lock-on is lost, but these missiles have yet to be produced and distributed in quantities large enough to ensure that this problem would not be a factor. The AGM-114L when fielded will, however, provide a true fire-and-forget capability.

The first delivery mode is known as the Lock-on Before Launch (LOBL) technique. In this mode, the missile laser seeker acquires and locks-on to the coded laser energy reflected from the target prior to launch. The advantage to using this particular delivery mode is that the air crew is assured that the missile has already positively locked on to the target prior to launch from the aircraft, thereby increasing its P^h and reducing the possibility of a lost or uncontrolled missile. The disadvantages of a

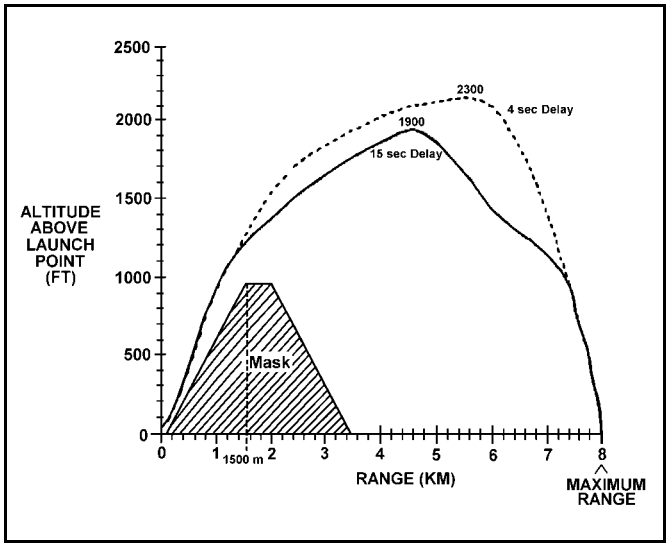

Figure 4. LOAL-HI Trajectories (AGM 114-A)[8]

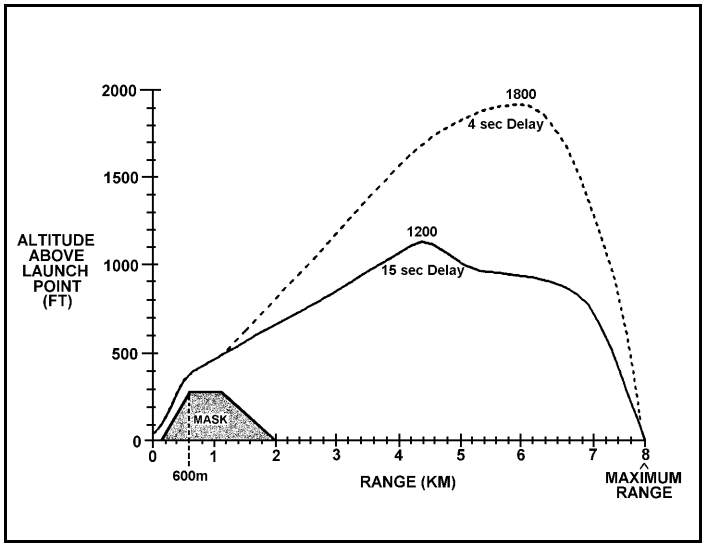

Figure 5. LOAL-LO Trajectories (AGM 114-A)[9]

LOBL delivery revolve around the trajectory of the Hellfire missile as it streaks toward its target. LOBL engagements cause the missile to fly the second highest trajectories of all delivery modes, and the altitude the missile reaches is a function of distance to the target. Simply put, in LOBL mode, the farther the target, the higher the missile flies. Figure 2 shows examples of the maximum trajectories of an AGM-114A missile during different engagement ranges. As the graph in Figure 2 depicts, the missile will reach a maximum altitude above launch point of 1700 meters at its maximum effective range of 7 kilometers. This altitude can be decreased only if the distance between the launch aircraft and the target is reduced. Thus, to compensate for a low cloud ceiling, an aircraft may need to expose itself to threat weapons ranges in order to ensure a successful engagement.

One method to reduce the maximum altitude of the Hellfire's flight trajectory is to select the Lock-on After Launch - Direct (LOAL-DIR) delivery mode. This delivery mode results in the lowest of all trajectories during missile flight because it is employed using a laser designation delay. In this particular mode, the aircraft launches a missile toward the direction of the target before it is designated by a laser. As a result, the missile travels "blind" initially. It will climb slightly, but remain relatively low until the laser is activated after a pre-determined time. Once the missile acquires reflected laser energy, it pitches up to achieve an optimum dive angle at the target. Overall, depending on the length of laser delay time, the maximum altitude reached during the flight trajectory is much lower; a distinct advantage over all other delivery modes. Figure 3 depicts the lower trajectories that may be achieved using LOAL-DIR. A 12-second designation delay would cause the missile to reach its apex at only 800 feet when fired at a maximum engagement range of 7 kilometers. The downside to this method, however, is that air crew is not assured of positive lock-on prior to launch. In addition, if the laser designation delay is too long, the air crew runs the risk that the missile may never actually acquire the reflected energy or that it may lack the maneuver distance and time required to impact on the target. Thus, overall P^h may be reduced.

The last two delivery modes are unique in that they allow the launch aircraft to remain masked behind terrain to reduce its firing signature and increase aircraft survivability. These delivery modes are known as Lock-on After Launch - High (LOAL-HI) and Lock-on After Launch - Low (LOAL-LO). The first mode, LOAL-HI, allows the missile to clear a 1,000 ft. high terrain feature to front of the aircraft, provided the aircraft remains a minimum of 1500 meters away from that terrain feature. In addition, the maximum effective range of the Hellfire is increased to 8 kilometers using this method. This technique is most effective in a remote engagement. The major disadvantage of employing the LOAL-HI method, however, is that the missile flies the highest trajectory of all delivery modes and is most susceptible to a break in missile lock due to penetration of low-lying clouds. Therefore, it requires the fairest of weather conditions to ensure target destruction. As with the LOAL-DIR mode, a laser designation delay can help to lower maximum altitude attained to some degree. Figure 4 depicts typical trajectories achieved at the maximum effective range.

Using the last delivery mode, LOAL-LO, will help to reduce the maximum altitude of the Hellfire trajectory somewhat, but will also limit the size of the terrain mask utilized by the aircraft for survivability. Employing this technique, the missile is able to clear a 260 ft. high terrain feature to the front of the aircraft as long as the aircraft maintains a minimum of 600 meters standoff distance. Maximum effective range of the Hellfire is again extended to 8 kilometers using this technique. Figure 5 depicts the nominal trajectories attained by engagements using this delivery method.

Limitations of Lasers

As previously mentioned, positive and precise laser guidance of the Hellfire missile until impact is absolutely essential to the probability of hit and target destruction. Like the missile itself, the laser energy used to designate the target is also susceptible to factors of terrain, weather, and distance. Again, these factors must be adequately planned for prior to execution whenever possible to ensure successful target destruction. In particular, five conditions of laser designation or *negative illumination factors* must be taken into consideration and compensated for. These conditions may be present regardless of whether the designation is performed from an aerial platform or a ground-based system. The five negative illumination factors are: beam divergence, attenuation, backscatter, overspill, and underspill.[10]

Beam divergence is a phenomenon that occurs with all directed light energy, but it varies amongst different types of laser designators. Beam divergence is the ever-increasing width of a beam of light

from its point of emission to its point of termination. Thus, the general rule of thumb: *the farther the laser designator is from the target, the wider its beam becomes over distance and the wider the resultant spot on the target.* In and of itself, beam divergence does cause a negative illumination of the target, but when combined with certain terrain and weather conditions it gives rise to the other four negative illumination factors, especially over extended ranges.

Attenuation is the overall weakening of the laser beam as it gets wider. This occurs because the concentrated laser energy is diffused as the beam gets wider over distance. In this situation, portions of the beam become "scattered" by airborne particles such as dust and water vapor. These particles absorb or diffract laser energy along the way to the intended target. *Excessive amounts of airborne particles may result in severe attenuation and cause the seeker of the missile not to detect reflected energy from the target*. Conditions that tend to exacerbate attenuation are extended-range engagements planned during periods of rain, fog, and snow. Engagement areas, aerial battle positions, or designation points planned in excessively dusty environments or the presence of battlefield obscurants such as smoke will also contribute to attenuation.

A similar phenomenon occurs due to backscatter. Backscatter is defined as the portion of the laser energy that is "scattered back" or reflected in the direction of the missile by an obscurant. *The result is that backscatter energy competes with reflected target energy and the laser seeker of the missile may lock onto the obscurant instead of the target*. Consequently, a missile may lock-on to a smoke or dust cloud between the target and the designator if it receives a stronger reflection of coded laser energy from this source. Again, careful consideration of the location of laser designators and aerial battle positions in addition to methods of fire distribution and control are needed to reduce the overall effects of backscatter.

Overspill and underspill are products of beam divergence and attenuation, but *are most severe at long designation distances*. Overspill is caused when a portion of the laser spot spills over the top of the target, causing variable portions of the laser beam to pass beyond the target. If a target is engaged from too far away, much of the laser energy may be spilled over onto objects or terrain beyond it, creating intermittent false targets for the missile to hit, instead of the intended mark. With underspill, the opposite is true. At the same extended ranges, the laser spot hits low on the target causing false targets to be illuminated short of the intended mark. As a result, the missile may then hit short without effect.

Beam divergence, attenuation, backscatter, overspill, and underspill are all negative illumination factors that must be understood by everyone, but can only be compensated for by the designators actually executing the mission. Therefore, *mission planners must set the conditions for success by limiting engagement ranges to distances that correspond to maximum effective ranges, and by implementing measures to reduce the negative factors of terrain and weather*. Tactical plans involving air/ground integration and the use of Hellfire missiles must take these factors into consideration to ensure mission success.

Applications for the Future

So what does any of this information mean to the ground maneuver commander or S3/S3 Air? Commanders and their planners who understand the system will be able to effectively employ it to meet their tactical needs. The scope of this article is not to downplay the effectiveness of the Hellfire missile system. Much to the contrary, the Hellfire remains one of the most effective and lethal weapons on the battlefield today, and will continue to perform in this capacity far into the future. At a unit cost of less than $40,000, it allows friendly forces to destroy an enemy tank worth millions from a distance unparalleled by any other direct fire weapon system.[11] Married to the modern aerial platforms utilized by highly mobile and flexible aviation forces, it provides the ground commander with an excellent means of destroying HVTs/HPTs at times and places of his choosing. Synchronizing its lethal effects with other battlefield weapon systems will allow the commander to mass fires and overwhelm would-be enemy forces, defeating their ability and will to fight. However, not unlike any other weapon system used today, it does have its limitations.

You must plan around these limitations in order to achieve positive tactical results. The Hellfire is quite different from other direct fire weapons; just seeing a target within range *does not* necessarily mean that it can be hit. Additionally, it cannot be stressed enough that thorough and careful planning are essential when selecting aerial battle positions or engagement area locations. When pre-planning JAATs or the use of attached/OPCON attack aviation assets in the ground tactical plan, look closely at forecasted weather minimums for the time period in question. Commanders will want to weigh heavily the odds of successful long-range Hellfire engagements during marginal weather conditions. A combination of low ceilings, low visibility, and extended engagement ranges may result in low probability of hit/probability of kill ratios. The terrain in which the system is to be employed must also be considered. The presence of extensive battlefield obscurants like dust, fog, and smoke could seriously degrade the effectiveness of laser designation systems. Very quickly, a well-planned counterattack against massed enemy armor by a commander's aviation reserve element could turn disastrous if the conditions do not permit the use of Hellfire missiles, potentially jeopardizing the battle plan. In some cases, decreasing the engagement range will help assist in lowering the flight trajectories of Hellfire missiles, but may, in turn, sufficiently decrease the standoff range and/or limit the terrain available for cover and concealment, thereby exposing the aircraft to threat weapon systems. This decision must be thought through carefully. Task Force Normandy's preemptive strike on Iraqi radar sites to start the Persian Gulf War might have met with terrible results if the limitations of the Hellfire missile system had not been adequately considered, potentially resulting in a loss of many Coalition aircraft.

Finally, understanding that aviation forces are the primary proponent of the Hellfire missile system, these units are not to be relinquished of the responsibility to coordinate and conduct parallel planning with the ground maneuver forces that they are integrated with. Ultimately, it is the aviation unit that must keep the ground commander informed of what his unit can or cannot achieve. The best means to achieve successful integration of air and ground assets is to incorporate knowledgeable aviation liaison officers early into the ground unit's planning process to ensure that proper conditions are set to support the ground ma-

neuver tactical plan with Hellfire systems. With a commitment to do this, both air and ground forces will enjoy considerable success on the modern combined arms battlefield. *Target identified, laser on, missile away...*

Notes

[1]U.S. Department of the Army, *Operations*, Field Manual 100-5, (Washington, D.C.: U.S. Government Printing Office, 1993), pp. 2-2 thru 2-10.

[2]U.S. Army Aviation Center, *OH-58D Hellfire Missile System*, Student Handout 4A/H/L/W-5563-4, (Fort Rucker, Ala.: Aviation Training Brigade, 1995), pp. 56-57

[3]*Jane's Weapon Systems 1986-1987*, (New York, N.Y.: Jane's Publishing Inc., 1987), p. 193.

[4]U.S. Army Aviation Center, *OH-58D Hellfire Missile System*, Student Handout 4A/H/L/W-5563-4, p. 58.

[5]U.S. Army Aviation Center, *Helicopter Gunnery*, Training Circular 1-140, (Washington, D.C.: U.S. Government Printing Office, 1991), p. 6-30.

[6]U.S. Army Aviation Center, *Hellfire Missile System*, Student Handout 15-6443-6, (Fort Rucker, Ala.: Aviation Training Brigade, 1996), p. A-2.

[7]U.S. Army Aviation Center, *Hellfire Missile System*, Student Handout 15-6443-6, p. A-2.

[8]*Ibid.*, p. A-4.

[9]*Ibid.*, p. A-3.

[10]U.S. Army Aviation Center, *OH-58D Hellfire Missile System*, Student Handout 4A/H/L/W-5563-4, pp. 97-98.

[11]Headquarters, U.S. Army Armament, Munitions, and Chemical Command, *Ammunition Book Complete*, (Rock Island, Ill.: HQ, U.S. Army Armament, Munitions, and Chemical Command, 1994), p. 524.

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Training Smart With Resources Available

by Sergeant First Class Edward W. Seaman

The Army's principle of "Soldiers are our credentials" again rang true in the success of the 2-172 Armor Battalion, Vermont Army National Guard Annual Training (AT) FY97. Between 13-27 September 1997, a very important event with long-reaching effects was unfolding at Fort Knox, Ky. The battalion leadership had a well thought-out and tested plan for the train-up and execution of TT XII.

In FY96, the sister battalion, 1-172 Armor Battalion, had four platoons execute TT XII with all four qualifying. Utilizing that knowledge and lessons learned, 2-172 Armor Battalion began their own Inactive Duty Training (IDT) gunnery program. The units established a sound, executable M-COFT schedule/rotation (Sep-May) for IDT. Crews then received a detailed AAR on their performance.

The battalion crews that had already qualified TT VIII utilized the following M-COFT strategy for sustainment. Each crew executed Normal Matrix Groups 2, 3, and Special Purpose exercise "Killer Tank" for one hour.

In April, the unit integrated the Virtual Training Program into their IDT training. This provided the unit with structured, task-based training which allowed each platoon the ability to execute platoon fire and maneuver during IDT. The Observer/Controller (O/C) teams provided structured AARs for each platoon. The platoons also utilized during IDT the Platoon Gunnery Trainer (PGT) and U-COFTs at Fort Knox. This allowed the platoon leader to practice his platoon fire commands and distribute platoon fires. The platoon sergeant was also able to send the required reports forward.

TT VIII qualification was conducted at Fort Drum, N.Y., during IDT. This was conducted on 20-22 June for C/2-172 and A/2-172 with 11 crews qualifying and 27-29 Jun for D/2-172 and B/2-172 with 14 crews qualifying. The "Roll on/Roll off" range concept was supported by elements of battalion and brigade staff.

The battalion advance party for AT arrived at Fort Knox on 10 Sep 97. The unit provided several of its own wheeled vehicles. The remainder were drawn from the KYARNG Mobilization and Training Equipment Site (MATES) on Fort Knox and/or from local KYARNG units. On 13 Sep 97, the main body arrived at Godman Army Airfield aboard C-130 Air National Guard aircraft from the states of Illinois, Missouri, and West Virginia. Twenty M1 tanks were drawn and moved to Boydston range by the 233rd Heavy Truck Company (HET) from Fort Knox. On 15 Sep 97, O/C teams from the 3rd Regional Training Brigade at Fort Knox aligned with the platoons that they would be evaluating on TT XII and occupied assembly areas in TA-2 and 3. While a platoon was conducting its TT XI on Yano Range, the other platoon was conducting assembly area exercises, waiting to move to Yano Range. The remaining two platoons utilized the PGT in Hill Hall. On the following day, the platoons rotated. Yano Range TT XII target presentation and sequence was confirmed by the 3rd RTB Armor Battalion master gunner. Each platoon was allowed two TT XI runs (day and night).

On the morning of 20 Sep 97, four platoons of 2-172 Armor Battalion executed TT XII and completed in the early morning hours of 22 Sep 97. The 3rd RTB evaluated and provided detailed AAR after each TT XI run. The 3rd RTB confirmed computer hits by counting holes in targets. The results are as follows.

Unit	Gunnery Score	Tactical Score	Total
1/A	79.6	96.4	88 (Q)
1/B	68.3 (U)	76.0	72 (U)
1/C	81.7	89.2	85 (Q)
1/D	71.6	89.2	80 (Q)

As an ARNG divisional unit, the 2-172 Armor Battalion maximized the available opportunities of live, virtual, and constructive simulation training. This resulted in a higher operational readiness and clearly proved Fort Knox is "The East Coast Hub For Simulation Training."

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M1A2: One Year Later

Photo: CPT Wade McVey

by Captain John Basso

My objective in this article is to both demonstrate the need to alter how we train the M1A2, and to recommend new ways to train M1A2 units. I've based specific examples of why we need to change how we train the M1A2 on a supposition that I will not address in any detail — that the M1A2 is a *very* different tank than the M1A1. More importantly, I will discuss specific ways to improve how we currently train with the M1A2. As necessary corollaries to this main theme, I'll first detail M1A2 manning and maintenance challenges prior to my discussion of training.

Manning:

M1A2 units face many of the same crew turbulence challenges that their brother M1A1 units face. The requirement for all M1A2 crew members to have the "K4" identifier, though, drastically exacerbates these problems. Soldiers earn the identifier after completing Operator New Equipment Training (OPNET). Such training, typically conducted for the Certification Course (TC^3) at Fort Knox, requires a soldier to be sent TDY. An additional option is a home-station mini-OPNET if a soldier arrives at an M1A2 battalion after that battalion has completed its initial unit level OPNET. This final method's primary shortcoming is that it keeps a soldier away from his unit for two weeks during what is often a critical "get-to-know-the-unit" period. What soldiers cannot do is simply go through "on the job training." The complexity of this schooling issue has grown exponentially as numerous K4-qualified soldiers PCS to Korea, AC/RC, recruiting, and other assignments; there is no stabilization policy. (Of course, in return, we gain inbound soldiers; unfortunately, very few of them are K4-qualified.)

Current solutions to this lack of stability include tying internal battalion and company moves to gunnery train-up periods, and corps and division pinpointing incoming K4-qualified soldiers to assignments in M1A2 battalions.

Likewise, M1A2-qualified mechanics require Mechanic New Equipment Training (OMNET), and similar manning problems naturally occur. M1A2-qualified communications specialists are a separate problem, as there is no program to initially train these soldiers on the VIC-3 intercom or the digital communications infrastructure of the tank.

Recognizing the skills necessary to fight the M1A2 tank only magnifies the complexity of these manning moves. This tank is more like an F-16 than an M1A1 and, just as pilots require consistent flight time to remain current, M1A2 tank crewmen require regular and redundant training on the many systems in the tank. The home station down training, designed to re-familiarize our soldiers with the M1A1, that accompanies our regular rotations to Kuwait and NTC, reduces our opportunities for this redundant training. Quite obviously, it follows, then, that training on M1A1s in Kuwait and NTC — the two sites where our best field training occurs — degrades our ability to learn how to fight the M1A2.

Maintenance:

The M1A2's maintenance system is more reliable, user-friendly, and deployable than the M1A1. The tank's improved reliability is a function of redundant, common Line Replaceable Units (LRUs) [For example, the Hull Electronics Unit (HEU) and the Turret Electronics Unit (TEU) can take over functions from each other in the case of a component failure], computer-driven start-up and shut-down sequences (shut-down requires the driver to override the system if he does not want to wait two minutes prior to shut-down), prominently displayed cautions and warnings, and the excellent fault management system. Improvements in ease of use and deployability are in many ways linked to the elimination of STE-M1 as the primary diagnostic tool. The Built-In Test (BIT) and Fault Isolate Test (FIT) are very user-friendly, as is the gunner's computer-driven self-test. The BIT and FIT, both contained within the tank, eliminate the need for STE-M1, which was both cumbersome and difficult to maintain in its own right.

Maintenance on the M1A2 does challenge the crew and the battalion's and company's maintenance managers in many ways. Of greatest concern is the availability of LRUs, demand-supported

PLL, and what we call the "PPI mentality" or "re-booting the tank" (PPI = Prime Power Interrupt). Lack of available LRUs, a natural outgrowth of the small number of M1A2s fielded, has increased down time on a tank designed to be repaired through replacing LRUs. Initial PLL demand history is generally non-existent for the M1A2. With limited OPTEMPO resulting in an insufficient exercising of the tank, and the strenuous ULLS demand "hits" requirement to carry a part on PLL, we've had a difficult time building a usable PLL in the first year. Units should consider restructuring how they input into the ULLS, in order to base demand on a 58 tank fleet instead of the 14 tanks on which demand is currently based. Units should further examine how they requisition parts (to maximize "hits" on ULLS, input a quantity of one for each widget ordered, and continue to order on separate document numbers until you've ordered the required number of widgets). Taught during OPNET and executed regularly by crews, "re-booting" the tank, or "PPI-ing" it, works around a suspected software or hardware fault and allows the M1A2 to remain in the fight. Because of the M1A2's redundant systems, the tank itself will often find a way around a fault when re-started. Unfortunately, this does not mean that the fault is corrected; it is simply circumvented for short term gain. Eventually, this mentality can lead to extended down-time when the back-up component also breaks. An additional maintenance challenge has followed each M1A2 modification. Invariably, there's a considerable delay between each modification and the subsequent arrival of the publication necessary for maintaining the new equipment. Without the current publication, the crews and mechanics are often "fighting blind" when it comes to diagnosing a new fault.

Overview:

The M1A2 brings a new dimension to the battlefield. The tank has revolutionary improvements in lethality, situational awareness, and maintainability.

The improvement in lethality is primarily a function of the M1A2's faster target acquisition times, due to the tank's "hunter-killer"-capable Commander's Independent Thermal Viewer (CITV). The CITV, controlled by the Commander's Control Handle Assembly (CCHA), allows for independent scanning and a sight picture displayed on the Commander's Integrated Display (CID). The CCHA has a "designate" button which slews the turret from the gunner's current sight picture to the target the commander has identified. The CITV picture is excellent in both narrow and wide field of view.

The M1A2's drastic improvement in situational awareness comes primarily from the Intervehicular Information System (IVIS), which indicates to crew members where they are on the ground, where friendly forces are in relation to them, and where enemy forces have been identified. IVIS provides the commander his current position (through the tank's POSNAV system), along with icons, representing friendly vehicles, on a blank, gridded screen. The IVIS screen on the CID can also display, send, and receive overlays and pre-formatted reports, and will also display an icon representing an enemy contact (with a grid) when the gunner lases a target.

The gunner's and driver's displays can access IVIS information. The Driver's Integrated Display (DID) can also receive up to 99 "way points" from the commander. Combined with a compass — which the driver can change to a "Steer-To" indicator to take him to the commander's way points — the DID and a trained driver can give the tank commander more time to fight his tank, platoon, or company. The TC, gunner, and driver all have improved situational awareness of the tank's operating status through digital cautions and warnings.

The M1A2's maintainability improvements are generated, in part, by an operator- and a unit-level diagnostic system. The crew uses the Built-In Test (BIT) to diagnose faults at crew level. Mechanics use the Fault Isolate Test (FIT) much as the STE-M1 was used. The FIT test, however, is far easier to use than STE, and — since it is a part of the tank — is obviously far less cumbersome than the large, often-broken STE kit with its many pieces.

The gunner also has a Self Test (ST) to run from his GCDP as part of prep-to-fire tests. All three diagnostic tools can be run from the tank commander's, gunner's, or driver's position, and all three are very easy to run.

Training:

Let me begin this section by saying that the M1A2 tank is a "revolutionary" system. Our challenge is how to maximize the incredible potential of this tank. M1A2 company commanders now must think in concrete terms about three issues in particular: a training strategy that addresses a new brand of lethality, drastic on-tank changes in gaining situational awareness, and a maintenance diagnostics system (discussed earlier) that involves the crew and the mechanics. I'll first detail the effectiveness of our current lethality (gunnery) training program, and then depict how we are trying to employ the tank's situational awareness systems. We've never had a tank with true situational awareness capabilities, so I will not focus on our current training program for IVIS, but rather what equipment and procedures are and are not working for us on the tank. (One IVIS training note: to learn IVIS, a unit must work with it every time it trains on the tank. Similar to how we train frequency hopping on the SINCGARS radio, we've found that adding an IVIS element to every event is our best training solution.) As a conclusion to each of these two sections, I'll also postulate on how to improve training or equipment in each area. Because any new strategies must flourish in an environment structured by less OPTEMPO, greater training costs, smaller maneuver areas for a vehicle that has a greater requirement for space, and reduced STRAC, I will also cover Training Aids, Devices, Simulations, and Simulators (TADSS) usage — the Army's primary tool to neutralize these training constraints — in a separate section prior to my final thoughts on future training. The bottom line is that the M1A2 company commander must use greater imagination and innovation to maintain a band of excellence over a wider spectrum of tank capabilities — he has to challenge the M1A2 crew and tank every training day of the year. I've encapsulated most of my major recommendations in a concluding section titled "Thoughts on Future Training."

Lethality. The M1A2 initial training year begins with OPNET and the subsequent OPNET gunnery. The OPNET program introduces the crew to the tank, but definitely does not teach the crew how to fight the tank. You leave OPNET knowledgeable on the M1A2's systems, but you have a lot of room to grow. On the other hand, OPNET gunnery truly challenges the M1A2 crew. The key to M1A2 gunnery train-up is a strategy that implements TADSS early to overcome a significant learning curve between the tank commander and the gunner. Though the Advanced Gunnery Training Simulator (AGTS) is not part of OPNET, we borrowed our fellow battalions' systems, and made extensive use of this excellent simulator "after hours." There was a clear correlation between high gunnery scores and the amount of time crews had spent in AGTS. Table IV was our next focus. We made this "gate" table a more difficult test by requiring TWGSS qualification and firing two additional small arms live-fire engagements. These key moves allowed us to replicate TT VIII conditions (which TT VII does not adequately do) without using precious 120mm bullets. TT VIII itself is an excellent test as its three and four target engagements are presented across the breadth of our largest crew qualification range. The table includes delayed presents which, coupled with the dispersion of the targets, requires the tank crew to use the "hunter-killer" system.

M1A2 gunnery, though, is not without its faults. It is still focused on a "marksmanship" mentality which fails to challenge the entire crew and train all the systems on this tank. TT VIII does not force any kind of TC-driver interface with respect to POSNAV-IVIS and the DID. Gunnery in no way requires the driver to navigate by TC-inputted waypoints while choosing terrain suitable for protecting his tank. Target acquisition — the most difficult piece of the "Red Zone" fight — is not realistically tested by our target arrays and the large plywood presents (I recommend initial presents of vehicle antennas, glint off of enemy binos, etc). As you can see, we are not fully challenging a crew's ability to employ the IVIS.

Battle Command and Situational Awareness. The M1A2 has transformed a unit's ability to maintain situational awareness during maneuver. The POSNAV-IVIS driver/tank commander interface allows our tank commanders, platoon leaders, and company commanders greater freedom to command their unit. By following the TC's way points, a trained driver can effectively maneuver his tank to where the TC wants it, using appropriate terrain. Combined with the VIC-3 programmable intercom system, which allows a tank commander to share "listening" duties for different nets among his crew at different times, the commander is now less apt to be sucked into the immediate fight (fighting his tank only). By properly employing the M1A2's situational awareness capability, then, the commander can plan his unit's next move in the fight in order to determine a course of action that will force the enemy to react to him, instead of vice-versa. IVIS should allow the commander to complete this process of battle command by easing his ability to rapidly relay his thoughts via digital traffic. The IVIS 286-like processor, however, is far too slow to allow a commander to send his instructions, even if the IVIS system were user-friendly enough to let him rapidly compile his FRAGO. Instead, the M1A2 unit in contact remains an FM communications-controlled beast. **IVIS is a 286-like system in a Pentium-like tank.**

An additional element of the IVIS's ability to communicate information is its capability to provide greater fidelity in spot reports and calls for fire. Currently we cannot train this process because it requires the tank's laser to be active. With no eye-safe laser rangefinder, our ability to fully employ the system during force-on-force maneuver training is crippled. The task force's ability to command and control its M1A2 companies is reduced to the battalion commander's and battalion S3's tank, as we have no IVIS Ground Station (IGS) at battalion level. This keeps TF command and control nodes from being able to participate in M1A2 FCX-type events. As mentioned earlier, the IVIS is cumbersome to use. Constant practice is an absolute requirement to stay current on this system. A "Windows-based," simplified program would drastically reduce the learning curve and make IVIS far more effective in "pressure" situations.

Prior to this change, we can increase our day-to-day ability to train on the M1A2's battle command and situational awareness systems by incorporating the Crew Station Trainers (CSTs) into our company training plans. We currently use the CSTs only during OPNET. Five CSTs fielded to each M1A2 battalion would allow excellent platoon-level IVIS training. Company and TF leadership "IVIS-EXs" could also be run on five CSTs. The cost, speed, and cross-training value justify this need.

Finally, the TC could more easily overcome this "challenge" of managing information if he could transition with less difficulty from the "up" position in his hatch to the "down" position. Currently, it is a struggle to reorient the CITV display on the CID to a target he may have acquired with binos, as the thermal picture give a different perspective. That issue is magnified by the inability of a thermal sight to pick up vehicle signatures — like antennas or glint. The CITV needs a daylight channel to maximize its effectiveness.

TADSS Usage. TADSS are clearly an important part of the M1A2 training cycle. TADSS not only allow us to save on costs as we train up in garrison in order to train effectively in the field ("Train to Train"), but also allow us to make our field training both more realistic and less expensive as we save bullets. Unfortunately, in an era when we never seem to have enough time, each TADSS system requires a necessary significant investment in soldier hours to certify leaders on the proper use of these new tools (as MILES required when it first came out). I'll address our two gunnery training systems first, beginning with AGTS, which plays as important a role as UCOFT previously did.

The AGTS is an absolutely critical part of our gunnery train-up. Its excellent graphics and realistic controls maximize tank commander-gunner teamwork and training. The AGTS does not, however, fully integrate IVIS, nor does it allow the driver or loader to be involved in the training.

TWGSS, our other primary TADSS gunnery training device, does fully integrate the entire crew. It provides tank crews immediate feedback on their gunnery performance. Its ability not only to project a round's flight and impact after a trigger pull, but also play audio replication of a tank firing a round over the crew's intercom system allows for live-fire realism. More importantly, the system's laptop AAR configuration allows the Tank Crew Evaluator to conclusively demonstrate faults in engagements and show trends throughout a run. Unfortunately, TWGSS does not come with a "splash" replicator for the CID, nor does it adequately replicate machine gun engagements. TWGSS and AGTS are our primary gunnery train-up TADSS devices.

Precision Range Integrated Maneuver Exercise (PRIME), though we have not employed it to do so, can be used to train gunnery skills. We've used it for our maneuver training because it allows a battalion commander to produce excellent "NTC-like" AARs for his companies and platoons through its satellite tracking and "RGB" map playback capabilities. The PRIME system is tailor made for an M1A2 maneuver exercise as it allows the unit to judge how well it maintained situational awareness while dispersing to make full use of the M1A2's ability to effectively increase battlespace.

Similar to SIMNET, but with far greater fidelity and realism, the Close Combat Tactical Trainer is a full simulation that can train M1A2 maneuver. It superbly matches the functions of each crew station in the tank, while allowing for realistic integration of the M1A2's increased lethality and situational awareness. Its realism, coupled with CCTT's "unlimited maneuver area," allow this device to successfully act as a potential surrogate for some of the maneuver training eliminated by current constraints.

As OPNET's primary training aid, the Crew Station Trainers (CST) are remarkably effective trainers of the digital interface between the driver, the gunner, and the tank commander. This high-speed, linked computer can replicate the DID, the GCDP, and the CID. The quality of the replications, the speed of the computers — which are much faster than the IVIS's processor on the actual tank — and the ability to link the CSTs together to train a platoon, a company, or a task force make this device invaluable in training our units to learn how to maximize the capabilities of the tank.

Thoughts on Future Training:

This tank is an absolute **superstar**. Here is "a way" to re-orient our training programs to allow M1A2 units to train to the full potential of the tank.

Crew level gunnery needs to remain as is, in terms of training an M1A2 crew to put steel on target. IVIS and POSNAV, however, need to be incorporated in order to fully test every member of the crew. The tank commander should be given operational graphics from which he would be required to create an IVIS overlay with waypoints at each "support by fire" checkpoint (these grids could even be purposely incorrect to test the TC and driver's understanding of an "intent" graphic). We should eliminate course roads as we know them. To ensure safe training, each SBF checkpoint would be a safetied fighting position, as would each "maneuver box." Drivers would then have to move the tank based on the "Steer-to" indicator and their knowledge of terrain. TT VIII should include an initial call for fire engagement that requires a digital call for fire report to be sent up, based on a lased enemy target. Finally, force the crew to fight the "Red Zone" fight by changing FM 17-12-1-A2 standards. The standards should penalize crews that remain up on the berm for too long (currently a crew could stay up for 45 seconds in a defensive engagement). FM 17-12-1-A2's gunnery conditions should also incorporate realistic target acquisition problems into the scenarios (get rid of the huge plywood barns that "appear" in the middle of the range).

Section-level gunnery should be considered as a live-fire surrogate to TT XII. Our home station ranges cannot support the incredible amount of battlespace that an M1A2 platoon is capable of fighting on (only at the NTC). These current TT XII ranges are really only capable of challenging an M1A2 section. Incorporating a TT X does have additional training benefits. For example, an M1A2 section-level battle run will more realistically test fire coordination and maneuver using the wingman concept, still a requirement for lethal platoons, than did TT XII. In order to incorporate command and control training — a critical element of TT XII — into section gunnery, the platoon leader could maneuver as a non-firing third tank and IVIS situational awareness training, as described in crew gunnery, could be extended to the section and platoon level. Our range constraints, as well as our budget and live-fire ammunition constraints, necessitate this shift from a live-fire TT XII to a live-fire TT X.

Units, though, cannot discard platoon-level gunnery. Two separate TADSS-based training events, and one live-fire M1A2 training event, could take the place of the current platoon battle run. Current TADSS options, including PRIME, TSV, and TWGSS, all allow for construction of a realistic "maneuver-TADSS TT XII." An example of this battlespace-realistic platoon battle run would take place with triggered target lifters, to the front and flanks of the platoon, on Fort Hood's Training Area 35, Antelope Corridor. The ability of the battalion commander to train platoons on fire distribution and situational awareness would only be limited by his imagination. The second TADSS option would be CCTT if land were not available. (If land was available, CCTT would serve as a solid TT XI.) The only live-fire option that would fully challenge the M1A2 platoon would be at the NTC. I recommend studying the feasibility of extending the rotation by a week to allow units to begin a rotation with a live-fire "Drinkwater" TT XII.

For the M1A2 to reach its "this generation" potential as the primary maneuver system of the U.S. Army, it needs a few minor modifications. First, we need to improve each unit's ability to acquire targets and hand them over. Let's begin these improvements by giving our TF scouts an IVIS Ground Station (IGS)-linked, hand-held laser rangefinder capable of sending a spot report to an M1A2. The M1A2 tank commander then should be able to "double click" his mouse on the spot report enemy icon and have the grid go into a "designate cue." With the M1A2's internal POSNAV system providing its own grid, the tank — after the TC activates the cued icon — should automatically designate either the gun tube or the CITV onto that suspected enemy position. The tank should have the capability to execute the same function, based on a fellow M1A2 wingman's spot report. These improvements would reduce the difficulty of target handover — one of our biggest "Red Zone" problems. The recommendations outlined in this article are only "a way" to improve M1A2 training. What hopefully is clear, though, is that the M1A2 is a very different tank than the M1A1. We need a different training model to allow our units to reach their potential on this fantastic tank.

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Up-Armored HMMWVs:
The Answer For Peacekeeping Operations

by First Lieutenant Jonathan C. Byrom - Apache Troop, 1-1 Cavalry

The 1st Squadron, 1st United States Cavalry deployed to Bosnia-Herzegovina in December 1995 with 39 M3A2 Bradley Fighting Vehicles, 12 M1A1 Abrams main battle tanks, and mortar and logistical support. The squadron provided security for engineers as they bridged the swelled waters of the Sava River. With the completion of the bridge, Apache Troop, 1-1 CAV brought in the new year by crossing the Sava River and establishing the first checkpoint in Bosnia. The combat vehicles of the squadron ran countless patrols in northern Bosnia, clearing the way for the rest of the 1st Armored Division's combat and support elements. As the OPTEMPO of the squadron increased in the first six months of the deployment, the deployed units realized that the thousands of miles of patrols would greatly increase wear and tear on their tracked vehicles. Thus, the Army hurriedly fielded the XM1114 experimental up-armored HMMWVs to supplement the Bradleys on their countless patrols. The integration of this experimental HMMWV in Bosnia allowed the squadron to continue its peacekeeping mission and remain within the financial constraints imposed by the budget for U.S. IFOR forces.

The author and SSG Mike Shelton, with their Serbian interpreter, patrol in the 1-1 Cav area of operations in Bosnia-Herzegovina.

As a platoon leader in Apache Troop, 1-1 Cavalry, I often maneuvered through Checkpoint A2 in the Posavina Corridor of Bosnia-Herzegovina with my XM-1114 HMMWV platoon. It never ceased to amaze me how the M1A1 Abrams tanks of 2nd Platoon, Apache Troop dwarfed my vehicles. Their overwhelming bulk and firepower conveyed an aura of invincibility to both my platoon and thousands of Muslims and Serbians in Apache Troop's area of operations. After receiving the non-standard HMMWVs, though, and running thousands of miles of patrols, including factional weapon storage site verifications and inspections, identification of election polling sites, and diplomatic missions to maintain communication with local officials, I realized the value of the XM1114 HMMWV platoon to the troop's peacekeeping mission. The greatest strength of an XM1114 up-armored HMMWV platoon is the versatility it provides through a combination of its fuel efficiency, its mobility, its low "wear and tear" on roads, and its survivability and force protection capabilities.

The XM1114 uses significantly less fuel than both Bradleys and M1A1 tanks. My platoon was able to patrol for an entire day and use less than 30 gallons of fuel per vehicle, compared with the hundreds of gallons needed for Bradleys and tanks during the same patrol duration. The use of fuel is a serious logistical consideration during an extended operation. By running daily patrols with up-armored HMMWVs, and occasional patrols with Bradleys and M1A1s, a unit can save considerable dollars, reduce the stress on the unit's fuel requirements, maintain a show of force, and minimize OPTEMPO on tracked vehicles.

Another strength of the up-armored HMMWV is its mobility. It can traverse some terrain that a tank or Bradley cannot, particularly tight spaces in villages and on wooded trails. On multiple patrols conducted by my platoon, collecting political, economic, and demographic intelligence for the September 1996 national Bosnian elections, we traveled on many narrow trails which an M1A1 tank would have found impossible to traverse and rolled over bridges which an M1A1 would have crushed. Also, in crowded and busy villages, the up-armored HMMWVs could slip among buildings, parked cars, and moving vehicles much easier than a Bradley or M1A1. I have heard numerous horror stories of tanks accidentally peeling off the sides of cars in a variety of exercises. My skilled drivers, though, drove 10,000+ miles through busy towns accident-free for the duration of the deployment to Bosnia-Herzegovina. Thus, using the experimental HMMWVs, the unit possessed the mobility to efficiently reach Serbian and Muslim leaders' headquarters for meetings in crowded villages which lacked maneuver space for tracked vehicles.

The XM1114 equipped platoon is also effective because the vehicles preserve the roads, unlike tracked vehicles. The infrastructure in Bosnia is devastated from the years of war which destroyed bridges, electrical towers, and most importantly, roads. This infrastructure damage, compounded by the lack of mobility resulting from unmarked minefields, makes road travel difficult. Because of the condition of these roads, logistical convoys encountered difficult conditions during supply runs. When Bradleys or M1A1s make sharp turns or pivot steer, they tear up both paved and dirt roads, compounding the problem and making

travel less efficient for both civilian traffic and these logistical convoys. HMMWVs, though, are able to run countless miles on these roads without damage. This lack of destruction to the infrastructure can save the United States Army significant money in maneuver damage compensation to host countries during a peacekeeping operation, and can promote efficient military movement.

In addition to preservation of the infrastructure, up-armored HMMWVs also provide soldiers adequate protection and survivability. The armor of the XM1114 protects against projectiles 7.62mm and smaller, against shrapnel from 155mm artillery and smaller, and against land mines. In addition, its tires can continue rolling even when they become flat from enemy fire or rough terrain. The XM1114 HMMWV is also equipped with combat locks on each door which allow it to function effectively in the riot situations that soldiers often encounter in tense peacekeeping or peace-enforcing operations. Therefore, against most third world threats encountered in operations other than war, the up-armored HMMWVs protect the crew from sniper fire, riots, and terrorist attacks.

Although an up-armored HMMWV platoon is excellent in military operations other than war, it does have limitations. The primary one, is that the unit does not project the image of brutal and overwhelming force that a Bradley or M1A1 platoon does. An up-armored HMMWV platoon does not have a 25mm or 120mm direct fire weapon, but carries a mounted .50 caliber machinegun or a Mark-19 automatic grenade launcher. These smaller weapons allow the XM1114 platoon to protect itself and suppress most threats in a peacekeeping operation such as Operation Joint Endeavor, but do not give it the firepower to destroy enemy armor. Therefore, a combination of up-armored HMMWVs, Bradleys, and M1A1 tanks is necessary to protect our soldiers and react to any potential enemy threat.

One other weakness of the XM1114 platoon is that 19K and 19D soldiers lack training with HMMWVs. The U.S. Army maintains its edge in military operations primarily due to the versatility and intelligence of its soldiers. Hence, units must train their soldiers on various vehicles and weapons systems. My up-armored HMMWV platoon in Bosnia was made up of 19K tankers who had not trained on HMMWVs. Because of this lack of experience, the soldiers needed a crash course on maintaining and operating the new vehicle. Because of the quality of these soldiers, they adapted and performed excellently. Units, though, can prepare in advance by licensing and certifying their tracked vehicle drivers on the user-level-maintenance of other vehicles, such as HMMWVs and 5-ton trucks, because many of them will need to temporarily transition to one of these vehicles when deployed. Therefore, 1-1 Cavalry has adapted its predeployment preparation and instituted an aggressive user-level-maintenance program on various vehicles and weapons systems, which will contribute to the versatility of its soldiers in the future.

While conducting a patrol, 4th Platoon, Apache Troop, 1-1 Cav, exchanges information with 1st Platoon and Serbian police just prior to national elections in Bosnia-Herzegovina.

The XM1114 up-armored HMMWV platoon has a limited number of weaknesses, but they are far outweighed by its strengths. The up-armored HMMWV is versatile and flexible, as noted, with its fuel efficiency, its mobility, and its survivability. With these attributes, it can effectively perform in a variety of roles. Thus, with the aid of a small heavily armored force, the up-armored HMMWV platoon should be the mainstay of military operations other than war. American forces in Operation Joint Endeavor have tested this mix of XM1114 platoons and heavy armor platoons and have shown it to be effective. The United States Army should continue to develop these experimental HMMWVs to confront future threats.

1LT Jonathan C. Byrom, an Ohio native, graduated from the U.S. Military Academy in 1995. He completed Armor Officer Basic Course and then attended both the Scout Platoon Leader Course and Airborne School. His first assignment to 1-1 Cavalry in Buedingen, Germany, took him immediately to Bosnia where he worked as an assistant S3. He then took an up-armored HMMWV platoon and ran numerous escort missions and patrols throughout Bosnia, culminating in the national elections in September 1996. He is currently a scout platoon leader in Apache Troop, 1st Squadron, 1st U.S. Cavalry.

Ed. Note: The following reaction was written after the riots surrounding late '97's elections in Bosnia suggested another viewpoint.

HMMWVs Lack the Firepower And Protection for Bosnia Role

by LTC Michael Prevou

While I appreciate LT Byrom's article for adding to the professional debate about the future of armor, I disagree with the assertion that the up-armored (M1114) HMMWV should be the mainstay of operations like Joint Endeavor/Joint Guard in Bosnia. Based on recent experience, mixing units with HMMWVs and heavier Bradley IFVs and Abrams tanks appears to have merit. Furthermore, I am concerned about the tone of this and other articles that advocate efficiencies over combat effectiveness. With the future of armor in the post-Cold War scenario in debate, will we grasp at quick fixes or develop a vision and a long-term solution?

While the up-armored HMMWV is great to patrol the countryside and perform administrative tasks, like weapons

Continued on Page 56

PART THREE: POWERING THE NEW SYSTEM

The Future Combat System (FCS):

A Satellite-fueled, Solar-powered Tank?

by Asher H. Sharoni and Lawrence D. Bacon

(This is the last in a three-part series exploring a conceptual future combat system.-Ed.)

The Two Man Crew - Is It Feasible?

The FCS must be significantly smaller and lighter than the M1 tank. Its crew ought to be smaller than the conventional four crew members in order to yield a lesser protected volume. Full automation, consolidation, and centralization of major functions performed by a conventional crew will eventually lead to dramatic crew reduction. The major functions of commander, main armament operator, weapons/self-defense suite operator, data processing, and driver/navigator could be alternately assumed by each one of only *two* crew members.

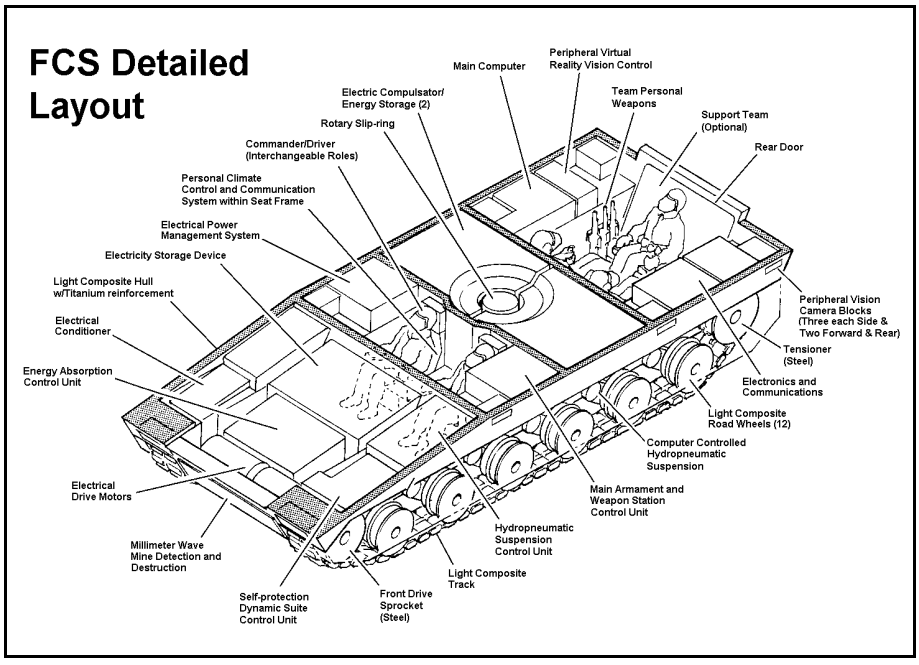
The adaptation of a reduced crew requires a dramatic departure from the underlying philosophy of conventional tank operation. The two crew members must be regarded as 'pilots' that could not and should not be expected to perform routine functions presently assigned to conventional tank crews. It practically implies that logistics, maintenance operations, sentry duties, and alike, should be *minimized* by virtue of highly-advanced technologies and extended reliability. The tank self-defense systems should operate intelligently and independently, continuously watching, monitoring and protecting, while the crew is asleep, recuperating, or inoperable.

Alternative Energy Propulsion Sources for Automotive Applications

A predominant FCS requirement is to significantly lessen the dependency on conventional fossil fuels, thus making the FCS more independent and capable of operating over long periods of time without resorting to periodic maintenance and logistical support. This requirement is extremely difficult to satisfy, and necessitates a dramatic departure from any conventional power source presently in use. As shown, the FCS power pack is configured for an all-electric front drive installation (see FMBT). Electrical propulsion for mobility applications is widely recognized today as the wave of the future, let alone the fact that another major system is also utilizing electrical energy for its operation.

• Hybrid Electric Power System

Last year, it was reported in *Defense Daily*[1] that DARPA is embarking upon a new venture to find a contractor team able to inexpensively develop and demonstrate the capabilities of a highly-effective, Hybrid Electric Power System (HEPS) for generation and storage of electricity. HEPS is intended for automotive applications as a prime-mover in advanced combat vehicles (FCS and the Future Scout Cavalry System - FSCS). In essence, HEPS is comprised of a diesel engine or gas turbine directly coupled to generators to produce electrical energy for storage and subsequent use by the vehicle systems. To promote industry participation, DARPA is contemplating that the development of electricity-producing and storage systems will give the contractor team a hedge on the worldwide competition in the developing commercial electrical vehicle market. DARPA has realized that, only through the economy of scale offered by the financial strength of commercial industries could it expedite the outrageously expensive development of such novel systems. Only with sound mutual commitment via partnership with industry, ag-



Sketch of the FCS concept vehicle shows a third, optional crew member who could relieve the two men necessary to fight the tank. Automated functions would also provide self-defense during rest periods, and the crews would be relieved of many current logistic and maintenance tasks.

"Present commercial and military nuclear applications are considered unpopular because they contradict the current trend towards diminishing civil nuclear applications, and in particular, the trend toward banning the proliferation of nuclear weapons...."

gressively pursuing the Pentagon's new *Streamlined Acquisition Reform* (SAR) and *Integrated Product Team* (IPT) processes, along with the promise of significant potential benefits to the commercial worldwide market, could such an enormous endeavor come to pass.

DARPA has announced its intention to invest more than $40 M(!) to develop and test the HEPS over the coming few years. Competing teams will develop and demonstrate an integrated HEPS for a 15-ton vehicle (e.g. FSCS), but they will also be required to demonstrate, by computer simulation and computer virtual modeling, that a more powerful version of the HEPS could be integrated into a 40-ton vehicle (e.g., FCS). Granting industry the prerogative to come with its own designs, without stringent directives from DARPA, is another fine idea that has great merit and will pay handsome dividends in terms of shorter schedules and overall reduced developmental costs. Nonetheless, though same basic technology could be used to power the FCS, it is not in accordance with the requirement for simplified and reduced logistics. Integrated HEPS are more efficient, and have improved performance compared to contemporary diesels or turbine-based power packs. They operate with less noise and with reduced thermal signature, thus improving survivability. It remains to be seen whether integrated HEPS will come out less costly in production and deployment than contemporary power packs. Attempting to capture the best of two worlds, HEPS seem to be more applicable, as a near-term solution, to the lighter FSCS and similar vehicles, and less so for the longer-term, heavier FCS. HEPS is still going to require diesel or turbine fuel for its operation, and would add a piston engine or a gas turbine, in addition to a sophisticated electrical power generating system, to worry about.

• Nuclear Energy Propulsion As a Prime-Mover Energy Source

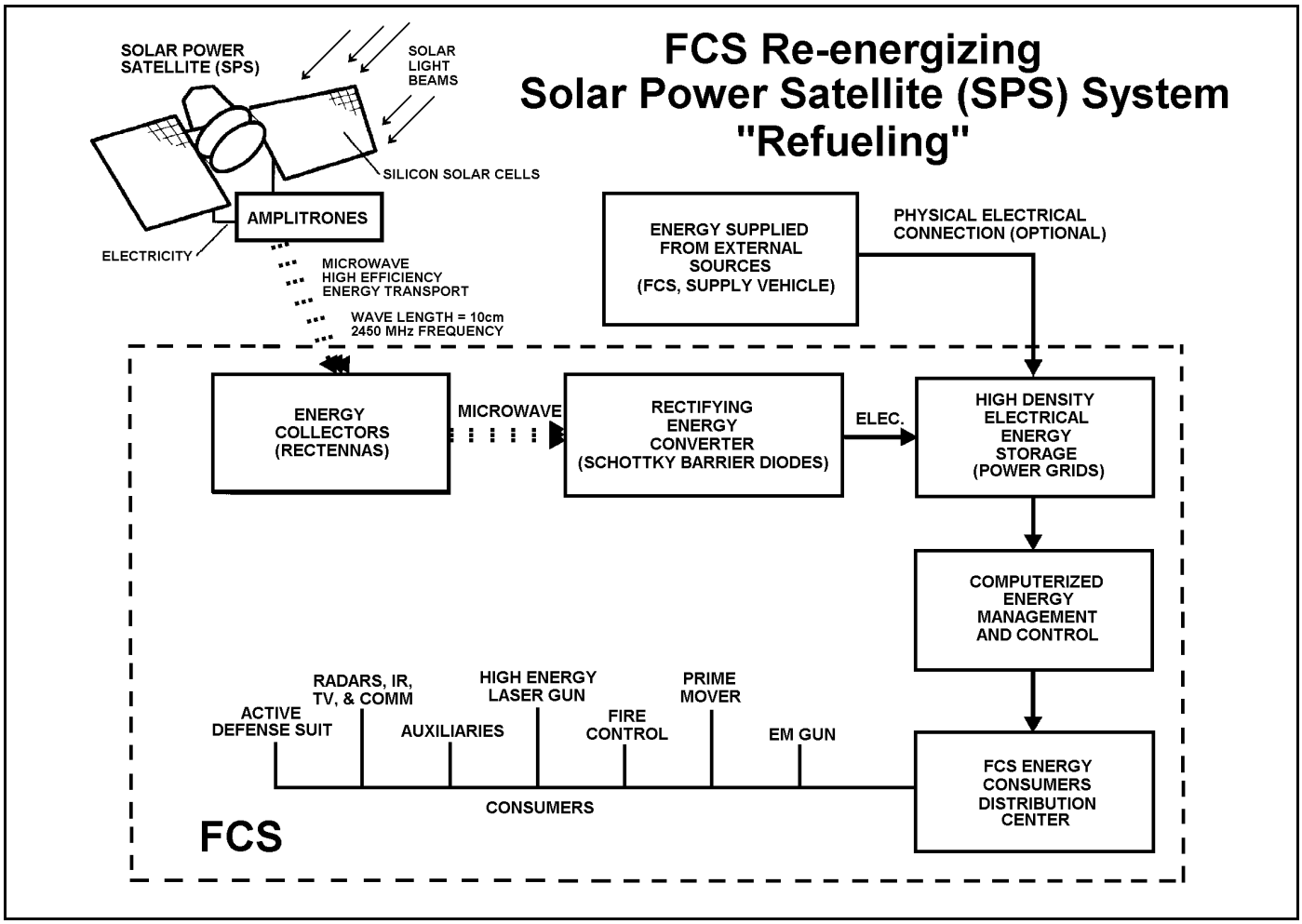
When one thinks of feasible options, *nuclear* propulsion for ground automotive applications immediately comes to mind. The energy produced by a nuclear reactor is released by the fission of atomic nuclei in a controlled and self-sustaining manner, and appears as heat, which is then converted to electrical energy by using conventional turbine generators. As an example, the *Fast Breeder Reactor*[2] (FBR) now under active development, uses fast neutrons produced by fission without slowing them down, such as in a conventional Thermal Reactor (TR). The fuel used has a higher concentration of fissile material (plutonium-239 and uranium-235) with the high concentration resulting in a much *smaller* core. Molten sodium or high-pressure helium are used as coolants. In essence, the FBR generates more fuel than it burns, so it could continuously operate for extended periods of time. By processing the burned fuel, it is possible to use up to 60 pecent and more of the energy stored in the uranium, as opposed to just a few percent with thermal reactors. The energy potentially available from the fissioning of uranium and thorium in FBRs is at least a few orders of magnitude greater than that of all fossil fuels sources combined.

The emergence of nuclear power as a viable energy source for automotive military applications comes at a time when additional environmentally acceptable sources of energy for civil and military consumption are sorely needed to meet continued rapid increases in demand. Despite its undeniable potential, the authors decided to reject this alternative up front on both environmental and political grounds. It is primarily because of the inherent difficulties and safety hazards involved in dealing with radioactive radiation in peacetime, accidents, and war.

Another drawback will be the formidable demilitarization problems associated with discarding radioactive products and radioactive residual materials. Furthermore, there are insurmountable difficulties in cooling the nuclear reactor and 'purifying' the working liquid when the only available coolant in abundance is ambient air (a poor heat conductive substance with a much lower heat transfer efficiency than water), rather than the unlimited sea water supply commonly used in submersible and surface naval applications. The reactor under armor must be ruggedized, and the control rods — which regulate the speed of reaction — must be stabilized to account for the jagged motion over typical cross-country terrain. In addition, the nuclear reactor and its auxiliaries — its insulation, cooling, pumps, controls, monitoring and redundant safety devices — must all be made inexpensive to produce in order to make any economical sense. Present commercial and military nuclear applications are considered unpopular because they contradict the current trend towards diminishing civil nuclear applications, and in particular, the trend toward banning the proliferation of nuclear weapons. This option may be regarded as feasible if there was a *safe*, practical, and economical way to neutralize radioactive radiation and demilitarize residual nuclear materials while preserving the natural environment.

• Solar Power Satellites In Space: A Possible Long-Term Energy Source Solution For The FCS

Solar energy is considered by many as an ideal energy source. It is clean; it produces no pollution,[3] and there are none of the nuclear residual radioactive wastes that make nuclear energy so unpopular in the public eye. It is practically unlimited, so it will still exist in abundance long after fossil fuel reserves become scarce, sometime during the next century. And best of all, solar energy is free, short of the cost of harnessing it for human consumption. A Solar Power Satellite[4] (SPS) is placed in a *geostationary* orbit (36,000 km) above the equator, similar to the orbit being used for communication satellites. The SPS is so positioned in space that it revolves at the same rate as the Earth spins, being relatively fixed to the equator, and can intercept at least four times as much solar energy as the sunniest spot on Earth. The SPS intercepts unobstructed sunlight (no clouds, bad weather, or darkness in space), converts it into microwaves (short-wavelength radio waves) and beams them back to collector arrays on Earth where they could be converted with *high efficiency* into electricity. Depending on its size, the SPS could deliver thousands of millions of watts, practically in a continuous manner. In 1980, a joint study conducted by NASA and the U.S. Department of Energy



(DOE) concluded that it was feasible to construct a fleet of 60 solar power satellites, the first of which will be in operation in 2010 and the last by 2040.

A SPS could reach a mass of about 50,000 tons, but it is weightless in space. Solar cell arrangement is preferred, because there are no moving parts to malfunction, and the use of solar cells in space is already well established. SPS subsystems and structural components must be lifted off the face of the Earth while overcoming gravity, and subsequently positioned in orbit. Solar cells, made of silicon (or gallium arsenide for better efficiency) convert sunlight directly into electricity. Remotely-controlled and operated *'space robots'* could construct the lightweight structures which support the array of solar cells. Whether the SPS uses turbines or solar cells, the electricity generated will be converted into microwaves by devices known as *Amplitrons* (also *Klystrons*) and then beamed to Earth at an area of limited diameter. At a wavelength of 10 cm (2450 MHz) this type of microwave radiation passes through the atmosphere virtually unabsorbed. At the ground, receiving arrays termed *Rectennas,* installed on the FCS as shown, will collect the microwaves to convert them very efficiently (83+ %) into electricity. The rectennas will consist of panels studded with T-shaped aerials linked to rectifying devices known as *Schottky* barrier diodes, which convert the microwave beam back into electricity. One of the arguments against beaming power to Earth is that microwave beam radiation might damage humans. This problem could be mitigated by using a beam that is stronger in the center, but it must be very accurate. The accuracy of beaming could be much improved with the aid of the Global Positioning System (GPS), which is also satellite-based. Any realistic assessment of the dangers of power satellites must be balanced against the pollution from fossil fuels, and the waste from nuclear reactors.

The SPS concept may resemble "Star Wars" and frontier-of-science type of technology, but successful and promising experiments have been conducted in the past that validated the feasibility of such an idea. Using its Global Positioning System (GPS), each individual FCS could identify its definite location so that it could receive the transmission with high accuracy and, better yet, while on the move. Once the transmitted energy has been absorbed by the FCS, it will be converted into electrical energy and stored in high-density storage devices for future consumption. An energy management and control system will allocate energy to the various "consumers" (EM gun, fire control system, laser gun, prime-mover, etc.). The FCS could also receive electrical energy from a dedicated "refueling" vehicle (generator) and by physical connection to another FCS that could share some of its own electrical energy.

Admittedly, there is a vast array of problems yet to be solved in order to harness this type of energy source for automotive applications. To mention just a few:

- The *rectennas* on the FCS must be small to accommodate its limited size, and still be efficient.

- The safety hazard of exposure to microwave radiation must be eliminated or reduced to controllable and acceptable levels.

- Radio noise disruption over a wide range of frequencies, and detrimental

ionospheric and atmospheric effects, must be mitigated.

- The beaming process must be sufficiently accurate to hit a single FCS, or a group of them, in a pre-planned rendezvous location, and recharge them within a reasonable duration. The high efficiency of microwave power transmission and reception is crucial to the economics of placing the SPS in space for practical military applications.

In conclusion, the authors realize that one may challenge the feasibility and practicality of such an approach to the refueling problem. It stands to reason that, if we are to be independent from conventional fossil fuels, we *must* use a different source of energy. Just another, even more potent, "synthetic" fuel is not going to provide the desired level of independence from the burden of the logistical "umbilical cord." Compact, reliable, and economical diesel engines[5] have probably reached their peak performance. Turbocharging, recuperation, intercooling, high-temperature resistant materials (e.g. ceramics) and combustion control, have all contributed to their performance with limited progressive improvements yet to be expected. One way or another, this particular problem must be addressed sometime in the course of the next century, when fossil fuel reserves become scarce.

High-Density and High-Energy Storage Systems

The utilization of tactical, electrically energized EM/ETC guns, high energy laser and charged particle weapons, and other subsystems will aggressively drive energy densities (Wh/kg) far beyond those presently deemed acceptable. It will require capacitors and batteries to provide highly-mobile sources of stored energy for producing electrical pulses at the MegaJoules (MJ) level.

Development of electronic components that can handle megawatts of power will lead to solid-state, optical and gaseous switches, high-density batteries and capacitors, advanced magnetics, high-power microwave devices, electrical actuators, and superconducting energy storage.[6] The U.S. Army Research Laboratory's Electronics and Power Sources Directorate, in collaboration with the Tank Automotive Command, are engaged in a study to identify future components such as electric drives, weapons, active protection, and countermeasures.

The most common type of storage device is the conventional lead-acid battery (accumulator). Typical batteries for automotive military applications require a 10-hour charge-up period. When discharged, about 90% of the actual storing capacity (current times time) is recovered. However, when the discharge voltage is lower than the corresponding charging voltage, the actual energy recovered is only 75% of that used previously to charge the battery.

There have been great efforts to reduce battery weight and volume for a given output. This has been accomplished with the development of alkali batteries, which have nickel and cadmium, or nickel and iron plates immersed in a potassium hydroxide solution. These batteries are very robust mechanically and electrically, and have found considerable applications with electric vehicle drives, but they are not adequate yet for utilization in an all-electric military vehicle. Current recovery is 75-80%, but the ultimate energy return is only 60-65%.

High-power/high-densities and cycle-enhanced efficiencies could be obtained from *high-temperature* batteries such as lithium alloy-iron sulfide, and sodium-sulfur batteries. For example, the sodium-sulfur design has a working temperature of over 300° C and has sodium and sulfur electrodes, which are maintained in a liquid state at the working temperature, and an alumina electrolyte, which is in solid state. The output per unit weight (140 Watt x hr per kg) is currently more than five times that of the common lead-acid battery. Promising research is conducted by the Electronics Technology and Devices Laboratory (ETDL) aimed at a *second* and *third* generations of lithium thionyl chloride batteries with energy-density up to 300 Wh/kg and beyond! Current aluminum-air batteries are comprised of an aluminum-alloy anode sandwiched between air-breathing cathode sheets while electrolyte is pumped through the system. They are about twice the volume of a lead-acid cell, though with 15 times the power output. Much research is still required to improve storage capacity and increased recovery levels. Nonetheless, further developments will yield new technologies for developing super high-density storage for extended operations. Computerized integrated power-energy management systems will be introduced to optimize performance, reduce maintenance costs, and improve reliability. Undoubtedly, the logisticians' desire to reduce the vast number of batteries replaced each year in military service, and the emerging electric car market, will substantially contribute to developing technologies for super high-density, maintenance-free, long-life electrical energy storage devices.

Enhanced Mobility

The FCS will be equipped with a highly-efficient, all-electric power train which consumes substantially less energy than conventional prime-movers to produce equivalent output. It could increase the operating range by up to 50% compared to the fuel-guzzling gas turbine engine. It has a much higher power density (HP/ft^3) and is much smaller in comparison to conventional diesel or gas turbine prime-movers (up to 50% increased volumetric efficiency). Power electronics could be increased by 100%, which ultimately implies a smaller envelope of the tank. Other improvements will be in utilizing a composite 'band' track to reduce noise signature (30-50%) and increased life such that no maintenance is required during operational activity.

Tracked suspension is by far the best system ever devised for ground automotive applications in terms of mobility, reliability, and durability. There is no emerging evidence of any other system that could match or outperform it, currently or in the foreseeable future. Tracked suspension will remain the best and only choice for tanks as long as they will ride on the random surface texture of the earth. Future improvements will include extended durability, maintenance-free operation, and substantial weight reduction. The FCS will be equipped with a Hydropneumatic Active Suspension (HAS).[7] HAS is a hydropneumatic tracked system that provides a high degree of tactical mobility. Variable suspension height is dynamically computer controlled and allows operation over all terrain types and in all weather conditions, while improving accuracy of firing on-the-move. HAS can save over a ton of weight compared to conventional torsion bar suspension systems and will significantly contribute to the paramount overall goal of weight reduction.

Composite Armored Vehicle For Reduced Weight

To allow rapid deployability and facilitate transportability, weight reduction is one of the dominant and mandatory pre-

requisites imposed on the FCS. To achieve meaningful weight savings, the crew must be repositioned in the hull (see FMBT) such that the overall protected envelope could be dramatically reduced. A possible way of complying with this requirement is to manufacture the hull and possibly the 'turret' out of composites with reinforcement of titanium or other light but strong metallic components to serve as a 'skeleton' for maintaining structure integrity. In essence, the issue is to achieve large scale economical production while establishing the level of confidence in ability of composites to be successfully applied in armor structural applications. To gain additional weight reduction, the tracks and road wheels must be made of composites, though they may also contain metallic components for reinforcement. Hughes is currently developing a composite material known as Silicon Carbide (SiC) Whisker Reinforced Squeeze Casted Aluminum Metal Matrix Composites[8] (MMC). This affordable MMC technology could be demonstrated as a cost-effective alternative approach to manufacturing military components. Applications may include road wheels, suspension components, and track shoes, leading to significant weight reductions and increased durability. Composite materials, like those utilized in the construction of the B2 Bomber structural elements, are lighter than steel and can improve a vehicle's fuel consumption, cross-country speed, operational range, and endurance.

A four-year contract to develop a lighter, more transportable composite armor vehicle was awarded to United Defense L.P. in 1994. The program is aimed at exploring the use of composite materials in structural applications to reduce weight, enhance vehicle survivability, and improve deployability.[9] In order to reach a practical stage of applicability, there are still many problems associated with ballistic and structural integrity, non-destructive testing, signature reduction, producibility, and field repairability that must be resolved. Although the program focused on developing a medium-size chassis (17-22 ton) for typical applications such as Bradley and the Future Scout Vehicle (FSV), similar principles and production techniques could be successfully applied to a heavier chassis, such as that of the FCS (40-45 ton). It is expected that as much as 50%(!) weight savings could be achieved in the future compared to a conventional steel structure. Composite materials technology[10] will bring about substantial reduction in size and weight of high performance future tanks without sacrificing operational capabilities. Indisputably, lighter tanks offer many advantages in the form of strategic deployability, tactical mobility, and sustainability. The lighter FCS will play a key role attaining the new logistic goals and restoring the rapid maneuvering essential to full exploitation of armor.

The FCS Scenario - A Major Digitized Battlefield Contributor

Operational requirements dictate that the FCS should operate as a 'combat system' while functioning and communicating beyond the conventional rather *narrow* tactical level. The FCS will be an *active* node on the battlefield digitized network. This is, in essence, a dramatic departure from the conventional way tanks have been operated and deployed since their inception. The FCS will carry Reconnaissance Missiles (RM) that will be the natural evolution of today's Unmanned Aerial Vehicles (UAV). The RMs will be fired to assist the local commander and crews in obtaining real-time digitized information on the close-area battlefield. This information will be used by the local forces, but also will be conveyed to the Greater Area War Management Center. Information on enemy targets obtained from the RMs will be fed back to the FCSs, prioritized, and used to automatically direct, aim, and fire the EM and high-power laser guns and anti-armor/air missiles at their potential targets.

The FCS will be an integral part of the digitized (computerized) battlefield network system and will serve as its "eyes" and "ears." Much has been recently written about the essence of battlefield digitization, so that it will not be elaborated any further here. The FCS will be equipped with a *second* generation vetronics[11] system that will further advance digitized data control and distribution, electrical power generation and management, computer resources, and crew control and display processes. The vetronics system will be capable of accepting a variety of inputs and delivering outputs related to power system control, communications, countermeasures, weapon control, sensor control, artificial intelligence, training, maintenance, diagnostics and prognostics. This architecture will provide the required interface between the various functional modules, computer, and power resources.

Concluding Remarks

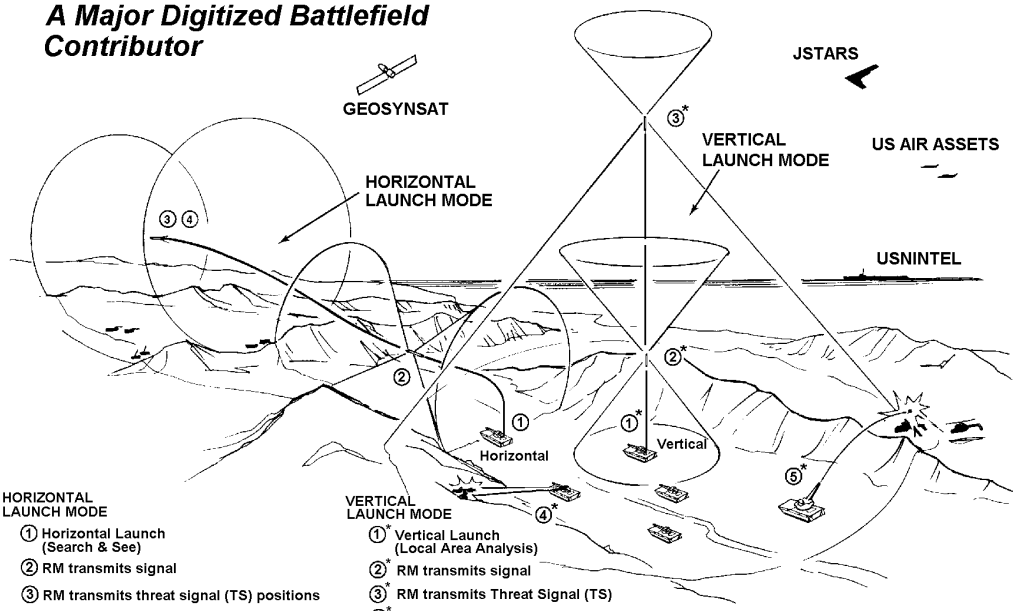
The futuristic FCS is indeed an *extraordinary* but visionary combat weapon system which, with its extended capabilities, pushes the boundaries of technology well beyond what is achievable today. It is virtually an all-electric platform that uses electricity as a *sole* energy source. Electricity is used to power its EM (or ETC) and laser guns, main power train, and all other self-defense suites, communications, fire control systems and auxiliaries. It is designed to be highly reliable by virtue of advanced technologies, requiring only low-level or virtually no maintenance during operation. In essence, it is the logistician's ultimate 'dream war machine.' The FCS may be the first tank that could veritably transform armor warfare. Armor maneuver forces that never seem to halt while on the offensive could rarely be defeated or held back (remember German 'Blitz' armor attacks across Europe, and General Patton's fast advance in Italy during WWII). The underlying philosophy here is that the only imposed limitation on armor deployment should be human resilience, rather than a shortage of consumables, or low reliability of equipment. *In terms of freedom from logistic constraint, one could argue that, in principle, the FCS will do to tank warfare what the nuclear powered submarine did to the deployment of conventionally driven diesel submarines.*

The proposed particular configuration of the FCS is not as important as the core idea behind its conception. Revolutionary main armament, extraordinary survivability and deployability, and substantial reduction in logistic reliance are the key to the FCS. From its inception to its fielding, it took the M1 tank development program more than 20 years. Considering the time that was necessary for maturation of new technologies that were incorporated in the M1, such as the gas turbine engine and the British-developed *Chobham* armor, the FCS represents a much higher and riskier performance step than the M1 was at the time, in comparison to the M60-series Patton tank.

In the author's personal opinion, the opportunity for fielding an FMBT type fleet has already been missed. Nonetheless, FMBT prototypes could still be

FCS Scenario

A Major Digitized Battlefield Contributor



HORIZONTAL LAUNCH MODE

① Horizontal Launch (Search & See)
② RM transmits signal
③ RM transmits threat signal (TS) positions
④ All Computers process Signal (IFF, Prioritization, Optimum Response, Selects Platform, Weapon Performance and initiates response)

VERTICAL LAUNCH MODE

①* Vertical Launch (Local Area Analysis)
②* RM transmits signal
③* RM transmits Threat Signal (TS)
④* FCS Computer processes Signal (IFF, Prioritization, Optimum Response, Selects Platform, Weapon Performance and initiates kill)
⑤* FCS Computer initiates 2nd TS kill

built to serve as 'technology-carriers' and 'test-bed' demonstrators for test, evaluation, and maturation of emerging technologies that, if successful, will be implemented in the FCS in the 2020-2030 time frame.

The FCS, as formidable a concept as it appears to be, must compete on availability of funds for R&D like any other major development program. The fully justified requirement to support the existing M1 series tank fleet and preserve the industrial base for tank design and production, will naturally limit the allocation of funds set aside for the FCS. To optimize allocation of funds for development, test, and evaluation, the U.S. Army *must* determine whether emerging technologies are best fielded in a new tank design (technology carrier) or better implemented as a part of the existing M1 Abrams series fleet upgrade program. This unavoidable situation will further stress the practicality of the FCS's proposed fielding time frame — 2020-2030. The FCS's ultimate destiny, among other major development programs, will be determined in the forthcoming Army's Quadrennial Defense Review (QDR) that will dictate the Army's shape for the next 20-30 years.

The proposed FCS, with its extremely powerful main armaments, alternative unique energy source to operate *all* systems, enhanced self-defense capabilities, digitized communications, computer networking ability, precision navigation, and advanced aerial sensors, will be a paramount member of Army XXI and beyond. It will be able to maneuver, occupying and retaining territory, and collapsing the enemy's resistance by attacking rapidly and deeply into its center of gravity, thus ending the war more expeditiously and with much fewer casualties. Undoubtedly, if the FCS will come to pass, it will dominate the maneuver battlefields of the future with virtually no or little competition.

***Note**: All information contained in this article was derived from open-sources and the analysis of the authors.*

Notes

[1]*Defense Daily*, 12/11/96, p. 398.

[2]The New Illustrated *Science And Invention* Encyclopedia, H.S. Stuttman Inc. Publishers, *"Nuclear Reactor,"* Volume 13, p. 1727.

[3]Meadows, S.I., "Army, Navy, Air Force Vow New Weapon Systems Will Not Pollute," *National Defense*, October 1996, p. 26.

[4]The New Illustrated Science And Invention Encyclopedia, H.S. Stuttman Inc. Publishers, *"Frontiers of Science, Power Plants In Space,"* Volume 7, p. 884.

[5]Ogorkiewicz, R.M., "MTU Tank Diesels - New Developments," *International Defense Review*, 1/1988, p. 57.

[6]Hewish, M. and Hammick, M., "Battlefield Power At The Technical Limit," *International Defense Review*, 11/1992, p. 1083.

[7]Editorial, "We Have a Winner!," *ARMOR*, July-August 1993, p. 6.

[8]Proceedings, 1996 Combat Vehicles Conference, American Defense Preparedness Association (ADPA), September 24-26, 1996, U.S. Army Armor Center, Fort Knox, Kentucky.

[9]Grimes, V.P., "Next Generation Tank - Looming Lethal Leviathans Demand Development $$$," *National Defense*, September 1996, p. 26.

[10]Dr. Hoffman, P.R., "The Latest Developments In Specialty Aerospace Materials," Textron Specialty Materials, p. 197.

[11]Brig. Gen. (USA Ret.) Bolté, P.L., "Vetronics: what it's all about," *ARMOUR 1987 supplement, IDR* 7/1987, p. 13.

Western Design HOWDEN (WDH) is a small defense company in Irvine, California, which specializes in the design, development and production of ammunition and material handling systems for the U.S. and International military markets. WDH's track record includes a variety of air, land and seaborne weapon systems which require automated feed, resupply and optimized ammunition packaging. WDH has been involved among others in the Tank Test Bed, AC-130U Gunship, AH-64 Apache and Tank Compact Autoloader Programs.

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The Battlefield Combat Identification System:

A Task Force XXI Response to the Problem of Direct Fire Fratricide

by Captain Chad Jones

The first requirement in warfare is the ability to distinguish friend from foe.[1]

-Recognition Pictorial Manual, FM 30-30 [June 1943]

Fratricide, a problem as old as warfare itself, is a complex issue that defies simple solutions. Defined as the employment of friendly weapons and munitions with the intent to kill the enemy or destroy his equipment or facilities, that results in unforeseen and unintentional death or injury to friendly personnel. Fratricide is a grim fact in combat operations. [2]

As the latest version of FM 17-15 [*Tank Platoon*] points out, the accuracy and lethality of modern weapons systems make it possible to engage and destroy targets at unprecedented ranges. At the same time, the ability of U.S. forces to acquire targets using conventional daylight and thermal imagery often exceeds the ability to accurately identify targets as friend or foe. As a result, friendly elements can be engaged unintentionally and destroyed in a matter of seconds.[3]

During Operation Desert Storm, direct fire engagements accounted for 12 of the Army's 15 total incidents of fratricide. The numbers of casualties these incidents represent are sobering: of 615 total soldiers either wounded or killed in action, 107, or 17 percent, were the result of friendly fire. Thirty-five American soldiers were tragically killed; another 72 were wounded because one friendly vehicle opened fire on another.

Of these 12 incidents, 11 occurred at night. Ten are believed to have occurred at ranges of less than 1500 meters. Almost all were characterized by reduced visibility. The effects of rain, dust, smoke, and fog, coupled with the vast distances American forces traveled over Southwest Asia's often featureless desert terrain, were also clearly contributing factors. "On the unrestricted desert battlefield, direct fire lethality far outstripped [a] gunner's ability to achieve positive target identification." Studies suggest that the decision to fire was based largely on the tank commander's and gunner's perception of where they and other friendly forces were located with respect to a given target. "This situational awareness, dependent upon planning and control measures, [is] key in understanding Desert Storm fratricide incidents."[4]

For the last ten years, the Army's CTCs have routinely tracked incidents involving fratricide. The RAND Corporation conducted a study in 1986 that examined 83 direct-fire battles executed by 15 different task force-sized units. Among its conclusions, the study reported that most of the direct fire fratricides were isolated incidents involving single vehicles during one engagement. Of the few incidents involving multiple engagements, 75 percent occurred in darkness. In addition, Rand found that over half of the firing vehicles could have avoided fratricide had they known the location of their sister units. Another 33 percent would have needed to know the location of isolated friendly vehicles not in contact with the enemy. The remaining 16 percent would have required an IFF device to distinguish friendly vehicles intermixed with the enemy.[5]

A similar study, conducted by the Center for Army Lessons Learned [CALL] and the Army Research Institute [ARI], used computer records from 1986-1990 to show that in certain conditions, as many as 11 percent of total attempted direct-fire engagements were fratricidal. This study concluded that "the average self-inflicted toll at the NTC... may be as high as two to three combat vehicles" per mission.[6]

Causes of Direct Fire Fratricide

There is no simple explanation for direct-fire fratricide. Immediately following the Persian Gulf War, General Gordon Sullivan, then Army Vice Chief of Staff and later Army Chief of Staff, directed TRADOC and the Army Material Command [AMC] to examine the causes and find potential solutions to the problem. The TRADOC-AMC task force on combat identification identified more than 200 different potential solutions spanning doctrine, training, leader development, organizations, material, and soldier support, but focused on two:

- *Situational Awareness* (SA). The real-time accurate knowledge of one's own location and orientation, as well as the locations of friendly, enemy, and noncombatant elements. SA includes awareness of the METT-T conditions that affect the operation.

- *Positive Identification.* The immediate, accurate, and dependable ability to discriminate through-sight between friend and foe. This ability must extend to maximum acquisition and engagement ranges, and cannot increase vulnerability or decrease system performance. Finally, positive identification must occur reliably in all light and weather conditions and take into consideration all battlefield effects.

In its conclusion, the task force noted that these two factors; the "lack of positive target identification and the inability to maintain situational awareness in combat environments," are the major contributors to fratricide. "If we know where we are and where our friends are in relation to us, we can reduce the probability of fratricide. If, in addition, we can distinguish between friend, neutral, and enemy, we can reduce that probability even more" [TRADOC-AMC Combat Identification Interim Report].[7]

The Battlefield Combat Identification System [BCIS]

Enter BCIS, one of the initiatives designed to prevent fratricide that was recently tested at the National Training Center. Part of the Army's Advanced Warfighting Experiment, the Battlefield Combat Identification System [BCIS] is designed to immediately identify potential targets as friendly, enemy, or neutral/noncombatant. BCIS is an all-weather, digitally-encrypted question and answer system developed by TRW Space and Electronics Group for the Army's Communications and Electronics Command.

The system has been described by proponents as "the long-distance equivalent of 'Halt! Who goes there?'." BCIS queries a potential target with a 38-GHz electronic millimeter wave pulse. Fully integrated into the platform's fire control system, BCIS is largely transparent to the vehicle's crew. After aligning the

COLOR	INDICATION		MEANING
	AUDIO	VIDEO	
M1A1 ABRAMS TANK			
Yellow	NA	Flashing	Friend
Yellow	NA	Constant	Unknown
M2A2 BRADLEY IFV			
Red	Pulsing 666Hz	Flashing	Friend
Yellow	Warbling 455/666 Hz	Constant	Unknown

Figure 1. BCIS Indicators by Platform Type

weapon's sights on a potential target, the gunner activates BCIS by using the vehicle's laser rangefinder [M1A1 Tank], or by pressing an interrogation switch mounted just below the vehicle's trigger [M2A2 Bradley]. If also equipped with BCIS, the potential target responds with a signal of its own. Vehicles not responding are characterized as unknown. Whichever the response, the answer to the query is displayed in less than one second as a visual signal in the gunner's sight. At the same time, an audio tone is transmitted through the firing platform's intercom, and is heard by each member of the crew. If equipped with BCIS, a distinct tone is also heard by the crew members of the potential target, informing them that they are being interrogated. [See Figure 1 - BCIS Indicators by Platform Type.]

Each interrogation is the sum of three queries. In under a second, the system issues three separate pulses and analyzes three separate responses before displaying the status of a potential target. This triple redundancy allows for an accuracy rate of above 97 percent. The system transmits only when interrogating or responding. Built-in features prevent detection, jamming, or interception by enemy electronic warfare assets. Signal encryption occurs via a COMSEC variable and is loaded utilizing a standard KYK-13 COMSEC fill device. Frequency hopping, where the frequency changes a minimum of 43 times during the one second interrogation and response cycle, and specialized waveforms, practically eliminate the possibility of detection. The entire cycle is summarized in the eight steps listed below:

- Gunner presses laser rangefinder or interrogation button
- BCIS transmits message containing platform ID via interrogator antenna
- Target receives message via transponder antenna
- Target BCIS validates message
- Target BCIS responds with interrogator's ID and own ID
- Target platform operators are informed of query
- Interrogator validates message
- Results of interrogation displayed in gunner's sight ring

BCIS is effective in all visibility conditions. The system ranges from 150 meters to 5500 meters at elevations between -10 degrees and + 40 degrees; and from 150 meters to 2750 meters at elevations between +40 degrees and +50 degrees. As shown at left, the interrogator has +1.3 degrees, or +/- 22.5 mils of discrimination. When activated, the BCIS interrogator emits a millimeter wave beam, baffling out from the interrogator in the shape of a cone, that increases 45 meters in width for every 1000 meters traveled. At 5500 meters, the wave baffle is 250 meters wide. [See Figure 2 - Interrogation Range Pattern.]

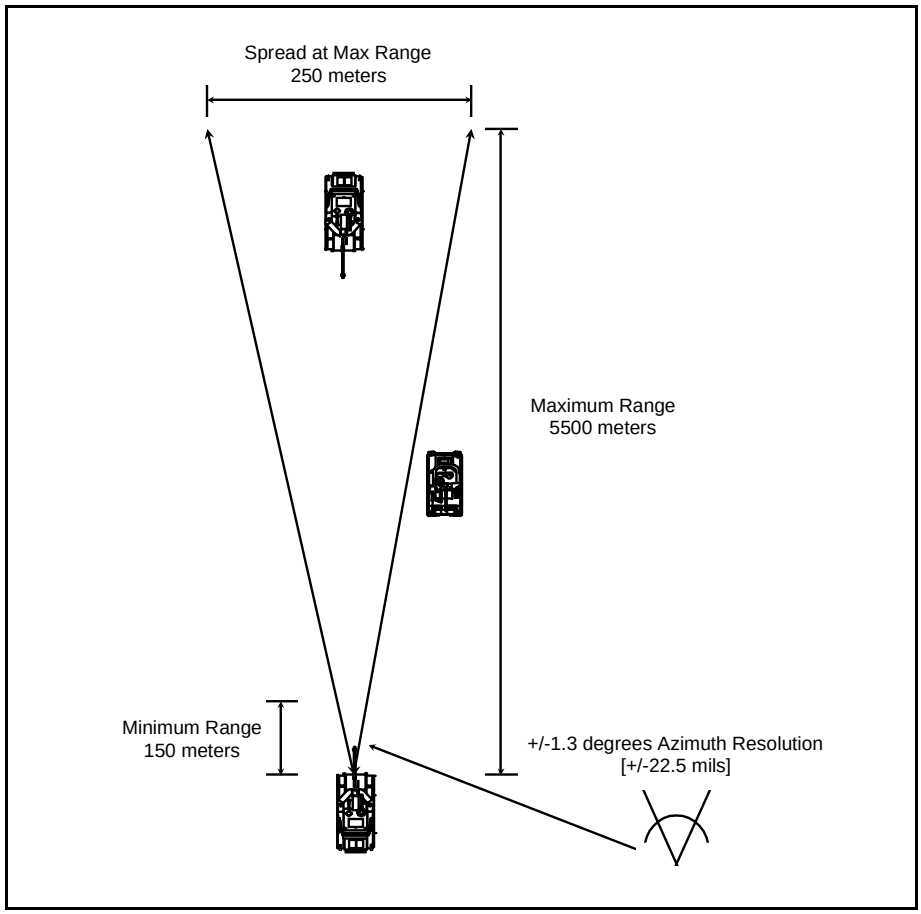


Figure 2. Interrogation Range Pattern

The system is also effective in all types of weather conditions and battlefield effects, though maximum ranges are affected as identified below:

Maximum Effective Range	Weather Condition
5500 meters	Clear Sky
5500 meters	Fog Oil
5000 meters	Dust
4000 meters	Radiation Fog
3000 meters	Steady Rain

Figure 3. Maximum Ranges vs. Weather Conditions

BCIS has an additional feature unique to Task Force XXI vehicles: the ability to provide accurate situational awareness

information. In field trials conducted in June 1995, a TRW team successfully demonstrated that BCIS could be configured to send, receive, and display friendly position information about other BCIS-equipped vehicles on the battlefield. This digital data link [DDL], not part of the Army's original BCIS requirement, was implemented using no new hardware and one piece of new software.

When a BCIS/DDL-equipped shooter interrogates another BCIS/DDL platform, the target platform responds automatically by transmitting a covert, digital signal from its omni-directional antenna. This occurs in conjunction with the 38-GHz electronic millimeter wave pulse that carries the anti-fratricide information. The signal contains the target vehicle's global positioning system [GPS] coordinates and an identification code unique to that platform. The shooter adds this information to its own display, an appliqué computer screen showing a digitized map, digital graphics, and the location of friendly icons. It then transmits a composite signal that shows the GPS location of all known BCIS/DDL platforms within the area.

The composite signal is retransmitted several times per minute through the BCIS omni-directional antenna. Any BCIS/DDL platform within a one kilometer radius will receive this situational awareness information, update its display, and retransmit its own composite signal. The presence of multiple BCIS/DDL platforms transmitting position and identification data in parallel allows situational awareness to spread rapidly across the battlefield, even to those systems not directly involved in the interrogation sequence.[8]

System Components

BCIS is composed of an interrogator subassembly, a transponder subassembly, an antenna, a processor and display unit, and the sight ring indicators.[9] The complete system is installed on vehicles designated as "shooter" platforms, primarily tanks and Bradleys. A transponder-only system, consisting of an antenna and processor display, is used on "non-shooter" platforms.

The Transponder Antenna. The transponder antenna is an omni-directional antenna mounted at the end of a 3-foot mast. When installed, a heavy spring at the base provides impact resistance during collisions with obstacles. The radome, at the tip of the antenna, is elevated from the platform to provide a maximum field of view for receiving and responding to queries from interrogating platforms.

Receiver-Transmitter Group. The receiver-transmitter group processes the interrogation data for the internal transmitter. It transmits the encrypted interrogation and receives encrypted replies from other friendly BCIS-equipped platforms. The R-T group is mounted inside an armored housing that provides environmental and limited [7.62 mm and smaller] ballistic protection.

Interrogator Antenna. During the interrogation cycle, the interrogator antenna is used for the transmission of the millimeter wave signal, and the reception of the transponder reply. Approximately 12 inches in length, it is coaxially mounted on the firing platform's gun tube. Like any weapons system, it must be boresighted to achieve maximum effectiveness.

Interface Unit [BCIS Control Box] and Interconnecting Box. The BCIS control box provides a majority of the BCIS operator's controls and indicators. It generates the required regulated DC voltage and routes it to the various circuits and subassemblies in the BCIS system. It provides COMSEC and TRANSEC capability and interface. It controls and passes data to and from the R-T Group. And, it performs conventional encoding and decoding and error detection. The interconnecting box provides the interface between BCIS and the rest of the platform. Mounted just below and attached to the control box, it connects to the vehicle intercom, laser rangefinder or interrogator switch, platform ID, PLGR, sight ring, and appliqué.

Sight Ring Indicators. Mounted on the gunner's eyepiece, the sight ring indicators superimpose BCIS symbology onto the gunner's sight. The Bradley sight ring indicators consist of two LEDs, one yellow and one red. These lights rotate with the diopter ring as the gunner focuses his Integrated Sight Unit [ISU] and may turn up to 300 degrees. The M1A1 Abrams indicator consists of one yellow LED, located to the left of the range readout. [See Figure 4 - Sight Ring Indicators.]

Outfitting the Army's Experimental Force

Task Force 3-66 Armor, one of the two balanced task forces in the Army's EXFOR, was outfitted with BCIS in the Spring of 1996. Forty-four shooter platforms were distributed among two tank and two mechanized company teams. Each had a total of eleven systems, three in each platoon, one installed on the XFIST Bradley, and one installed on either the company team commander's tank or Bradley, or company team executive officer's tank or Bradley. Ten additional non-shooter systems were installed on each of the task force's scout platoon HMMWVs. Eight more were installed on an assortment of engineer and chemical support vehicles: three on M93 FOXs, two on M113 personnel carriers, and three on M9 ACEs. In total, the task force had 62 BCIS systems.

New Equipment Training [NET], created and implemented by representatives

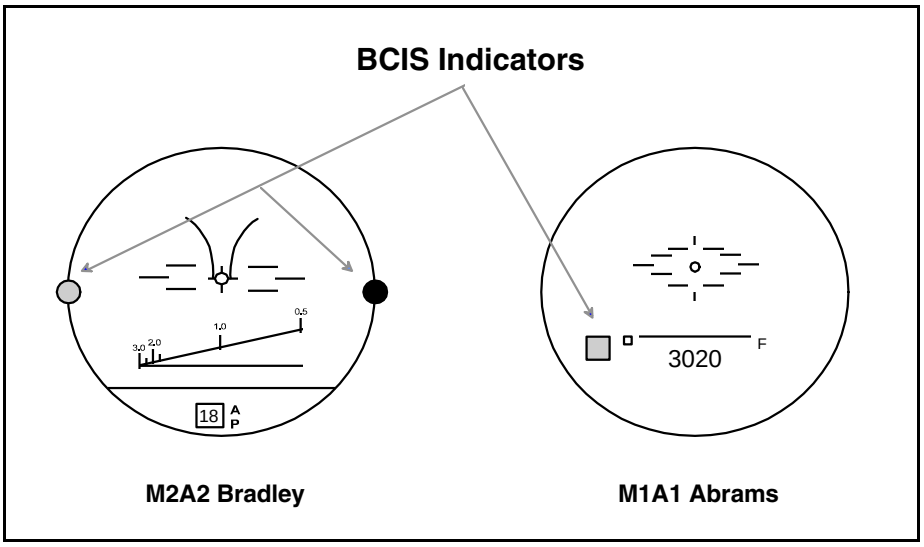


Figure 4. Sight Ring Indicators

from TRW, began shortly after instrumentation. It consisted of a four-hour block of classroom training, and focused on topics ranging from theory and hardware descriptions to PMCS and troubleshooting. Classroom training culminated with a written exam. Four additional hours of hands-on training was conducted by each soldier on the platform he would ultimately fight on.

After a series of unit-level functionality experiments, Task Force 3-66 Armor put BCIS to the test during a series of maneuver training exercises. Platoon lane training was conducted for almost four weeks in August and September of 1996, company lane training for two weeks in October, and task force exercises for two weeks in December. Throughout, BCIS was utilized with steadily improving accuracy and effectiveness. Beginning in February 1997, all 62 BCIS systems were transported to the National Training Center for evaluation as part of the Army Warfighting Experiment conducted throughout March 1997.

Performance

Overall, BCIS performed very well, and largely as advertised. Though specific performance data has yet to be released, TF 3-66 Armor experienced countless instances where BCIS prevented direct fire fratricide. Counterreconnaissance elements were routinely interrogated during periods of limited visibility to confirm that no enemy vehicles had compromised their formations. Assaulting elements were often interrogated by the support force as they became intermingled with the enemy on friendly objectives. Scout HMMWVs, which at extended ranges resemble enemy (OPFOR) BRDMs, were effectively interrogated while occupying screen line OPs or while displacing behind friendly lines. The list goes on and on.

Like any system, BCIS had particular strengths and weaknesses. On the positive side, it was extremely durable: the system's operational readiness rate exceeded 95 percent throughout the train-up and rotation. Timeliness was also a plus. As advertised, BCIS added no noticeable lapse in the target acquisition — engagement sequence. When an M1A1 tank gunner activated his LRF, he simultaneously activated the BCIS. If also equipped with BCIS, the potential target vehicle responded to the interrogation and results were displayed in the gunner's sight ring and over the intercom; all in under a second. BCIS was also accurate. When properly boresighted, the system displayed reliable interrogation results at ranges up to 5000 meters, in a variety of light and weather conditions and battlefield effects.

It was nearly impossible to determine the effectiveness of the digital data link. Each vehicle's appliqué, operating independently, provided extremely effective situational awareness over distances far greater than BCIS's maximum effective ranges. In addition, friendly icons on a vehicle's display were identical for BCIS/DDL and appliqué generated data. Still, BCIS's DDL did provide some redundancy when the appliqué did not function properly.

There were also several weaknesses. Systems would occasionally dump the COMSEC fill, a problem caused by the short duration of the BA 5372/U lithium "keep-alive" memory battery. Projected to last for up to six months, the battery often failed in under a week. In addition, BCIS was not compatible with the Automated Net Control Device [ANCD], the COMSEC fill device used for all other Task Force XXI equipment: BCIS required the less reliable KYK-13 fill device. And, though an artificiality of the experiment, BCIS's effectiveness was reduced by the fact that not every vehicle was instrumented with the system. The most important weakness, however, was the inaccuracy caused by BCIS's wave baffling effect. During the close fight, when friendly vehicles became intermingled with enemy vehicles, BCIS's effectiveness was limited. This problem was magnified at greater ranges, when visual identification was impossible, and where the effect of the baffle was more prominent. At 5000 meters, if a BCIS equipped friendly platform was within 250 meters of the enemy, and a gunner interrogated that enemy vehicle, he would receive a friendly indicator.

Despite its shortcomings, the bottom line for BCIS is extremely encouraging: throughout the train-up and during eight missions conducted over two weeks in the box, TF 3-66 Armor experienced no direct fire fratricide involving those systems equipped with BCIS.

Conclusion

"The modern battlefield is more lethal than any in history. The pace of operations is rapid and the non-linear nature of the battlefield creates command and control challenges for all unit leaders."[10] Technology by itself will never provide the sole means for the prevention of direct fire fratricide. Crew discipline, situational awareness, and challenging, realistic training designed to ensure the rapid acquisition and positive identification of potential targets remains the first and best means of preventing friendly fire.

As advances in technology push the envelope in target acquisition and engagement ranges, however, tank and Bradley crews will need technological assistance to take advantage of this improved lethality while still preserving the force. The Battlefield Combat Identification System is one system that has proven its worth for use by soldiers in the Army of the 21st Century.

Notes

[1]*Recognition Pictorial Manual*, War Department Field Manual 30-30 [June 1943] p. 1.

[2]FM 17-15, *Tank Platoon*. Headquarters, Department of the Army [April 1996] p. F-1.

[3]FM 17-15, *Tank Platoon*, p. F-1.

[4]*Fratricide: Reducing Self-Inflicted Losses.* Center for Army Lessons Learned [CALL], No. 92-4 [April 1992] p. I-1.

[5]*Fratricide: Reducing Self-Inflicted Losses*, p. I-1.

[6]*Fratricide: Reducing Self-Inflicted Losses*, p. II-1.

[7]*Ibid.*

[8]Associated Press Release, Redondo Beach, Calif., [August 2, 1995].

[9]TM 11-5895-1554-10, *Battlefield Combat Identification System*, Headquarters, DA [1 June 1996] p. 1-9.

[10]FM 17-15, *Tank Platoon*, p. F-1.

Captain Chad Jones earned a Bachelor of Science degree in business administration from Bucknell University in 1989. He has served as a scout platoon leader, troop executive officer, and squadron plans officer in 1/11 ACR in Fulda, Germany; and as the battalion motor officer, S4, and tank company commander in 3-66 Armor in Fort Hood, Texas. He is currently assigned as a small group instructor for the Armor Officer Advance Course at Fort Knox, Ky.

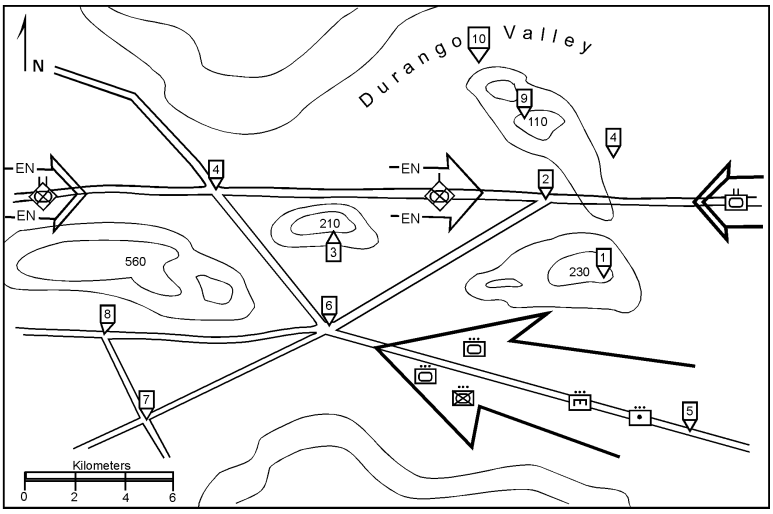
THE PROBLEM:

"The Battle of Durango Valley" - from the September-October issue of ARMOR

Situation:

You are the commander of A Team (tank heavy), TF 2-8. You are the advance guard company (AGC) of the TF as it conducts a movement to contact. The brigade commander wants the task force to find, fix, and destroy the advance guard of an MRR that is moving east. This will allow the rest of the brigade to maneuver and destroy the regimental main body, with enough combat power left to block the second-echelon MRR. The task force commander directs the AGC to find, fix, and destroy the FSE allowing the task force main body to maneuver into the flank of the AGMB.

Your team consists of two M1A1 tank platoons and one mechanized infantry, (BFV) platoon. An engineer platoon and the mortar platoon follow in support; you have priority of mortars. Your team is moving on an axis south of the task force based on an erroneous report that the FSE was at CP 8. The terrain is mostly open desert flanked by mountains, with some high terrain in the center of the zone. As you approach the intersection at CP 6, your 1st Platoon reports seeing approximately 20 vehicles moving east and starting to deploy vicinity CP 2. A moment later, task force scouts report they have identified the AGMB north of Hill 560 moving east toward CP 4.

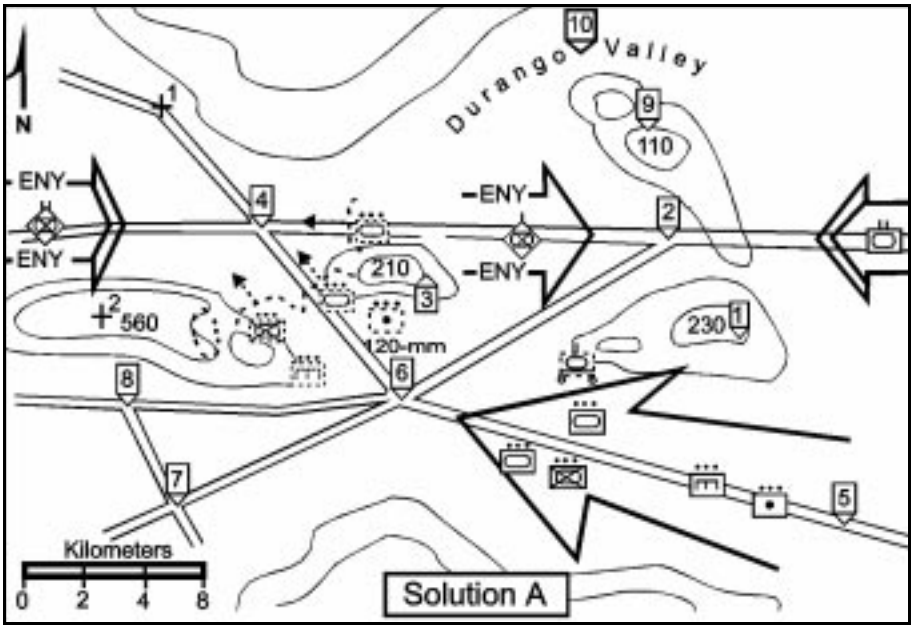


You suddenly realize that the element identified by 1st Platoon must be the FSE and that it is probably deploying to engage the task force from Hill 110. You attempt to contact the task force commander but receive no response. The last transmission with the task force had them approximately 15 minutes out from CP 2. Based on the scout's last report, the AGMB is 20 minutes from CP 4. It will take you 9-10 minutes to move northeast to engage the FSE or 11-12 minutes to move northwest to intercept the AGMB. You must act now! What do you do?

THE SOLUTIONS:

The following solutions pertain to the tactical vignette, "The Battle of Durango Valley," published in the September-October issue of *ARMOR*. They include the author's solution, provided by the Doctrine Division, and two solutions submitted by our readers.

We would like to thank those other readers who also submitted their solutions to the tactical vignette.



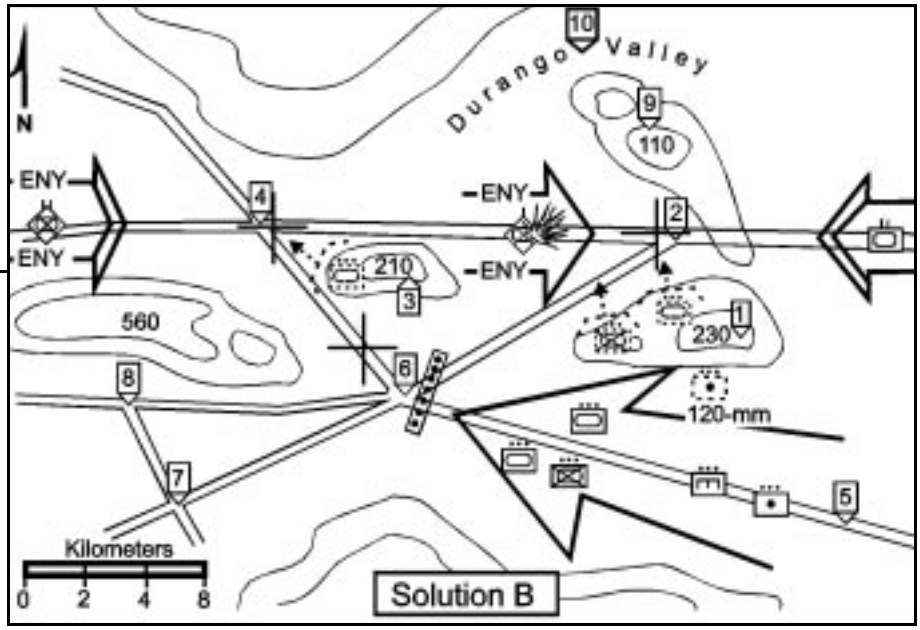
Author's Solution

FRAGO:

"GUIDONS, this is BLACK 6, FRAGO follows. **Situation:** The enemy FSE is deploying at CP2 to engage the main body of the task force, and the AGMB is moving east toward CP4. BREAK.

"**Mission:** We will attack by fire to fix the AGMB vicinity CP4 to allow the task force to move to a position of advantage to destroy the AGMB.

"**Intent:** (Purpose) The purpose of our mission is to fix the AGMB to allow the task force time to move to a position of advantage and destroy the AGMB. We will accomplish this by attacking by fire from a blocking position west of CP3 oriented north and west of CP4, in effect luring the AGMB into an 'L'-shaped ambush. (End state) The company team arrayed in attack by fire positions vicinity Hill 210, oriented to the west; the AGMB fixed vicinity CP4; and the task force maneuvering to destroy the AGMB. BREAK.



Tasks to subordinate units:

"RED (MECH), move to the intervisibility line vicinity grid 135454, oriented north. **Task:** Attack by fire from a blocking position, orienting fires from TRP1 to CP4. **Purpose:** To protect the company team's flank, denying enemy movement toward the south. Be prepared to shift fires to the west, oriented on CP8. Move dismounts to vicinity grid 130451 (Hill 560) to block enemy dismounted avenues of approach. BREAK.

"WHITE, move to grid 140456 west of CP3, oriented north. **Task:** Attack by fire from a blocking position, orienting fires on CP4. **Purpose:** To prevent the enemy from maneuvering to the north. BREAK.

"BLUE, move to grid 145473 north of CP3, oriented west. **Task:** Attack by fire from a blocking position, orienting fires from CP4 to TRP1. **Purpose:** To prevent the enemy from maneuvering north. BREAK.

"MORTARS, move to grid 145442. **Task:** Disrupt the AGMB with HE/smoke. **Purpose:** Disrupt the enemy's formations, giving us a direct fire advantage by forcing him to button up and disperse. BREAK.

"FIST, move to a position vicinity CP3 to regain communications with the task force and call for fires against the AGMB. You have priority of fires.

"BLACK 5, provide protection for the FIST. Assist in calling for and adjusting fires. Observe location and movement of FSE. Regain contact with higher and report. BREAK.

"SAPPER (ENG), move to vicinity grid 132424. **Task:** Provide flank security, oriented on CP8. **Purpose:** Provide early warning of enemy forces moving on southern avenue of approach. BREAK.

"BLACK 7, move trains to a hide position near Hill 230, west of CP6; be prepared to execute MEDEVAC. ACKNOWLEDGE, OVER."

RATIONALE:

Our mission was to find, fix, and destroy the FSE, but it has bypassed us and may fix the task force, allowing the AGMB to maneuver on it. Our dilemma is whether we should attempt to destroy the FSE or move to fix the AGMB. We do not have the time or the combat power to accomplish both. I decided to establish a blocking position and attrit the AGMB before it has time to develop the situation and maneuver against the task force.

I moved the mechanized infantry to high ground, oriented northwest, to provide greater range for their TOWs as they establish their blocking position. Red's dismounts will block enemy dismounted avenues of approach. I positioned the tank platoons along Hill 210, fixing the enemy from the east and denying him movement north or south. We should be able to accomplish the mission of fixing the AGMB with accurate direct fires. I had the XO provide security for the FIST to regain communications with higher and keep an eye on the actions of the FSE.

Both the company FIST and the mortars are in a position to support the company fight. The engineers are positioned to reinforce the blocking position and observe the southern avenue of approach.

Even though my mission to find, fix, and destroy the FSE has essentially failed, the brigade commander's intent for the task force was to find, fix, and destroy the AGMB. By fixing the AGMB, we are disrupting the enemy's plan, providing time for the task force to destroy the FSE and still gain a position of advantage to destroy the AGMB. Although we have not achieved our original task, the task force still has a shot at winning.

SOLUTION B

(Submitted by MAJ John Allen and CPT(P) Donald Barnett, Doctrine Writers, Combined Arms Doctrine Directorate, Fort Leavenworth, Kansas)

FRAGO:

"RED and WHITE (MECH) will occupy attack by fire positions west of CP1, on Hill 230 oriented on CP2. Fix and/or destroy the FSE vicinity CP2. BREAK.

"BLUE, along with BLACK 5, will occupy Hill 210 vicinity CP3, oriented on CP4. Observe approach of the AGMB, and cover hasty minefield emplacement vicinity CP6. Engage the lead company of the AGMB between CPs 4 and 6. Delay the lead company of the AGMB for 10 minutes or withdraw under direct pressure. Move now. BREAK.

"DIGGER (ENG) will emplace a hasty minefield at CP6; intent is to delay the lead company of AGMB from moving eastward from CP6 to CP5, allowing BLUE more engagement time. BREAK.

"FIST, use mortars to suppress the FSE vicinity CP2; plan to suppress the lead company of the AGMB using targets vicinity CP4 and CP6. Plan for a smoke target between CP3 and CP6 to screen BLUE's withdrawal. DIGGER will inform BLACK 5 and FIST of minefield grids. BREAK.

"MORTARS will emplace vicinity grid 123456 southwest of Hill 230 and return fire within 10 minutes. BREAK.

"FIST, DIGGER, and BLACK 7 will immediately contact higher to report our intent. BLACK 7, attempt to regain con-

tact with battalion by either FM or face to face. ACKNOWLEDGE, OVER."

Rationale:

The company will maneuver north to fix and, preferably, destroy the FSE. This is in keeping with the commander's intent: preventing the FSE from fixing or turning the battalion prior to CP2 while exercising the initiative to destroy the enemy force. The commander feels he can destroy the FSE because he is on its southern flank. The BLUE platoon is pushed forward to Hill 210 to gain observation of the AGMB and to delay the AGMB if it continues straight or south at CP4. If the AGMB goes northeast, the battalion can then attack its flank from CP2 to CP10.

If the AGMB continues straight, the battalion can flank it by attacking from CP9 south, or it can attack from CP5 to CP3 or CP6, then turn north. If the AGMB goes south (most likely because of the expected demise of the FSE), the enemy will be delayed trying to negotiate the minefield and defeat the BLUE platoon on Hill 210. This delay gives the battalion commander the option to bypass remnants of the FSE at CP2 and attack the flank of the AGMB from CP3 and/or CP4. Of course, to make any of this work, the AGC must regain contact with the battalion!

SOLUTION C

(Submitted by 1LT Daniel T. Head, XO, HHC, 2nd BDE, Fort Stewart, Georgia)

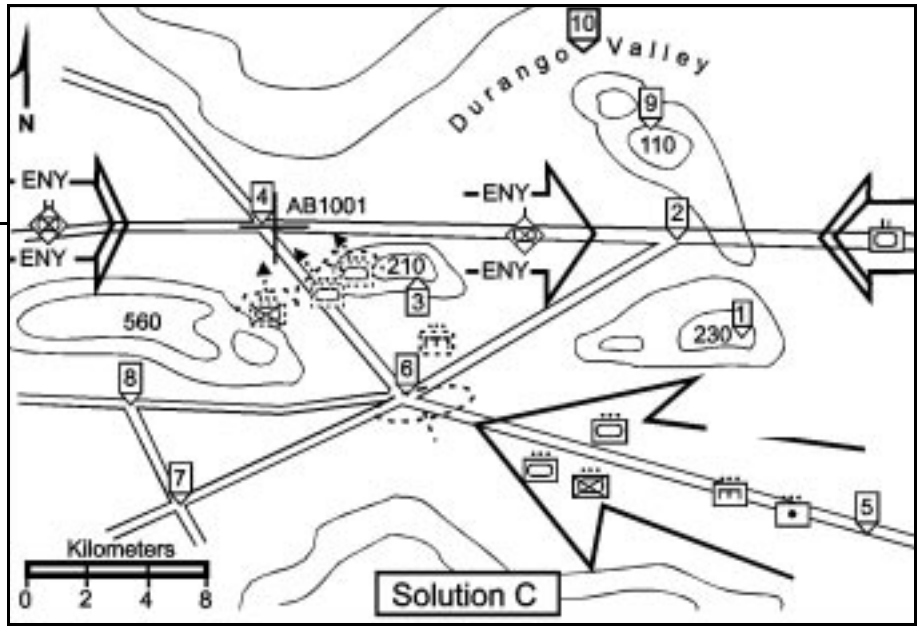
FRAGO:

"GUIDONS, this is BLACK 6. Probable enemy AGMB spotted vicinity grid 123445. Will arrive at CP4 in approximately 20 minutes.

"WHITE (MECH), set vicinity grid 124678; orient from CP4 left. Engage enemy vehicles with TOWs when they reach CP4. Do not dismount.

"RED, set to the right of WHITE; orient on CP4. Engage enemy once three vehicles are past CP4.

"BLUE, set to the right of RED; orient from CP4 right. Engage once enemy is 1,000 meters past CP4. Watch CP2 for possible enemy or friendly activity. Ensure positive ID before firing. Prepare to bound to the left of WHITE. Prepare to cover the company's displacement.



"MORTARS and FIST, CP4 is target AB1001. Tanks and BMPs in the open. Fire as the first enemy vehicles pass CP4. FIST is the primary shooter. RED is the alternate.

"ENGINEERS, begin digging hasty, hull-down fighting positions vic grid 122455, oriented west.

"GUIDONS, on order, the company will shift south, with left-most platoon vicinity CP6. We will orient on CP4. BLUE will cover the company's move. ACKNOWLEDGE, OVER."

RATIONALE:

The commander's intent was for the company to find, fix, and destroy the FSE, but with the enemy AGMB coming toward me and the FSE behind me, this is no longer practical. The task force should be able to deal with the FSE, especially if I can reestablish communications. A hasty attack on the FSE leaves me open to attack from the rear by the AGMB as well as to friendly fire from my own task force as they engage the FSE.

I would set my company on the northwest side of Hill 210 (on the reverse slope in turret-down positions) in a hasty defense oriented on CP4. A tank company in the defense is a match for an AGMB in a direct fire fight. If I can successfully fix, delay, and destroy most or all of the AGMB, the task force will be able to destroy the FSE and then move on to destroy the AGMB piecemeal.

This plan allows the company to engage the AGMB from a hasty defense if the enemy chooses to follow the road (an obvious axis of approach). Should he turn south, the company will reposition before the enemy is close enough to bring accurate and deadly direct fires.

One probable reason for the loss of commo is that we have gone too far and are now outside the TF's primary SINCGARS range. Switching to the retrans frequency will probably restore commo. If I can restore commo, I will send a spot report and SITREP to the TF commander or TOC (whomever I can contact).

Budget Cut Eliminates Knox Doctrine Home Page ...and "Issues in ARMOR"

Fort Knox's Directorate of Training and Doctrine Development (DTDD) has declined to renew the Entelechy, Inc. contract that originally created the Doctrine Home Page, opting to use the resources elsewhere.

The cutback also impacts the ARMOR Magazine Internet presentation, "Issues in ARMOR," which was part of that home page.

New Armored Vehicles Debut At British Equipment Exhibition

by Peter Brown

Britain's Royal Navy and British Army Equipment Exhibition, a major showcase of Britain's ground armaments industry, takes place every two years. Most recent events have been combined with the naval side, which is not as strange an idea as might first sight appear. Many companies in the helicopter, electronics, and missile fields produce equipment for both seaborne and land use. The land side of the 1997 event was held at a new location at Farnborough airfield. There was no mobility component, as seen at previous shows at Pegasus Village near Aldershot.

Despite this, there was a wide range of equipment on display. One innovation was a large static area with a variety of current equipment, with items ranging from Challenger 2 through Saxon and Sabre, all available for inspection with serving crews on hand to point out their good points.

There were some new armored vehicles in the main part of the display. No new main battle tanks were on show, but the UK's main producer, Vickers Defence Systems, had a Challenger 2 on static display on one of its bridges. Next to it, and demonstrated each day, was the full BR90 Automotive Bridge Launching Equipment being laid and recovered.

Among new light vehicles, Alvis exhibited Stormer 30, the armored reconnaissance/light tank variant of their Stormer family, which is itself an outgrowth of the proven Scorpion CVR(T) series. Although larger than Scorpion, Stormer 30 is fully air-portable. Fitted with spaced aluminum armor and good optical equipment, its stabilized 30mm Bushmaster dual-feed cannon and turret-mounted TOW missile launchers give its three-man crew sufficient firepower to act in a light force recce or holding role until heavier forces deploy. Capable of speeds ranging from 4 km/h up to 80 km/h, forward or backwards, it may prove to be a worthy successor to Alvis' earlier designs.

The Alvis Stormer 30 - Author's Photos

Equally useful would be the bridge layer variant. Using Stormer reduced to its most basic form, it carries a folding bridge capable of carrying MLC30 traffic across a 15 meter gap, which can be bridged in 5 minutes. It will carry all military traffic other than MBTs, allowing movement across a high proportion of wet or dry obstacles.

Its major advantage is that a bridge and its launcher can be carried by C130 or equivalent, offering units with light tanks or APCs the same mobility enhancement currently enjoyed only by those equipped with heavier AVLB systems.

A vehicle which may not need the bridge is Alvis' Scarab. For all its small size, it is well protected, being able to resist an RPG-7 rocket across its frontal arc and .50 caliber heavy machine gun fire all round. In addition, it has built-in mine resistance which many heavier vehicles would envy.

Carrying up to four crewmen, it can carry a wide range of weapons for missions from liaison, escort, and scouting up to antitank or antiaircraft support. Its larger cousin, Alvis 4, is perhaps a little less well protected but still offers good protection and has seen service in Bosnia.

One other new light vehicle comes from GKN. A contender for the TRACER scout program, for which GKN has teamed with GEC Marconi and American partners United Defense and Raytheon, it is based on the well-proven Warrior MICV chassis. The vehicle on show carried full additional armor and a turret fitted with a 25mm cannon and TOW missiles, giving it protection and firepower to match its mobility. Its three-man crew is equally well-equipped to observe; a Clark Masts telescopic mount carries RACAL's MSTAR radar and a RADAMEC electro-optical surveillance system, which feed into a Delco INIS information management system.

Other Warrior versions were also on show, one mounted an American Delco turret with a 30mm cannon in place of the 25mm type fitted to the Desert Warrior now in service in Kuwait. The Utility Vehicle carries a one-man machine

Alvis Bridgelayer on Stormer Chassis

Alvis Scarab

gun turret for uses such as mortar carrier, command and communications or cargo-carrying.

GKN offered a wide range of wheeled vehicles. Their Tactica series, with a normal driver's cab layout, was configured in mock-up MOD Police markings, and a higher capacity version with cab-forward format was on display alongside a Simba in anti-riot form, fitted with folding side shields. At the heavier end of the scale is the Piranha designed by MOWAG of Switzerland, which GKN has a license agreement to build. This very versatile vehicle comes in 4x4, 6x6, 8x8 and even 10x10 configurations. Available for inspection was an 8x8 infantry fighting vehicle in two formats, one mounting a Delco turret with 25mm cannon and TOW not unlike those in use by the U.S. Marine Corps,

MOWAG Piranha III - 8x8 Version

Canadian, and Australian armies, and the Saudi Arabian National Guard. The more recent version Piranha III offers an all-electric drive turret and improved crew and other facilities.

Premiered at the event was the ARGE/GKN proposal for the future family of wheeled utility vehicles to meet British, French, and German needs. The concept shown is a collaboration between GKN and Krauss-Maffei, MaK/ Rheinmetall and Wegmann from Germany. Such a partnership should mean the final vehicle will be able to draw on a variety of skills to fit it for many different roles.

Another contender for this program was at the Vickers display, coming from TEAM International, comprising Britain's Vickers and Alvis alongside Henschell and KUKA in Germany and France's Panhard. Its descriptive literature is in three languages, while two serving soldiers who inspected the vehicle at the same time as this author were very impressed with the very roomy interior. In service, it would soon fill up with a variety of equipment, as well as up to 11 crewmen.

More international cooperation was evident on the British Aerospace stand, with the 120AMS armored mortar system turret on a stretched M113 chassis. Developed in collaboration with Delco Defense, this effective system is already in service on a Piranha chassis. It offers powerful support from a wide range of 120mm mortar projectiles out to over 9km, all of which can be delivered under full armor protection.

Also shown by BAe was the Shorland S600 armored carrier, developed by Shorts Brothers of Northern Ireland. It is now marketed by British Aerospace Australia and Mercedes-Benz. Based on the proven Unimog chassis, it can be fitted out for a variety of tasks and has been offered as a contender for an Australian requirement.

Finally, but not least of the new armor at the show, was Panther, marketed by Greys Defence Systems. Optimized for scout roles, this sleek vehicle takes advantage of the latest technology. Fully amphibious without preparation, its rear engine layout leaves the central section clear to carry a variety of equipment, from a machine gun to antitank or antiaircraft missiles. Alternately, a crew of up to six can operate electronic and optical surveillance equipment under full armor protection.

Developing anti-armor systems were on view as well as armor, including TRIGAT in its MR infantry version and LR vehicle- and helicopter-carried versions. Already a strong contender for adoption by Britain, France, and Germany, interest has also come from Norway and Finland. Alongside missiles and launchers was the result of a very effective test firing showing residual penetration of 1,193mm, making this a system to be reckoned with — or avoided, depending on your viewpoint.

A lighter system is the next generation of light anti-armor weapon from Matra BAe Dynamics, teamed with Lockheed Martin. Designed to offer infantry anti-armor capability out to 600m, it would weigh under 10kg and be less than a meter long. Being able to be launched from confined spaces also extends its versatility. The computerized demonstration on show was, to say the least, spectacular.

Even with recent and continuing changes in the world, there is still a need for well-equipped armed forces using armored vehicles. This showcase showed that Britain's defense industry, increasingly in partnership with overseas companies, is well-placed to provide a range of equipment for these forces.

Peter Brown is an Englishman with a long-standing interest in armored vehicles, which he has studied for 25 of his 40-something years. A computer programmer by profession, he was editor of the Friends of the Tank Museum magazine, TRACKLINK for four years and active in publicity work for that organization. His writing credits extend to articles and reviews in many specialist publications in the field of full-size armor and model-making in several countries. He has attended BAEE events for almost ten years now and reported on new equipment and trends.

Greys Defence Panther

TACTICAL VIGNETTE 98-1

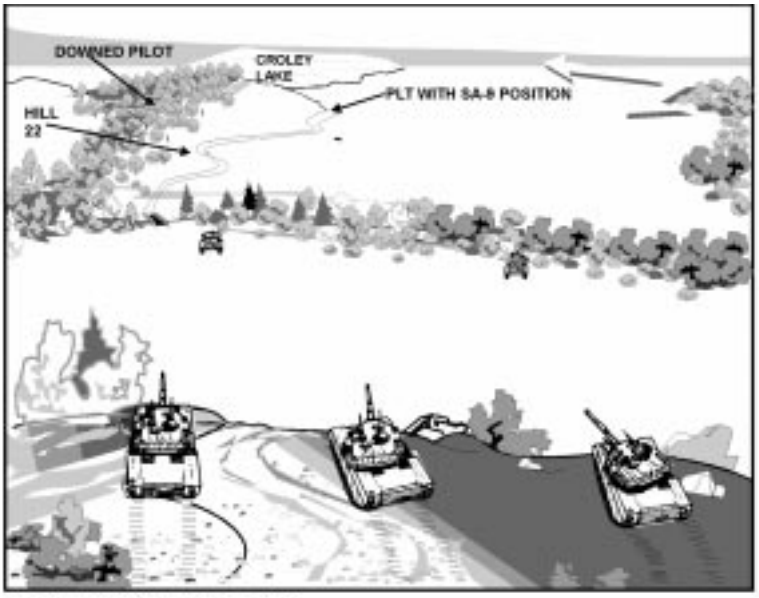
"Screen at Croley Lake"

Situation.

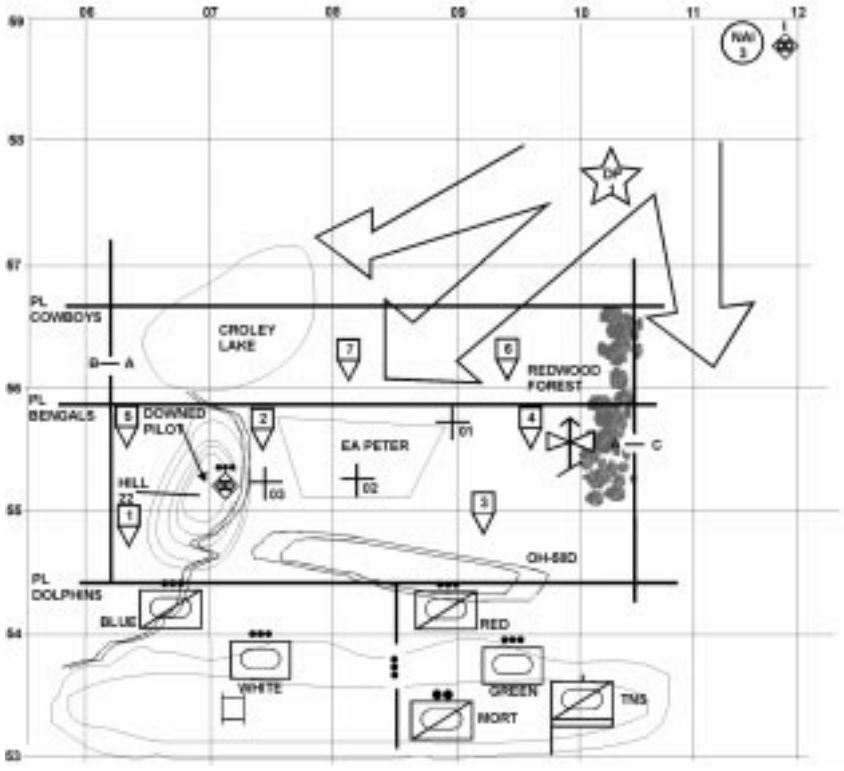
Terrain. The area around Croley Lake favors the defense. It is a mixture of wooded and open areas with undulating hills. The open areas contain farmland with several one-kilometer-square towns. There are numerous two-lane roads and intermittent streams in the area. Maximum visibility is no more than eight kilometers for ground vehicles, but can be limited to 500 meters due to the undulating terrain. The squadron's sector contains three north-to-south, regimental-sized avenues of approach (AA): AA 1, which runs west of Croley Lake in B Troop's sector; AA 2, which runs east of Croley Lake in A Troop's sector; and AA 3, which runs east of Redwood Forest in C Troop's sector. The weather is expected to be sunny and clear with a low temperature of 45 degrees and a high of 78. Winds will be out of the east at 5 mph. Sunrise is at 0530 and sunset is at 2030.

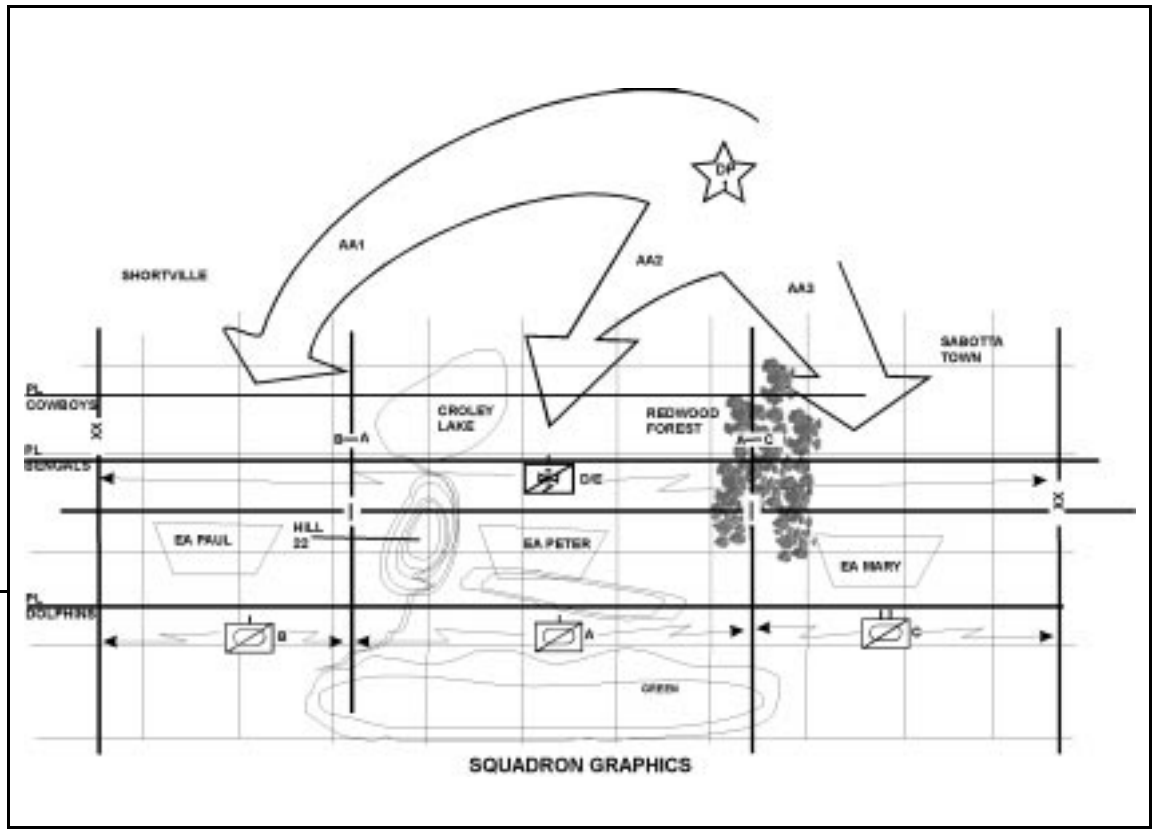
Enemy. The sovereign nation of Greenpieceland had its international border with Kevorkia violated by first echelon divisions of the Kevorkian Combined Arms Army. The 5th Kevorkian Division is expected to continue the attack to the south into the 52nd Armored Division's (AD) sector. The Kevorkians will attack in standard Soviet-style regimental organization/formations to secure a long-sought-after seaport in southern Greenpieceland. The most likely course of action is that the 5th Kevorkian Division will conduct a deliberate attack in the 52nd AD's sector down AA 1 and 2 with two motorized rifle regiments (MRR) forward and one MRR and the tank regiment in the division's second echelon. The lead regiments will utilize an advance guard main body (AGMB) formation for security. The second echelon will reinforce the most successful lead regiment.

Friendly. The 52nd AD was deployed to Greenpieceland to defeat the Kevorkian advance and to provide time for the deployment of more Coalition forces. 1-23 Cavalry conducts a guard along Phase Line (PL) DOLPHINS to destroy enemy reconnaissance forces and to fix



Commander's view from his turret





SQUADRON GRAPHICS

or repel the enemy main body before it can engage the division with direct fire weapons. The division commander's intent is to destroy the 5th Kevorkian Division's reconnaissance assets and force its main body to deploy at PL DOLPHINS. He expects to accomplish this with direct fires from 1-23 Cavalry, combined with close air support (CAS) and indirect fires. The 1-23 Squadron commander intends to deploy three cavalry troops abreast in sector, screening along PL DOLPHINS with the two air cavalry troops (ACT) conducting a screen along PL BENGALS. He expects to use Hellfire missiles from the ACTs and TOW missiles from the ground scout platoons to destroy enemy reconnaissance forces out of enemy direct-fire range in Engagement Areas (EA) PETER, PAUL, and MARY. He also expects to use the ACTs to trigger a CAS strike on the AGMB in EAs PETER and PAUL. The squadron commander's end state is all enemy reconnaissance assets destroyed north of PL DOLPHINS and all AGMBs fixed in specified engagement areas north of PL DOLPHINS.

Troop Situation. You are the commander of A Troop, 1-23 Cavalry. Your troop is conducting a screen along PL DOLPHINS. It is 0545, and your troop had successfully destroyed division and regimental reconnaissance elements that entered your sector at 1800 yesterday. A Troop's task is to destroy the enemy's reconnaissance assets, and the forward security element (FSE) in EA PETER, then conduct a rearward passage of lines through elements of the 52nd AD (FSE destruction is trigger for RPOL). D Troop, screening along PL BENGALS, will identify the follow-on AGMB and trigger a CAS mission to strike them in EA PETER. Your purpose is to provide the 52nd AD with three hours of advanced early warning of an MRR attack through your sector. At 0600, D Troop reports a platoon-sized element consisting of three BMPs and an SA-9 moving south vic CP 2. D Troop reports that the platoon went to ground from CP 2, South 0.5, West 0.3. Your Blue Platoon reports they are taking direct fire from an enemy element in the vic of D Troop's last spot report. D Troop continues to report that one of their OH-58Ds was shot down from CP 2, South 0.4, West 0.7. The pilots are wounded and immobile and the squadron commander orders your troop to conduct downed aircrew recovery and extraction (DARE) operations, and destroy the SA-9 vic CP 2. At 0635, the remaining D Troop OH-58s operating in the western part of your sector reports that a company-sized element is entering your sector vic of NAI 3 (Grid 119589), heading southwest in march formation at 15 kilometers per hour. Your Blue Platoon reports that one of his Bradleys has been destroyed by the enemy platoon in the vic of CP 2. You have the normal complement of support assets for a heavy division cavalry troop. D Troop has priority of indirect fires.

Requirement: In 5 minutes or less, choose a course of action (COA) and issue a FRAGO. The end state of the COA must have the SA-9 near CP 2 destroyed, DARE operations successfully completed, and your platoons arrayed to destroy the company-sized element that is entering your sector. When you submit your solution to the scenario, provide the following: Fragmentary order to the troop, the rationale behind the decision, and a sketch of your course of action. Mail your solution to ARMOR, ATTN: ATZK-TDM, Fort Knox, KY 40121-5210, or e-mail your solution to:

Harrisv@ftknox-dtdd-emh5.army.mil

In the May-June issue of ARMOR, we'll include some of the solutions sent in by readers, along with the author's proposed solution.

On page 47, we recap the September-October issue vignette, "The Battle of Durango Valley," and follow this recap with the author's solution and several others suggested by readers.

-Ed.

LETTERS (Continued from Page 4)

door opener and a cellular phone knows how certain electronic devices can interfere with the working of other electronic devices. Electronic countermeasures to guidance systems can be easily and rapidly produced. Such devices employed by an opponent in great enough quantities would render our "electronically-guided" rounds as ineffective as a "nearby shellburst" renders the operator of a TOW or Sagger. The only thing which will interrupt the flight of a properly aimed KE round to its intended target is another target suddenly masking it. I'll take that interruption over someone "jamming" my rounds any day.

Mr. Crist cites the development of a missile, termed a NAG, in India. The missile was to be employed as the armament for a tracked vehicle. He goes on to speculate how effective such a vehicle could be when coupled with a ground surveillance radar system (GSR) as part of the fire control system — being capable of engaging targets through elements which currently "block thermal sights." While I concede the capabilities of such a fire control system would be formidable, I would point out that the signature of such a system would also be formidable. Surely the author has heard of "cueing schedules," where specific radar systems are activated at specific times for a specific duration of time. Leaving a radar system on indefinitely creates a signature which is easily detectable by the opposing force, and generally results in targeting by his artillery. Such a system, when used as part of a fire control system, would have to be left on indefinitely. We have enough of a concern already with thermal signatures without having to worry about a signature caused by radar! Additionally, the GSR, as part of the fire control system, suffers from the same susceptibility to electronic jamming as all other types of radar (and missiles). I cannot think of anything which could "jam" a GPS, CITV, or GAS.

In his article, Mr. Crist hypothesizes on the rate of fire and engagement capability of an M1A2 with that of a "properly designed, missile-armed FCS." Not surprisingly, he finds the M1A2 lacking. I cannot presume to comment on what he believes a "properly designed" vehicle is. I can only offer the following information: A prototype of a tracked, ground-launched Hellfire system was commissioned by the U.S. Marine Corps in 1989. The prototype, based on an M113 chassis, was completed by Emerson Electronics and Space Corporation (in conjunction with the producer of Hellfire missiles, Rockwell International) in 1991. Upon reviewing pictures and statistics of the system as portrayed in *Jane's Armor & Artillery* (1991-92 Edition), one will notice that the 2 missile pods mounted on the vehicle contain 4 missiles each. Though no figures were given for the basic load, one can safely presume it is less than 25. After firing the 8 missiles in the pods, one would have to reload the pods (exposing a crewman in the process). This pretty much makes the rate of fire question moot. Also, I do not believe that most tankers would want to trade the basic load of the Abrams series (already limited in comparison to the M60A3) for anything less.

The author issues a challenge to the Armor community in the last paragraph of his article: Will we "follow Javelin and the Hellfire on the path to the future?" Having led a platoon of M1A1s in Desert Storm and having commanded one of the first M1A2 companies fielded, I can only say I hope not. I offer this "worst case scenario" based on the author's concepts: Having abandoned the MBT, following "Longbow Hellfire on the path to the future," you now sit in your vehicle under a hail of artillery brought on by your GSR signature. Your last Hellfire in the pod just short-lined because someone in a van on the other side of the battlefield is playing the Electronic Warfare game. Your GSR fire control system has been rendered useless by that same individual. You're about to send someone outside to reload your pods when suddenly an "old battleship" from the opposing side slips behind your position and pumps a SABOT in your grille doors. No thank you, I'll stick with the MBT.

The future of the tank is as finite as our willingness to improve it. Continued developments in the areas of sight resolution, fuel-efficient power packs, composite armor, and traditional KE/CE munitions are "the path to the future," not the scrapping of a combat-proven design.

RONALD J. BASHISTA
CPT, Armor
Dresden, Germany

What Missile Vehicles Miss: The Shock Effects of Tanks

Dear Sir:

Mr. Stanley C. Crist's article, "The M1A2 Abrams: The Last Main Battle Tank?," in the Jul-Aug 97 issue completely missed the boresight panel. In his comparison of past naval forces to the main battle tank, Mr. Crist forgets three important factors that differentiate the MBT from any other vehicle on the battlefield: vehicle endurance, shock effect, and the ability to accurately destroy vehicles on the move. The MBT's ability to withstand fire effects and still reach the objective cannot be compared to the survivability standards of an M2 or M113 chassis. Only an MBT is built to withstand fires from direct fire systems and reach the objective. And once on the objective, the shock effects, both physical and psychological, of a 68-ton vehicle hunting for targets is beyond measure. The MBT allows for accurate KE and CE fires to be taken to the enemy, not waiting for the enemy to reach the maximum distance of a missile system. And these direct fires are delivered on the move, not from a "short halt" mode that obtaining a target and firing a missile from one of Mr. Crist's suggested vehicles might involve.

Now, I'm not some anti-technology unabomber type, afraid of what the future might hold. Having just commanded an M1A2 company, I know the advantages of what technology can bring to the MBT. But victory on the battlefield can never be obtained from an air-conditioned enclosure, engaging targets with missile and radar. Desert Storm showed us that. Victory on the ground is obtained in an "in your face" manner, where the bold warrior takes the fight to the enemy when he pleases.

To paraphrase GEN Creighton W. Abrams, "Tankers are not in the Armor Corps, Tankers *are* the Armor Corps." And as such, we tankers need to unite and decide to keep the main battle tank as the vanguard of the United States Army's offense and defense. Let us not become overwhelmed by what technology can supposedly do for us. Never underestimate the strength and energy of a finely tuned MBT and crew.

MICHAEL C. MORTON
CPT, Armor
Presidio of Monterey, Calif.

Is the New Scout Motto Death Before Dismount?

Dear Sir:

With the advent of the HMMWV-based task force and light cavalry scout platoons, there has been an either/or approach in tactical mission accomplishment. Either the mission is conducted mounted, or it is conducted dismounted. It is nearly impossible to conduct mounted and dismounted reconnaissance that support each other and accomplish the mission.

Under the current HMMWV MTO&E, a task force scout platoon has 10 Hummers with 29 enlisted and 1 officer. Each Hummer is manned by a driver, TC, and gunner. The scouts normally operate in 2-vehicle sections which provide the section sergeant with a total of 6 personnel (including himself) with which to conduct operations. Reconnaissance patrols should consist of 3-5 men. This is where the decision to stay mounted, or hide the vehicles with 2 guards and go dismounted, comes to bear. If the decision is to hide the HMMWVs with guards and go dismounted, the HMMWVs will be unable to cover or extract the patrol.

With the Bradley-series scout platoons, there is a big difference in their ability to conduct mounted and dismounted operations. A Bradley-equipped scout platoon has 6 Cavalry Fighting Vehicles, but retains the same 29 and 1 manning as the Hummer-equipped scouts. Each CFV has a crew of 5 scouts. Section level is still the normal operating level, but instead of having to choose between mounted and dismounted operations, the section sergeant can effectively do both. By dismounting himself and one of his dismounts, and two dismounts from his wingman's CFV, the section sergeants can place a four-man recon patrol on the ground and still man both of his CFVs with a three-man crew. The section sergeant controls the dismounted element while the wingman controls the mounted element. The weapons systems and

sights, along with the mobility of the CFV , are available to support the patrol and/or continue any portion of the reconnaissance mission.

The Future Scout Vehicle, as was briefed at the '97 Armor Conference, will likely have a three-man crew and a total of six FSVs per platoon. This will give the FSV scout platoon a manning total of 17 enlisted and 1 officer. The briefing of the FSV stated that there will be space for a fourth man or additional equipment. The FSV will be loaded with sensors, detectors, digital equi pment and a mas t-mounted sight. It will be high tech in every aspect, but if it is manned by a three-man crew, it will be unable to perform sustained operations. It will breed scouts that focus solely on screens of the whiz bang gadgets.

The minimum manning of the FS V should be four men. Thi s would enable the section sergeant to put three men on the ground for security and rec onnaissance patrols and still be able to man the vehi cles for support and reconnaissance. The fourth man wi ll also enable the crew to perform sus tained operations, as well as perform maintenance on the fully tracked and turreted Future S cout Vehicle.

Given the maxim that he who wins the recon battle wins the fight, it is imperative that scouts are provided with not only the equipment but the personnel needed to accomplish the mission. The FSV is st ill in the des ign phase, so there is still time to ensure that it is manned appropriately. The FSV will replace all Hummers and B radleys at the task force, brigade, and cavalry levels. It will be the reconnaissance platform for 15 to 20 years. We must field the FS V with a tactical view, and not from a numbers-crunch or gadget point of view.

"SCOUTS OUT"

SFC MONTY A. MILLER
Ft. Hood, Texas

Hot Loop Budget, Now Slashed, Was a Bargain for the Army

Dear Sir:

Well, the budget has finally struck the last bastion of intelligence. The Hot Loops are one of the strongest resources for exchanging ideas that I have seen in a long time. It would seem that some of the most knowledgeable soldiers in the A rmor communities have subscribed to these assets and have successfully employed them in the tactical world.

As a National Guard E6 from the world of infantry, I will be among those hardest struck. The practical application of mortar doctrine in a cavalry atmosphere is never easy to adjust to. With the help of a regimental commander as well as others, I was able to improve my warcraft through this asset. This is knowledge that would have cost thousands to learn by trial and error.

Even the m ore trivial conversati ons — where to buy a S tetson hat, for example — saved those soldiers time and ef fort in carrying on the strongest of Cavalry tradi tions. Without this asset, the aviators who sought the hat would have been pressed into a global search fo r the best Stetson, and wasted more of the active soldier 's already limited spare time.

Through this network, I communicated with a corporal from Canada, and found one of the first E 6 tank commanders I ever met in the Army. SSG Sweigart (now SFC) taught me about the role of tanks in the cavalry, and with a resource like this one, c ould have taught others like me when I was a young E3.

As we stare into the abyss of an uncertain future, and as S addam refuses to allow inspectors into chemical plants, why do we cut tools which cost little and teach most? This relatively low-cost training tool, if applied on a larger scale, down to the unit level, could allow new soldiers to ask the question they were afraid to as k in clas s (or may be just didn't fully under stand). It woul d allow the young cavalry XO an opportuni ty to as k a mortar PSG how to properly employ the mortars without showing ignoranc e to hi s own troops, and it would allow the wise old regimental commander a chance to help mentor young lieutenants without the pressure of the senior/subordinate relationship.

So now what is next? I guess I just have to smile, nod and march on. When do we cut programs like the Bradley for the Cavalry , and use assets which work better , cheaper, and without a logistics trail? An asset like the Cav Hot Loop costs so little in comparison to other fatty programs. I guess we really should consider a bake sale.

Splash, Out.

SSG JASON PORT
11C3H
Troop B, 1st Squadron
104th Armored Cavalry Regiment
28th ID(M), PAARNG

Ed. Note: A t press time, funding for this initiative was still under review.

Before We "Quantum Leap," It Might Be Best to Look

Dear Sir:

Recent articles on Army modernization have been troubling because they seem to be absent of any discussion of the trade-of fs for the Army as it leaps into the "Info A ge," and the changes that will impact operations, people, and units.

Skeptics might ask if Army dollars are focused on the most probable war and serious threat, or the mos t politically/scientifically/industrially correct one.

Where does "Informatio n War" fit among other Army priorities, like strategic deployability and light infantry mobility and firepower? Are we "quantum-jumping" because we should, we must, or we can?

Information systems have a huge potential to speed and accurize time-consuming operational tasks, particularly sensor recon and targeting. But other uses have high potential for mischief or worse. They deserve ruthless practical, ethical, philosopical, and even moral proofs, not blind assumptions of cost/benefit payoffs.

It's less than professionally thoughtful to assume away either operational or human concerns in the crush to board the Information Age bandwagon. Here are some of them:

Immediacy Panic. Intervention of hi gher commands in subordinates' operations will increase exponentially with rapid transmission of "certainties," and the com munications needed to meddle. The enemy entering one man's ambush may seem a looming Cannae of friendlies to another.

Data versus Information. Who makes and polices the distinction? Data is systemic chaff unless converted into operationally essential information for commanders and their staffs to analyze, decide, execute, and follow through on FAST.

Invasiveness. In peace or war , undue penetration of all aspects of subordinate units will be easy , dangerous, and wi thout designed lockouts. Insecure, zero-defect leaders will kill speed and smother juniors' initiative, decisiveness, and risk-taking with queries about self-obtained, often unprocessed information. Is our criticism-shy psyche ready to do the knee jerk in "real time" to alleged "perfect knowledge"?

Vulnerability/Fragility. Man and nature can break systems. Start with the "crash" and its causes. Add hackers, weather , triple-canopy jungle, tunnels, decoys, disinformation, anti-sat systems, electronic combat — all threats to "world-is-flat" systems. What's the fail-safe back-up?

Indiscipline. Who or what is in charge? Net control stations still can't discipline the jabbering radios of the world' s most commo-ri ch forces, much less this hydra.

Human Nature. Speed-of-light tools wi ll worsen the immediacy and impact o f corroded values, weak ethics, and evasions. Ambitious situational ethicists bankrupted Unit Status Reports with stubby pencils, not ray guns. They're still around, as are the sad results.

Intrusiveness. Living soldiers deserve some peace, too. W atch divorces soar and retentions sink when work sta tions reach every desk, barracks, and dinner table.

"Control what you should, not what y ou can," is a notion we failed to adopt in a simpler era. W e must, and mold or force-fit it to our new systems, new media, and their proponents.

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site inspections, identification of election polling sites and diplomatic missions with local officials, they are not, and should never be considered a suitable substitute for the Abrams and Bradleys of our cavalry organizations. Remember, the cavalry wasn't sent to Bosnia just to conduct the administrative tasks LT Byrom lists in his article; they were sent to compel the reluctant Entity Armed Forces (EAF) into discontinuing war and subsequently demobilize and reorganize. Events in Brcko during the week of 8 September 1997 would prove the HMMWV advocates wrong in assuming it is great for Peace Enforcement Operations. When faced with an angry civilian demonstration — troopers from TF 1-77 AR and their attached MP company were not feeling very safe as the unruly crowds surrounded HMMWVs, walked and climbed over them, and blocked their exits with civilian vehicles and carts.

Many of us in the Armored Corps agree that we need a light armored vehicle that can perform on both ends of the spectrum of conflict — a vehicle that gives us greater versatility while allowing us to deploy early and offer a credible deterrence. Many vehicles have been recommended and many tested, and while we don't know what the answer is, those who have been on both ends of the spectrum know it is not the HMMWV. Our frustrations, born in the cancellation of the AGS and slow development timelines of the FSV, are causing us to grasp at straws.

Having worked with the HMWWV since when the Army first took receipt of this outstanding vehicle, I have experienced it in every imaginable terrain, from desert sands, to the forests of Germany, to the mountains of Bosnia and in between. It is a workhorse, and in earlier days I would have been one of the first to argue that it was a suitable recon, and maybe even combat, vehicle. My experiences since leaving the training grounds of the 9th ID and the NTC have taught me different. The HMMWV is great transportation, and while the OPFORs enjoy great success with it at our CTCs, it is not a suitable replacement for our anti-armor or reconnaissance vehicles. We cannot, as responsible leaders, continue to put our armored and cavalry troopers in harm's way, in a less than suitable platform, for the sake of budgetary constraints.

As LT Byrom stated, the up-armored HMMWV is an excellent vehicle for peacekeeping operations like Able Sentry in Macedonia, or multinational observer operations in the Sinai, but it has limited utility in peace enforcement operations like JOINT ENDEAVOR/ JOINT GUARD. Its disadvantages far outweigh its advantages in lieu of combat vehicles. To overcome some of these disadvantages, units in 1Bde/1ID maintained two sets of vehicles, HMMWVs for the administrative patrols as well as tanks or BFVs for more robust needs. Under the Chapter 7 mandate for Bosnia (vs. a Chapter 6 for peacekeeping operations) the application of military force or the threat of its use compels compliance to the Dayton Accords and sets conditions for diplomatic and civil efforts to reach long-term solutions. Peace enforcement, as outlined in FM 100-23, *Peace Support Operations*, "may include combat action." The up-armored HMMWV does not have the firepower or protection to compel a would-be-rival into complying with the type of restrictions/requirements we have imposed on the EAF. The EAF comply because they are fully aware that we can roll a platoon of M1s or Bradleys up to their cantonment gate, destroy every weapon system in the compound, and they can't do a damn thing about it. This is precisely why force planners included a heavy (BFV/M1A1) task force with the 2 ACR for their deployment to Bosnia.

Other nations have experienced similar problems with their light, wheeled recon cars. These vehicles are not intimidating. Crowds quickly surround the HMWWVs, trapping the crew inside. They block exit routes with other vehicles or debris and have literally climbed atop the vehicles. The windshields, lights and mirrors are usually the first targets of bricks and bats. On one occasion, the crowd actually attempted to overturn a HMMWV with crew inside. To escape the rock-throwing crowd, the XM1114 crew had to back out down a long street. Mirrors gone, the driver could not navigate the maze of rubble behind them — only the selfless courage of a young trooper climbing into the open hatch, exposed to the crowd's wrath, guided the vehicle backwards. Had there been bullets, rather than stones, flying in Brcko, the outcome would have had much more serious consequences. Although the doors and top hatch do lock, the crew-served weapon is left exposed and unattended once the crew is inside. The crowd gathering around has a physical and perceived moral ascendancy over the trapped crew. Not so with a Bradley or Abrams, or even the larger wheeled vehicles used by some of our coalition partners. Crowds keep their distances and crews can safely operate from an open protected position. Their physical height over the crowd and ability to negotiate obstacles increases their flexibility.

I am also concerned with LT Bryom's excessive focus on "budgets, fuel efficiency, low wear and tear of roads, and protection of infrastructure." Where has the Warrior Spirit gone? Are we breeding a generation of leaders more concerned with management functions than warfighting? Where is the understanding that the Army's mission is to fight and win the nation's wars if deterrence fails? Our mission in Bosnia is about deterrence — and we best deter by demonstrating our unequaled military capability! While resourcing the force is important, junior leaders at the pointy end of the spear should not be worried about such things. Leave the budgets and infrastructures to those staffers who help commanders "manage" resources. The warrior ethos is gradually being replaced by the cost-conscious, cautious, and careerist attitude being reinforced today.

Armor is losing ground to other branches that have adapted better in the new post-Cold War environment. The warrior ethos is falling victim to the zero-defect mentality of efficiencies over effectiveness and don't make waves. While many of our senior leaders tout our success in the Persian Gulf, and decree that we will sacrifice all else for the heavy force mantra, we give up the characteristics that made cavalry and armor the decisive arm of our forebears. We have sacrificed our flexibility, and now we grasp at interim solutions when we should be launching a campaign to cure the problem and retake the high ground. We must have a vision for the future of Armor and Cavalry in the 21st century, and an aggressive program to attain it.

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REVIEWS

Were The Odds Really Even?

by Captain Kevin W. Farrell

When the Odds Were Even: The Vosges Mountains, October 1944-January 1945 by Keith E. Bonn, Presidio Press, Novato, Calif., 1994. $16.95 (paperback).

The issue raised is a good one: how did American soldiers compare to German soldiers when the materiel advantage of the Americans was not a factor? Keith Bonn believes the ideal campaign to examine for this purpose is the fighting in the Vosges Mountains from October 1944 to January 1945. In sheer numbers, the American forces did not possess an advantage, while air cover was absent on account of the weather. In his words, "This appraisal is possible because of such factors as terrain, weather, and the strategic priorities that placed the opponents in this area on a comparable operational and tactical footing (p. 12)." According to Bonn, the German Army was not composed of "invincible Aryan supermen" after all. To the contrary, the operation "provides strong evidence of the superior combat proficiency of American units (p. 12)." Simply put, the odds were even and the Americans proved themselves superior fighters.

Keith Bonn's recent work examining the Vosges Mountains Campaign has received favorable coverage within military history circles. Unfortunately, this may be more the result of the popularity of its conclusions rather than rigorous scholarship. The topic certainly deserves attention, but Bonn's argument is based on a number of inappropriate assumptions which render this analysis problematic at best. Especially troubling is the strident tone of the text in which Bonn seemingly attempts to substitute emotionally charged rhetoric for thoughtful historical insight.

The shrill tone of Bonn's work comes through early when he strongly criticizes two prominent military historians: Trevor N. Dupuy and Martin van Creveld. It is perfectly appropriate, and warranted, to question their methodology and conclusions, as it is with any historian. Both historians, especially van Creveld, have been criticized for being overly impressed by the ability of the German Wehrmacht, while their methodology has, with justification, been considered questionable. However, to accuse such men — Dupuy was a retired U.S. Army colonel and van Creveld is a professor at the University of Jerusalem — of advocating "recommendations that the contemporary U.S. Army should discard its own uniquely evolved institutions and doctrines and instead simply imitate the Wehrmacht (p.2)," is an exaggeration. Furthermore, to castigate a retired (now deceased) Army officer and an Israeli professor and to admonish them of the dangers of their political and philosophical perspectives is simply outrageous. Indeed, Bonn's criticism of these scholars might more appropriately apply to his own work: "such books are actually most useful mainly for instruction in how not to write comparative history (p. 8)."

More troubling than the book's spiteful and amateurish writing style — for example, the simplistic and sloppy repeated reference to foreigners serving in the Wehrmacht as "turncoats" — is the underlying assumption of the work: if one recognizes the superb tactical ability of the German Wehrmacht, it is somehow demeaning to the extraordinary achievements of the American fighting man of the Second World War. This is simply wrongheaded. The notion that because the United States won the war means that its forces did everything better than the enemy is ridiculous. More ominous, it is precisely this type of thinking which limits critical and effective self-evaluation.

From the outset, *When the Odds Were Even*, is operating from a flawed assumption, stated in the book's very title. In the Vosges Mountains, the odds certainly were not as even as Bonn suggests, for as Napoleon tells us, "In war, moral considerations make up three quarters of the game: the relative balance of manpower accounts only for the remaining quarter." Despite the best intentions of Keith Bonn and others, it will be an exercise in futility to find a campaign where the "odds were even" between American and German forces in the European Theater of Operations. The German Army was in almost constant retreat, and it had suffered numerous strategic and operational setbacks, most importantly on the Eastern Front. The appropriate question is not who fought better, but how and why did the forces engaged achieve what they did.

Despite Bonn's quip, "From some accounts, indeed, one would believe that the American logistical situation was so extravagant that U.S. Army Air Force Thunderbolts routinely buried German positions under refrigerators and cartons of razor blades (p. 3);" the truth is that the American logistical situation was extravagant. It was not refrigerators and razor blades, but rather a tremendous amount of bombs, rockets, and artillery shells that shattered many German field formations and set the conditions for success in direct combat. A seemingly inexhaustible supply of M4-based armored platforms (over 100,000!) still had a very difficult time defeating German armor of all types (not just the vaunted Panther and Tiger tanks). In addition to the forces deployed and supplied in the west, the United States provided enough civil and military aid to her allies, especially the Russians, to equip hundreds of infantry divisions. The decisive theater of the war was in the east — that is where Germany suffered over 80 percent of her combat losses. Part of the credit belongs to Lend Lease and hundreds of thousands of trucks and thousands of locomotives and railroad cars provided to the Soviets. Americans fought very well, especially in the latter half of the war, but it would be disingenuous to suggest that American forces were not exceedingly well supplied.

Throughout the work, Bonn repeatedly undercuts his own position. The notion that the opposing units in the Vosges were comparable in morale and capability is insupportable, even though this is the basis of the analysis. In Chapter 3, he analizes the Battle for the High Vosges, presenting the orders of battle at several junctures in the campaign. The list of units comprising the Allied forces in the October and November campaigns reads like a "who's who" of great American units (along with perhaps the best of the Free French forces) and commanders. The 3rd, 36th and 45th Infantry Divisions were among the finest infantry divisions of any theater in the U.S. Army. They comprised the combat elements of the U.S. VI Corps, under the command of Major General Lucian K. Truscott, Jr., "one of the most combat-experienced American commanders by that stage of the war (p. 71)." All three divisions were proven in combat and had seen heavy fighting, to include the relevant "frontal assaults against enemy troops entrenched in mountain defenses (p. 73)." The French 2nd Armored Division, under the command of famed French armor officer, Major General Henri Leclerc, himself a veteran of the North African campaign, was a superbly led and motivated fighting unit. Attached to the 36th Infantry Division was the 442nd ("Go For Broke" or Nisei) Infantry Regiment. Composed of Japanese-Americans, this unit was the most decorated infantry regiment in the history of the United States Army. During the course of the war, its members earned one Medal of Honor, 52 Distinguished Service Crosses, 560 Silver Stars (28 Oak Leaf Clusters), over 4,000 Bronze Star Medals, and an astounding 9,486 Purple Hearts.

The Axis forces opposing, however, were comprised of a mixed bag of misfit divisions composed of the physically infirm, shattered remnants of formerly capable divisions, or obscure ad hoc units created out of desperation. Some specific examples are in order. Bonn describes the 21st Panzer Division as possessing "sound leadership and at least a modicum of cohesion (p. 81)." This may be accurate, but it is all the more remarkable considering the history of the division. After some distinguished and heavy fighting in North Africa in 1941 and 1942, it was virtually destroyed in the Second Battle of El Alamein in October and November 1942, reduced to only 12 tanks. Withdrawing across Libya, it was still able to assist in the defeat of the American

forces at Kasserine Pass before it was finally destroyed in the fall of Tunisia in May 1943. A completely new 21st Panzer Division was formed in Normandy in 1943, and the unit contained some Afrika Korps veterans, but overall it received obsolete foreign tanks and second-rate replacements. In fact, it was the only panzer division in France to be rated as unfit for service in Russia, truly a damning indictment considering the desperate need for units in the east. Despite a valiant effort, and stubborn fighting by its grenadiers, the division was mauled by the British in front of Caen. By the time it had retreated through France and was assigned to Army Group G, it was hardly a formidable fighting formation.

The 21st Panzer Division commander during the Vosges Campaign, Lieutenant General Edgar Feuchtinger, could hardly be considered the equal of most of his American opponents commanding divisions. Feuchtinger had assisted in the organization of the Nazi Party's Nuremberg rallies prior to the war and worked with the Fuhrer's secret weapons programs until he assumed command of the division in 1943. As for the assertion that by late October 1944 the division "was in the best shape it had been in since the Normandy campaign (p. 79)," Bonn offers no evidence. As for data supporting the assertion of the large number of replacement troops and equipment provided prior to the campaign, he cites the U.S. Seventh Army, *G-2 History*, 1-31 October 1944, but admits that, "Unfortunately, the account of the division commander, Edgar Feuchtinger... is too jumbled to obtain an accurate account of infantry personnel strengths, although the information included *does not deny* [emphasis added] the Seventh Army Estimates (p. 245)." Is this really sufficient evidence to show that the odds were even?

More unsettling still is the hodgepodge of irregular units composing the German force. Although I am confident that Keith Bonn is aware of the significance of the Volksgrenadier designation of most of the German infantry divisions and the high number designations of many of them, i.e., 553, he does not point out this significance to the reader, so I will. Volksgrenadier (people's grenadier) divisions were first created beginning in August 1944 in response to the desperate manpower shortages facing Germany, especially in the wake of the destruction of Army Group Center in Russia that June. The brainchild of Heinrich Himmler, the Volksgrenadier divisions represented a drastic reduction in personnel strength (barely 10,000 men as opposed to previous levels of 15,000 to 17,000) and greatly reduced offensive capability. Any division with the title Volksgrenadier means that the division was raised or refitted after August 1944. As for the number designation of the infantry divisions, it indicates the "mobilization wave" under which the division was raised — generally, the higher the number, the later in the war the division was raised. In addition, the so-called "static" or fortress divisions were of quite limited value because their members were considered unfit for service in regular units. Clearly, the vast majority of the German divisions facing the American forces came from the lowest category of units. A few more specific examples are instructive.

Prior to being severely damaged in the invasion of Southern France, the 716th Volksgrenadier Division had been smashed by the British 2nd Army near Caen soon after the Normandy Invasion. It was a static division composed of older personnel — thus by the time the Americans faced it in the Vosges, it had been mangled and refitted twice, never having been a formidable formation in the first place. The 198th Infantry Division, one of the few older and non-Volksgrenadier Divisions involved in the campaign, had a commendable combat record. It had taken part in the invasion of Denmark and the invasion of Russia *where it was continuously engaged from June 1941 until May 1944*. During the fighting in Russia, it had taken part in some of the most savage operations, including the Caucasus and the Kuban bridgehead in 1941-2, Battle of Kiev in 1943, and it was encircled and broke out of the Cherkassy Pocket in 1944. After more than three and one-half years of continuous fighting, during which the division acquitted itself extremely well, it was reduced to a mere shell of its former self. After the breakout from Cherkassy, it was pulled from the line and refitted in France in May, 1944, where its replacements came from the temporary *Böhmen* division of ethnic Germans from Bohemia. Other units, such as the 360th Cossack Regiment, do not need additional comment. While reading the order of battle for the German forces, and then looking up individual unit histories in detail, the thought that kept popping into my mind was one of amazement over how well the Germans did considering the forces that they had and the ones they faced.

A final word should be said about sources. Keith Bonn admits that he had difficulty in obtaining sufficient German primary source materials. He relies overwhelmingly on U.S. documents to support his assertions and conclusions. When he does use German sources that provide a perspective different from the one he is looking for, he is dismissive of them as being, "long on excuses ("*die verdammte Jabos*" [damned fighter-bombers]) and short on analysis (p. 10)." It is obvious, but still needs to be stated: U.S. unit histories are not always rigorous in terms of objectivity and analysis.

This could have been a great book. Keith Bonn is correct when he observes that this is a long-neglected operation, overshadowed by the more famous ones of the European Theater. It is too bad that he seems to believe that recognizing some excellent capabilities of the German Army of the Second World War somehow denigrates the proud and remarkable achievements of the U.S. Army. No one is arguing that Germany won the war, nor is any respectable historian even suggesting that the American effort was not outstanding. One of the recurring aspects of the German military experience has been the willingness to learn from mistakes of past wars and reacting accordingly. As much as Keith Bonn might wish to disbelieve it, the U.S. Army could stand to learn a few lessons from the German experience, while at the same time adding to and capitalizing upon those "uniquely evolved institutions and doctrine" that make the history of the U.S. Army such a great one.

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Breaking the Phalanx, A New Design for Landpower in the 21st Century by Douglas A. MacGregor, Praeger Publishers, Westport, Conn., 1997. 304 pages, $65 (hardback), $24.95 (softcover).

Future historians of American military doctrine may well identify this book as the fulcrum point for American military thought and force structure at the turn of the 21st century. Up front, it should be noted, this is not a book for 'lightweights.' This is not a collection of war stories or a diatribe against what is wrong with the 'system' today. This book looks at the future and offers a plan. It is easy to be a naysayer; I should know, but COL MacGregor did not take the easy way. *ARMOR* readers should be warned that there is some effort required to read and digest this important work. For most of us, I would guess that the price would come first; at $65 for the hardback, this is no cheap title (estimated softcover price will be $25). However, if the value of a book is measured by the time required to read and understand it, then I would suggest that this is well worth the price.

In a very few pages, MacGregor advocates a total redesign of our land-based forces. His vision is an Army without divisions, one with tailored "groups," such as an air assault group and a heavy combat group. These "groups" would consist of several (5-7) battalions of the required type, and could deploy more rapidly than our current divisions. MacGregor's vision of the future suggests as many as 18 of these groups, mostly based here in the United States. Based primarily upon this he has been labeled as a 'regimentalist,' a term that he explicitly denies as applicable to his ideas.

Beyond the redesign of the force, MacGregor does what nobody else has seriously attempted since the 1980s. He takes on the training structures and doctrine of the Army. Specifically, he addresses that most sacred of cows — synchronization. In practice, the contemporary Army still treats warfare as an activity that can be carefully scripted. Because of the concerns with synchronization in operational and logistical planning, not enough attention is devoted in training to the missed or seized opportunities for battlefield success which may result from subordinate initiative

and new fighting techniques and tactics. MacGregor takes this issue on. One should also remember that this book appeared before the new Draft 100-5. It now forms a portion of the discourse upon the concepts embodied in the new doctrine.

This is a well-written book that the professional Army leaders of today and tomorrow need to use and consult as they consider the uncertain future. If there are any shortcomings at all, I would say that it comes in the area of information and its applications in the future. In this area, MacGregor is both a little too positive and too vague about how anything beyond tactical communications affects our forces. He uses a hypothetical scenario to describe how a conflict might unfold once the Army adopts his force structure. Although he mentions CNN early in his scenario, that is the last significant point at which he notes the interaction and role of non-military communications/information upon the military. Admittedly, this is a book about the Army and landpower, and so perhaps information is a little beyond the scope. But given the quality of treatment for the other topics he addressed, I personally would have liked to see more on this subject from him. In MacGregor's book, satellites are never shot down, CNN doesn't show up on the battlefield, the BBC doesn't broadcast from your assembly area, and some pissed off private with a wireless satellite modem doesn't send the group OPORD out to the world via the Internet 12 hours prior to execution. These are potential show-stoppers for the Army of the next century, regardless of the structure.

With any luck, they will form the basis of Macgregor's next book.

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Steel Inferno: 1st SS Panzer Corps in Normandy by Michael Reynolds, Sarpedon, New York, 1997. 352 pages, $27.50.

Michael Reynolds' *Steel Inferno* is an excellent addition to the history of fighting in July and August 1944 and a first rate history of the 1st SS Panzer Corps' chief units, the 1st SS (Liebstandarte Adolf Hitler) and the 11th SS (Hitler Jugend). Coming on the heels of *The Devil's Adjutant,* a biography of Jochen Peiper (sic), this latest effort establishes Reynolds as the best contemporary historian of the German SS. A retired British officer, Reynolds' motivation is to determine why the SS fought so well even when greatly reduced. Specifically, Reynolds sets out to learn how did these units, and the German Army generally, maintain cohesion and continue to produce outstanding combat results under the worst possible conditions and in the face of heavy casualties.

Steel Inferno is a success on a number of counts. First it is a great read. Reynolds likes to recount combat actions and weaves after-action reports and interviews into a great guns and battles account. His own experiences in combat and training, while not imposed on the reader, do inform his account. Reynolds knows his business and is able to interpret historical events in a way which educate and entertain those of us who are students of our profession. General Reynolds does not apologize for the SS. Indeed, he takes the allegations of SS atrocities head-on. Not surprisingly, he concludes that there is evidence to support some of the allegations, but by no means all of them. Reynolds also illuminates the great characters of the SS including Peiper, Kurt Meyer, Michael Wittmann (the leading tank ace of World War II among all armies) and others. Reynolds is particularly effective in making Kurt Meyer, commander of the 12 SS, come alive. Kurt Meyer and his fellow division commander in the Corps, Teddy Wisch, were first-rate tactical commanders who had risen literally from the ranks through the SS.

To a large extent, these two officers were the epitome of the SS and archetypes of what the SS expected of its officers. Both were committed Nazis and committed to the combat arm of the party. Equally, they were brilliant soldiers who understood the synergy of combined arms operations, and exemplified the combined arms tenets of the Blitzkrieg. But they were also committed to effective training, and were first-class leaders. To a large extent, their story answers Reynolds' thesis question. SS units were cohesive for several reasons. First, the leadership was devoted to the followers. The Wehrmacht was, by comparison to the Allied armies, the hallmark of egalitarian principles. Both the Heere, or Army, and the SS led the way among the German services in doing away with the old Junker tradition of officer privilege. In the SS, officers led from the front, and were expected to be technically and tactically competent. Teddy Wisch and Kurt "Panzermeyer" were all of these things. Add to this the surprising longevity of a coterie of key leaders in the SS, and the pattern of SS success begins to emerge. Wisch, Panzermeyer, Peiper, and many others were involved in all of the major campaigns of the German Army and fought on both fronts. When their time came to lead large tactical units, they were ready to do so. Finally, all were good trainers in an army which believed in live-fire combat training to an extent no other contemporary army attempted.

Michael Reynolds' book is useful reading for the Armor force. Reynolds' accounts of training, planning, and execution in the SS illustrate patterns of behavior that produced success and demonstrate considerable flexibility. Our own army could do worse than emulate these positive aspects of the SS. Equally important, SS officers led from the front. Though they relied on subordinates to fight the close battle, they went forward to see conditions in the field for themselves. For all of these reasons, Michael Reynolds' *Steel Inferno* belongs on the book shelves of the Armor Force.

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The Last Hundred Yards: The NCO's Contribution To Warfare by H.J. Poole, Posterity Press, 1996. 400 pages, $19.95 (softcover).

Despite skillful lip service and good intentions, the U.S. military system of training for ground combat has not yet embraced the art of maneuver warfare at the infantry squad level. When we speak of maneuver warfare, we generally speak of armored and mechanized forces thundering around on widespread exploitation of enemy gaps and weaknesses. The infantry squad today is given little credit for independent thought and action, and its NCOs get no credit at all for innovation and resourcefulness.

The Last Hundred Yards is Poole's dedicated effort to apply maneuver warfare concepts to the infantry squad, to allow the infantry NCO to fight smarter, with fewer casualties, increasing the odds for tactical success on the modern battlefield. Poole is a retired Marine lieutenant colonel with extensive infantry experience, both as an NCO and an officer. Since "the last hundred yards in combat is the purview of the NCO," Poole's message is clear — small unit leaders must be trained and allowed to think for themselves.

Even with an attractive cover, stylish production, and a snappy foreword by maneuver warfare guru Bill Lind, the book is really a training manual, a classy FM. Explaining how maneuver warfare concepts (intent, initiative, aggressiveness, offensive spirit, etc.) apply to small unit tactics, techniques, and leadership is not easy, and Poole takes 26 chapters to get his points across. Front-loaded with theory, rhetorical questions, and historical examples, the majority of chapters focus on the tactics and techniques of maneuver warfare application for the NCO and the small infantry unit in a wide variety of tactical scenarios. Poole includes an inventory test, guidelines for free-play exercises, a glossary, and a useful bibliography.

The real meat of his book, however, is contained in the many chapters of NCO tactical application. Poole adequately covers the subjects you would expect — close air support, hasty and deliberate attacks, the defense, anti-armor ambushes, and NCO warfare. He really scores big with chapters on patrolling, the point man, indirect fire, the counter-ambush, and short-range infiltration. "The Ultimate Ambush" offers ingenious and simple tricks for ambushing a much larger force and getting away. Refreshingly, Pool is also a strong advocate of the night attack, and he proposes outstanding techniques for overcoming our psychological fear of the dark, making darkness an ally and a combat multiplier, and for resolving land navigation problems at night. He also provides lengthy and detailed, but much needed, chapters on urban warfare. "The Unbeatable Urban Defense" is a clever and sensible approach coupled with sound fundamentals.

Poole is right — maneuver warfare concepts can be successfully employed by the infantry NCO and his squad, if only we would train to

that goal and then let the NCO be the master of execution and his situation at the squad level. For its valuable message and contribution to modern combat training, this volume still has serious defects. Since it is an FM, it reads like one — wordy, short on anecdotal lessons, but long on quotes by Sun Tzu, Frederick the Great, and Rommel. There are no photos. All the maps and illustrations are poor-quality, dot-matrix reproductions from other FMs, blurry and indistinct. And, at 400 pages, its size and length do not propose a quick read.

Still, Poole is on target. Combat is elusive, fluid, violent, uncertain, surprising, paralyzing, loud, and pretty damn scary. Maneuver warfare kills fewer friendlies and can greatly increase the odds for tactical success, especially for those infantrymen who are face-to-face with the enemy. Doctrine is fine, but blind doctrine is fatal, and we need to adapt our training to permit our small unit infantry NCOs to be mentally flexible, bold, and audacious, with the authority and confidence to make sound decisions and then act on them. And this book is a good start.

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Fields of Battle, The Wars for North America by John Keegan, Alfred A. Knopf Inc., New York, N.Y., 1996. 334 pages, $30.00 (hardcover).

John Keegan is one of the most highly respected military historians of our times. His latest work, *Fields of Battle*, focuses on the wars that made North America what it is today.

Fields of Battle is unusual in that Mr. Keegan uses his personal and professional travels in North America to explain why he writes about American military history, and as the link between battles decades apart in time. Some may find these personal anecdotes distracting or tedious, but they serve a very important purpose: they stress the importance of North America's history, the geography that drove American and Canadian expansion and conflict, and the unique nature of America itself.

This book opens with Mr. Keegan describing his experiences of, travels in, and feelings for North America. This leads inevitably to a discussion of the colonists who brought European "civilization" to the Americas and who fought over the vast land they called home. The following chapters cover the subsequent wars in North America, focusing on specific battles. Mr. Keegan masterfully covers the battles of Quebec, Yorktown, the Peninsula, and the Little Big Horn.

Fields of Battle offers a great deal to the professional soldier or historian. If nothing else, this book is valuable for its insights into the military geography of North America and the driving forces behind American expansion and warfare. For these things, if no other, this book comes highly recommended.

For this author, *Fields of Battle* is doubly meaningful. I have always tended to regard American military history as, for some reason, less interesting or significant than European military history. With typical human contempt for the familiar, I failed to appreciate (or even comprehend) the significance of the many battlefields and historical sites within a few hours' drive from my New Jersey home: Princeton, Trenton, Brandywine, Valley Forge, Monmouth, and Gettysburg, among others. Mr. Keegan treats these places just as he treats places like Agincourt, Waterloo, the Somme, Caen, Omaha Beach, and Falaise. Thanks to *Fields of Battle,* I will never again fail to appreciate the battlefields of America, or the soldiers who fought there. Nor will I fail to appreciate the fact that, for over 130 years, we in America's Armed Forces have kept from our beloved soil the scourge of modern warfare.

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To Hasten the Homecoming: How Americans Fought World War II Through the Media by Jordan Braverman, Madison Books, Lanham, Maryland, 1996. 276 pages, $24.95 (hard cover).

Much has been written about World War II: the battles, the generals, the various theaters of operations, and the requisite summary of equipment used. So another book about World War II would not necessarily pique someone's interest.

But, this is not another book about World War II. It is not a book about the battles. It is not a book for those looking for answers to strategic or tactical questions. Clauswitzians can search elsewhere for their cup of "On War."

No, this is a book about the other theater of operations — the home front. It is also of a global information environment routed through vacuum tubes, newsprint, and newsreels.

Jordan Braverman takes a unique look at how Americans fought World War II at home. How did America live through those tumultuous years? While the conflagration was raging in the Far East, while the V2s were buzzing over London, what was Smallville, USA doing?

Braverman's Smallville setting is Lorna Road, Mattapan, Massachusetts. Lorna Road could be any road in any town in America. But, it was his road for this war. The author provides insightful information about the attitudes of those at home and what people were doing to help the war effort. "In 1944, our schools financed 2,900 planes, 33,000 jeeps, 600 amphibious jeeps, and 11,600 parachutes." According to Braverman's account, the financing came from the buying of stamps and bonds by school children from across the country.

Braverman does an excellent job of chronicling the growing medium of media by providing the reader the context of that chronology against the backdrop of historical engagements. And through that chronology he provides insights to what Americans were doing to support the war effort. It almost has the feel of a textbook with each chapter able to stand on its own. Yet, there is a very real sense that a story is being told.

Braverman describes the different aspects of the media and how that media transmitted information to its publics. He describes the fighting, not in the foxholes but in such struggling government agencies as the Office of War Information. He tells of the agencies that sprang up throughout World War II, struggling to determine how or what information to provide the public.

A 1942 poll revealed that Americans knew very little about the war. Almost fifty percent said they did not know why the war was being fought, and nearly a third would negotiate peace with Germany.

It was through the radio, music, theater, books, cartoons, and advertising that America lived the experience of World War II. It was through that medium that the U.S. government brought the war to the home front and informed that fifty percent.

"Radio was everywhere — at home, at work, and in the automobile. Listeners were only as far away from news, entertainment, laughter, tears, and mystery as the flick of a switch."

To Hasten the Homecoming, is a book worth reading, a book worth keeping.

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Fighting the Bolsheviks: The Russian War Memoir of Private First Class Donald E. Carey, U.S. Army, 1918-1919, edited by Neil G. Carey, Presidio Press, Novato, Calif., 1997. 240 pages, $24.95 (hardcover).

Russian war memoir of a U.S. soldier? This question may be asked in reaction to the subtitle of *Fighting the Bolsheviks*. U.S. Army soldiers of the 339th Infantry Regiment did serve in the Allied force that intervened in Russia following the Russian Revolution. U.S. soldiers fought, killed, and were killed by Bolshevik soldiers. PFC Carey's memoir is valuable primary history that serious students of World War I should consider reading. PFC Carey's diary is detailed and well-written, requiring very little editing. It is however, not gripping or thought-provoking in the manner of *All Quiet on the Western Front*: the researcher looking for details of U.S. Army service on the Archangel Front will not be disappointed, but the average reader will be. Details of guard duty, drill, inspections, and troop movements written in journal form are not in themselves inspiring. *Fighting the Bolsheviks* is for the serious historian researching or interested in the Allied in-

tervention; those with a passive interest in the topic would be better served by a secondary source history, such as Maddox's *The Unknown War with Russia*, or Rhodes' *The Anglo-American Winter War with Russia.*

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Leadership Secrets of the Rogue Warrior by Richard Marcinko, Pocket Books, New York, N.Y., 1996. 155 pages, $14.00 (paperback).

If a newly-commissioned lieutenant were to apply the principles outlined in the book *Leadership Secrets of the Rogue Warrior* to his tank platoon, he would fail miserably. The book does not follow many of the principles of leadership outlined in FM 22-100 *Military Leadership*.

Leadership Secrets of the Rogue Warrior contains Mr. Marcinko's Ten Commandments of SpecWar (a term he uses for Special Warfare). There is a chapter for each of the commandments. In each chapter the author follows the same three-part format. The author discusses a particular commandment in the first part of the chapter to explain why the commandment is important. He then discusses examples of how this commandment has been applied to the environments of both war and business in the remainder of the chapter. The author is directing his message to those in the business community who lack their own individual leadership skills.

The examples from his military endeavors were mostly from what the author claims were his own experiences, some of which I thought were a bit difficult to believe. The example he gives of conducting a HALO jump at sea and opening his chute at the masthead of his ship (138 feet above the deck), was the most difficult to believe. Readers should consider some of the material in this book with a grain of salt, but can appreciate the author as a very talented story-teller.

The book contains no pictures or diagrams. It does however, contain most of the clichés and pearls of wisdom I learned from my drill sergeant. Most of the words are just as small, too, so the writing style is easy to read. Additionally, the author displays all the vanity that my drill sergeant did.

Leadership Secrets of the Rogue Warrior does have some merit; it is interesting reading for those who like Rambo-type fiction. There are numerous reputable books on leadership which could be studied by serious students of the subject, but this is not one of them. I would only recommend this book to leaders who have already proven themselves, and desire some entertainment.

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Commander's Hatch (Continued from Page 5)

tion on these systems. With the assistance of our Mounted Battle Lab, AOAC students will receive additional instruction on these systems, beginning in late FY98. This instruction will be expanded as the actual systems are fielded to the schoolhouses in FY 99, and will be fully integrated into both classroom instruction and simulation exercises.

AWEs have clearly demonstrated that the 21st century mounted leader will also operate in an environment where improved digital technologies provide increased situational awareness and concurrently increase the demands on the commander and staff to more rapidly gather information, analyze, recommend, decide, and, most importantly, execute. This suggests a clear requirement for execution and digital leader reaction drills to improve leader decision-making competencies. In a previous "Commander's Hatch," I noted that Fort Knox already has the nucleus for these drills — the Force XXI Training Program, parts of which are already being used in the force. Two key components of this, the Battle Staff Training System (BSTS) and COBRAS III will be introduced into the AOAC POI this year. BSTS is a computer-based, self-paced program designed to train individual staff skills. COBRAS is a comprehensive package of Training Support Packages (TSPs) designed to provide the heavy brigade commander a series of vignettes, using constructive and virtual simulations, to train collective staff skills.

We are also at the forefront in incorporating various instructor-assisted technologies to make our instruction more accessible to the Total Mounted Force and more efficient and effective for resident and non-resident instruction. This also supports the Army and TRADOC's distance learning and classroom XXI initiatives.

One such initiative currently being tested with the Iowa National Guard uses the Internet and other instructor-assisted technologies to teach the military decision-making process to non-residents using SGIs here at Fort Knox. Another multi-year initiative, which will begin in FY 98, will transform the Armor School, beginning with Skidgel Hall, into a 21st century advanced learning environment.

This future University of Mounted Warfare will be laptop-based. It will provide all students access to the Internet, creating a library without walls. Residents and non-residents will have access, not only to information here at Fort Knox, but to other TRADOC schools, other branches, and the TO&E Army. A central terrain server will provide a visual terrain environment that will support a range of terrain formats, including 3-D, 2-D, video, and animation. This, in conjunction with emerging digital leader reaction tools and Force XXI Training products, will allow students to visualize not only terrain, but also conduct COA development, wargaming, and multiple leadership execution drills using the suite of virtual and constructive simulations available at the school. Instruction and use of emerging C2 technologies and systems such as FBCB2 and ATCCS will occur in hybrid classrooms, which will also serve as battalion and brigade TOCs during simulation exercises. This learning environment will also provide the vehicle for asynchronous and synchronous instruction to non-residents, both active and reserve. As an example, a National Guard captain would have up to a year to complete the asynchronous portion of AOAC in a non-resident mode. He would then receive the non-resident synchronous portion of the course over 10 weekends in his home state, taught by SGIs here at Fort Knox via teleconferencing. Finally, he would complete the course by coming to Fort Knox for a resident 2-week simulation-based phase to validate what he had learned.

Resident instruction, while perhaps reduced from present lengths, would still occur at Fort Knox. The socialization process and shared learning opportunities that exist in the small group will in the future, as they are today, remain as critical components of the officer's learning experience.

This University of Mounted Warfare will transform not only Skidgel Hall but ultimately the entire Armor School, encompassing not only OES but also IET and the NCO Academy. Members of the mounted force, both resident and non-resident, whether they are trainees, NCOs, or officers, will have access to a comprehensive suite of education, training, informational services, and materials. Education and learning will become a life-long experience for the mounted warfare community, beginning with their initial arrival at Fort Knox and continuing through their service in the mounted force.

FORGE THE THUNDERBOLT

Bladders Carry Extra Fuel for the M1

by Michael Calleja,
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Following Operation Desert Storm, Congress directed the development of a system that would increase the range and maneuverability of the Abrams tank during war and peace-time scenarios. As a result, the Army implemented the design and support of the Supplemental Fuel Carrying Capability (SFC2) program, which is now available to Abrams tank units. The SFC2 is a supplemental refueling system intended to extend the operational range of the M1-series Main Battle Tank (MBT) by providing additional onboard fuel availability and the capability to refuel other vehicles. This supports fuel requirements of the AGT1500 turbine engine during idle and in an active field environment.

Extensive testing has been conducted and successfully completed, and the system meets operational requirements. A Production Validation Test (PVT) of the SFC2 for the Abrams tank, TECOM Project No. 1-VC-080-1A1-224, was initiated at the U.S. Army Yuma Proving Ground (YPG). Tests were conducted to determine the performance characteristics of the SFC2 while refueling the Abrams tank, and to provide information/recommendations to the test program sponsor on the fielding of the SFC2. During the course of the testing, several product improvements were recommended, including the addition of a Velcro strap to serve as a positive safety device on the turret release mechanism, and a redesign of the bladder to decrease the possibility of internal failure. After incorporation of these improvements, the requirement of 30 refueling operations per bladder was successfully accomplished without any incident or failure. This system is safe and ready for use by Abrams units.

The SFC2 kit is composed of two 55-gallon fuel bladders, two hose assemblies with dispensing nozzles, strap assemblies to secure the bladders to the tank, a set of instructions (the technical bulletin), and a refuel adapter kit. Fuel is dispensed by driving the tank onto the fuel bladder (dispensing under pressure), or by gravity, leaving the bladders mounted on the tank. The SFC2 is capable of being refueled from the standard Army refuel system with the refuel adapter kit. The kit has been classified as an Additional Authorized List (AAL) item and is listed in the AAL section in the back of the appropriate tank (M1A1/M1A2) operator technical manual. The SFC2 kit, NSN 2910-01-434-4961, can be requisitioned through normal supply channels. The kit will arrive in cardboard shipping crates and needs to be stored under cover in a dry environment. These kits have a shelf life of four years and a wear limit of no more than 30 uses. The Abrams Logistics Management Division, SFAE-GCSS-W-AB-LD, DSN 786-6482, E-mail Address: callejam@cc.tacom.army.mil, can provide additional information on the SFC2.

SFC2 bladders are carried at turret rear.

Crewmen set bladders in path of tank's tracks.

Tank's weight on bladder creates system pressure.

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