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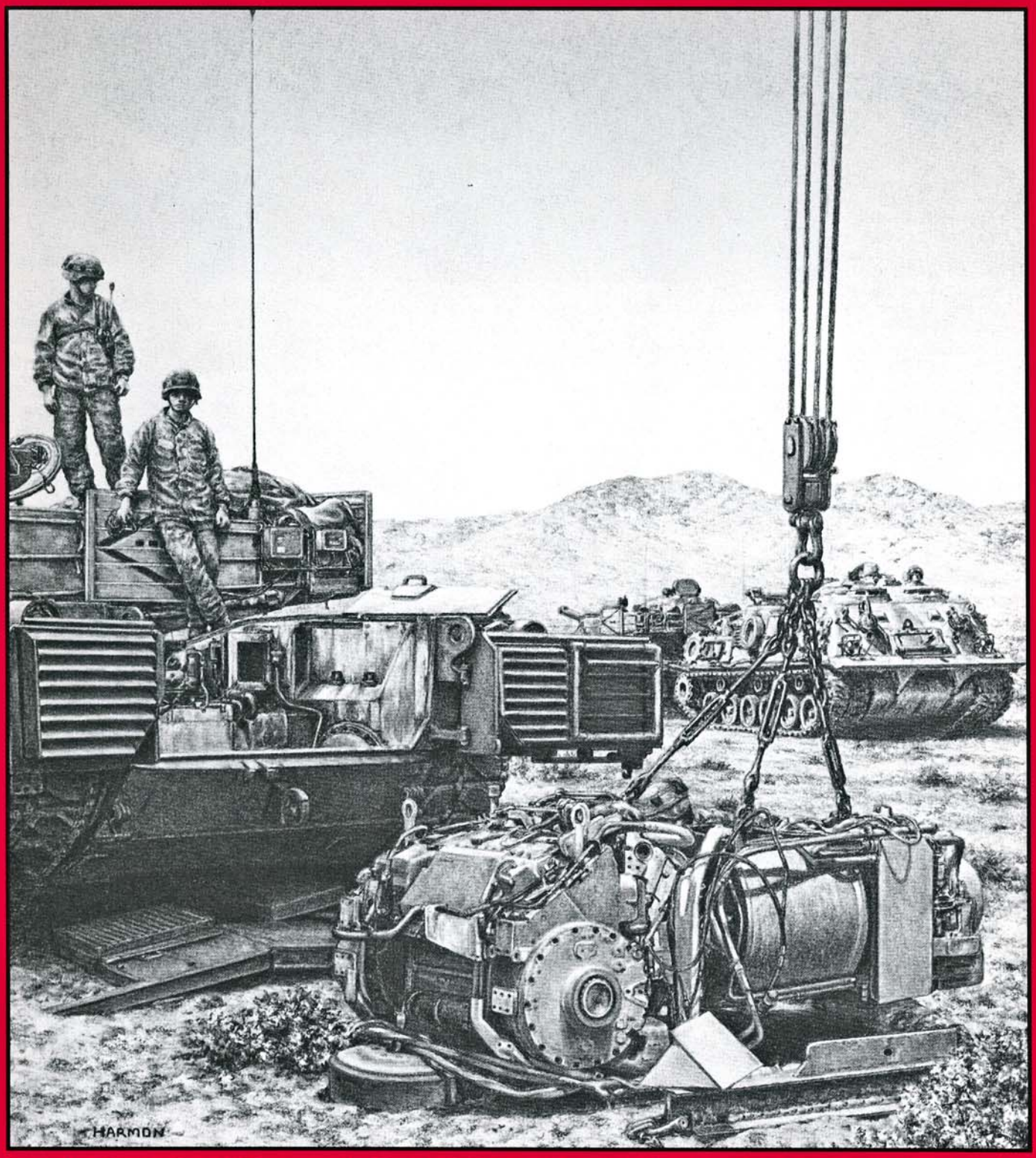

Lost Combat Power: Breaking the Maintenance Bottleneck

PB 17-96-1

January-February 1996

That you are reading material relevant to your profession right now speaks highly of you, no matter the location nor the aesthetics of your reading surroundings. Maybe you are sitting in the dayroom waiting your chance at the pool table; maybe you're in the S3 shop waiting for those briefing slides to spit out of a too-slow laser printer; maybe you are just relaxing for a few minutes at your home or under a desert shade; or maybe you've just returned from a patrol in a foreign land. It doesn't matter where you are, because you are engaged in professional thought and growing. This critical thinking business is a skill that one must regularly practice, practice, practice. It's one of those tools that the Chief of Armor says should be in every one of our tool bags. There are no boundaries; if you have a few minutes to sit, you have a few minutes to get smarter. I believe that there are a number of articles inside this issue which afford you such training opportunities.

Judging from the amount of recent mail on the subject, there is a great deal of angst at the company level regarding the look of future armored force operations. That distances between elements of our digitized formations will increase seems certain. That commanders at levels above the company will know more about the threat facing them and their subordinate units than their ancestors ever did isn't even debatable. That the higher level commander will one day know more about what is happening along the front line trace, and beyond, than do the men occupying and scanning from the battle positions. . . what of this?

In this issue, several contributors are thinking very much about what their piece of the battle space will look like — how much they will be able to see — how much their superiors will see — how much their superiors' superiors will see. They wonder about the resulting effects on the chain of command, and just how much help a future company commander will get. What is the right amount of help, and when does the help begin to degrade the freedom of action with which we historically have empowered our junior commanders? Captains Bateman, Brown, and Pryor ask incisive questions that deserve answers. They posit a future that, if we didn't know it was feasible, would have only a few years ago sounded like it might have come straight off the pages of a science fiction journal. These leaders and critical thinkers want to know that doctrine and technology are advancing hand in hand so the tactics, techniques, and procedures are right for the next time we squeeze rounds off at targets that can shoot back. It is a challenge for any bureaucracy to keep abreast of change, but it seems to me that this is happening in the armored force; you need only read on to see evidence of it.

There will soon be a new way for you to react to this and other issues in *ARMOR.* We plan to select 2-4 articles from a past issue that generated reader interest, e.g., letters to the editor or e-mail to the editor, and post them on the World Wide Web (WWW) at the Fort Knox home page site for all to read. If you can browse to the Fort Knox home page, you'll be able to access "Issues in Armor." We will include any letters we've received on the article plus create an e-mail feature in order that you can send in further comments which we will, in turn, post and update to the WWW site every week. Frankly, we aren't sure how much more work this new feature will entail, but we are very excited to give it a go. See page 12 for a fuller description on our vision for "Issues in Armor."

— TAB

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LETTERS

Key to Improve Accuracy: Tighter Gun Tube Specs

Dear Sir:

Major Held's article, "Zeroing In," from the May-June 1995 issue, has done a good job of highlighting the issues the Armor community must consider when selecting or modifying tank gun calibration procedures. A key element of Total Quality Management is continuous improvement, and improving hitting probability certainly is a worthwhile goal. This policy decision is ultimately one to be made by the user, within the constraints of cost and complexity, based on the best information available.

The performance of the 120mm gun system during Desert Storm would appear to provide a measure of effectiveness of the current policy. There is always the question "Can we do better?" As Major Held suggests, to make rational decisions one must know the relative magnitude of the individual error sources and the cost of correcting that error.

Current calibration policy has its genesis in a pioneering series of user tests and experiments carried out by the Armor and Engineer Board during the 1970s. The principal investigators were (then) Captains Jim Brown and Bob Kloecker with analytical support by Dr. Charlie Leake. The effort began with a complete analysis of various boresighting schemes and progressed through the characterization of boresight/zero relationships.

These tests, and subsequent tests involving the 120mm gun, clearly demonstrated that *the major source of tank-to-tank variability is the gun tube.* The variance is most pronounced when firing the more energetic rounds. Two of the possible alternatives proposed by MAJ Held (Surrogate Zero and Silent Zero) deal exclusively with gun-to-gun variabilities.

As an alternative to producing guns which have operationally significant variances in point of impact and requiring the user to compensate, I would suggest that the variances be addressed directly by the addition of an accuracy performance or acceptance specification for the gun tube.

For a number of years, the procurement specification for tank gun ammunition has included a performance requirement in terms of allowable round-to-round dispersion. Each lot of ammunition is required to demonstrate that it meets this requirement.

The specification for the tank gun is stated only in terms of manufacturing requirements. Tolerances, hardness, and finishes are specified, but there is no stated performance requirement. More importantly, scientific relationships between manufacturing specifications and fall of shot are essentially unknowns.

A performance specification which required all guns to shoot uniformly would ensure that the user can continue to use the simple and effective fleet zero policy. This sort of requirement places demands for uniformity of manufacturing on the producer. Given the number of years of U.S. 120mm gun manufacturing, it is entirely reasonable to expect that this level of process repeatability is achievable.

The following is offered as a strawman criteria. "The gun in a fixed mount will be boresighted using the troop issue boresight at a target placed at 1000 meters. After boresighting any ammunition-unique corrections will be applied, i.e., superelevation and jump. Five rounds of service APFSDS (normally the most energetic round) fired at the target shall demonstrate a mean center of impact (MCI) not more than .35 mils from the expected point of impact.

MAJ Held has done real service to the community by presenting the issues. Hopefully, the Armor community and its developer friends can work together to accomplish continuous improvement.

RICHARD F. PELL
COL, Armor, Retired

A Few Thoughts About the Digital Battlefield

Dear Sir:

As the Army transitions into the 21st Century, there is an exponential increase in the senior commander's access to battlefield information. In the 1st Cavalry Division, the division commander can locate every platoon leader using his Enhanced Positioning Location Reporting System (EPLRS) situational awareness terminal (SAT). The POSNAV system on the M1A2s in the 1st Cavalry Division provides leaders the locations of their tanks via Intervehicular Information System (IVIS). The availability of Global Positioning System (GPS) devices at the squad level enables leaders at the lowest levels to know their location within ten meters. Tactical Satellite Communications (TACSAT), once found at the highest command levels or with Special Forces units, are now available for use by heavy maneuver brigade commanders. The senior commander's ability to have almost immediate information on a unit's whereabouts and the enemy disposition facing them, implies that division commanders could begin very shortly to control the tactical employment of platoon-sized elements. Therefore, the question of "detailed control" versus "directive control" of forces becomes the centerpiece in the debate over how we may use this technology and fight in the next century.

The British doctrinal term "directive control" (often confused with the German concept of *"Auftragstaktik,"* means to give subordinates a mission and allow them to determine the best way to synchronize battlefield operating systems. The advantage of this method is that the commander closest to the fight, with the most information, has the freedom to make decisions. Directive control traces its development from infiltration tactics in WWI, through WWII, to the writing of the US Army's FM 100-5, *Operations.* The Army's concept of giving subordinates the freedom to exercise initiative and make decisions led to the often-used maxim, reinforced by lessons learned at the National Training Center, that battles are won at the platoon level.

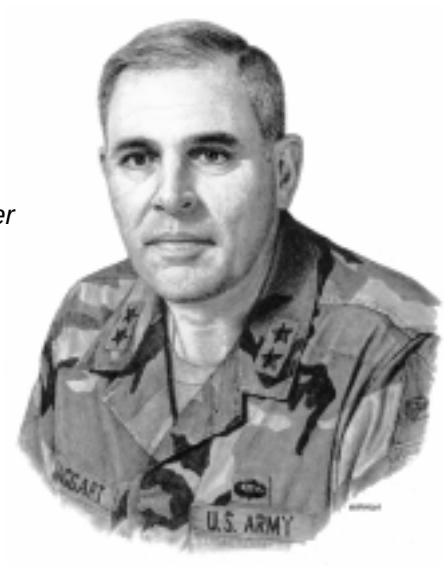
"Detailed control" gives subordinates specific instructions on what to do and how to do it. This type of command and control is usually associated with the former Soviet Red Army. Although it ensures a unity of command and effort, there is a minimal amount of tactical flexibility at the lower levels of command. The National Training Center has also shown us that detailed control often fails at the company and platoon level, where the fog of war is most pervasive and a correct assessment of the situation is difficult to determine until the battle is over.

Potentially, senior leaders' access to information provides them with a more complete picture of a particular tactical situation than the platoon leader. The division commander will not only see where a particular platoon leader's tanks are on his SAT terminal, he can utilize the intelligence gained through many other sources to see the enemy disposition throughout the battlefield. This will enable him to literally see whom the platoon leader is fighting, as well as whom his AH-64 Apaches are attacking in the deep fight. He will also see whom the Tactical Combat Force (TCF) is fighting in the rear from his command vehicle. The division commander is able to dispatch commands via TACSAT, or send a message via EPLRS almost instantaneously. Will digital capability make the division commander less likely to allow the platoon leader to exercise initiative? Has technology changed our doctrine already? How do we train leaders to process all the information that is available on the digital battlefield?

These questions and others confront the Army as it continues to modernize at a rapid pace. In fact, the Army is at a point where the units of Force XXI have the same or less of a digital and technological capability than the two heavy contingency divisions. While Force XXI units conduct testing to meet both the Army and contractor test requirements, the two heavy contingency divisions must leverage digital technology for today's battlefield requirements.

Continued on Page 48

MG Lon E. Maggart
Commanding General
U.S. Army Armor Center



Armor and Cavalry in Transition — Time to Inventory Your Tool Bag

Force XXI is causing us to reexamine the tactical, technical, and leadership abilities required of our warfighters to lead mounted soldiers and units into combat and other operations. As the architect of mounted leader development, the Armor Center is working hard to define what tools — both new and old — are needed in the future. While this is no easy task, the quantity and quality of our experimentation and developmental work with digitization, armor in OOTW, light armor and cavalry units, decisive operations concepts, and many other efforts have given us a unique perspective on the future. This perspective yields many insights into what the "tool bag" of the 21st Century mounted warfighter might contain.

While the Armor Center continues to define and refine leader skill requirements, it is imperative that each of our quality leaders and soldiers perform a personal assessment or "inventory" of their professional skills, knowledge, and abilities. Only through a realistic assessment of our current abilities will we be able to develop instructional and training programs to meet future challenges.

The tool bag analogy is useful to describe our challenge in this area. From my vantage point, it appears that we have many tools that have worked well in the past, continue to work in the present, and will most likely be useful in the future. Most of our leadership skills fall into this category. Based on recent work in digital operations, new tools will be required to maximize the effectiveness of these new capabilities. Technical knowledge, computer literacy, competence with information technologies, and tactical communications skills will be prerequisites to success in the future. In addition, some of our tools may require modification to adapt to future battlefield requirements. Current planning skills and mental tasks such as visualizing, conceptualizing, and synthesizing combat information take on new dimensions and importance on an information-rich battlefield.

While the exact details of future leader skill requirements are not fully known, important trends are emerging. It is within these trends that we all must focus our efforts to prepare ourselves for tomorrow. These trends include:

- Leaders will perform a greater number of tasks in the future than today.
- Junior leaders will need higher order mental skills, such as visualization, memorization, and conceptualization.
- Leaders will need creative and innovative abilities.
- Information management skills will be paramount.
- Communications with multimedia systems will be the norm.
- Technical competence with information technologies has become a core requirement.
- Alternative problem-solving skills, such as critical and inductive thinking, will be needed.

Preparing ourselves for the future is a formidable challenge. Many of the potential future requirements are subjects that are currently not developed in formal instruction or unit training programs. We must find innovative methods to introduce and hone these skills and capabilities in the great leaders that operate our mounted force. Only through a complete effort within all three pillars of leader development — institutional, unit training, and self-development — will we continue to excel as professional warfighters.

I encourage you to make time to reinventory your professional tool bags. Lean forward, anticipate, and take action today to ready yourself for success in the future. Self-assessment is the critical first step toward transition to the future and Force XXI.

On the way!

CSM Ronnie W. Davis
Command Sergeant Major
U.S. Army Armor Center

Excellence In Armor

If you are a gutsy, stellar performer that faces challenges head-on and plans to climb to the top of the mountain, then I have got just three words for you — Excellence in Armor.

In this issue, I want to talk about a program that is near and dear to my heart. It is a program that exists to catapult tankers and scouts who want to get ahead, and who are not afraid to work hard to get there. Read on!

The purpose of the Excellence in Armor program is to fill tank and cavalry vehicle commander's hatches with our best, brightest, and most highly motivated soldiers, whose performance is consistently outstanding. In essence, Excellence in Armor identifies and recognizes those soldiers who are a measurable cut above the rest. Additionally, the program provides incentives to help retain these quality soldiers.

First, some history. The Excellence in Armor program was initially proposed by the United States Army Armor Center, in May 1984, to the Department of the Army Deputy Chief of Staff for Personnel. After much review, the program was approved for implementation in October 1987.

Since 1987, enrollment has increased to well over 3,080 active duty and 821 Reserve soldiers. As more soldiers see the benefits of the program — that is, see their contemporaries advance — I expect it to grow even further.

The program is open to Career Management Field 19, private through sergeant first class. Enrolling is quite simple. Meeting the standards for enrollment is not!

Soldiers can either be enrolled during One Station Unit Training (OSUT) or by their unit. However, let me point out now that once in, failure to maintain Excellence in Armor standards will cause you to be disenrolled. Once you have been disenrolled, you cannot be re-enrolled. Later, you will see why soldiers benefit by staying in the Excellence in Armor program.

The OSUT selection process begins with the drill sergeant recommending a soldier in the 10th week of training. He bases his decision on the performance, motivation, and leadership potential displayed by the soldier. The soldier also appears before a battalion or squadron level board to confirm his nomination.

During OSUT, Excellence in Armor soldiers receive more than 50 additional hours of training in Skill Level's One and Two.

Before graduation from OSUT, the soldier is formally enrolled into Excellence in Armor, provided he meets the following minimum standards:

APFT Score	230
Weapons Qualification	Sharpshooter
End of Block Tests	Pass All
Armor Crewman Test (ACT I, II, III) or Scout Gunnery Skills Test	Passed All With No More Than One NO-GO Per Test
Armor Stakes	Pass All
High School Diploma or Equivalent	(Waiverable by Bn/Sqdn Cdr)

Once enrolled, his DA Form 2-1 is annotated on line 19 with Excellence in Armor and the enrollment date. Upon assignment to his first permanent duty station, his orders will indicate that he is an Excellence in Armor soldier. He also hand-carries a letter to the gaining commander informing him of his Excellence in Armor status.

Excellence in Armor enrollment at unit level occurs when a soldier is recommended by his commander and has met the following minimum standards:

- Satisfy unit commander's evaluation of technical proficiency and potential for leadership. This is the most important element.
- Achieve an APFT score of 260 points or higher.
- Pass the Common Tasks Test (CTT).
- Pass the Tank Commander Certification Test Level I.

The test by assigned vehicle is:

M1 Series Tank	FM 17-12-1-2	TCGST
M3 Bradley	FM 21-1	GST
M998 (HMMWV)	FM 17-12-8	GST

- Qualify Sharpshooter on assigned individual weapon.

NOTE: Soldiers enrolled during OSUT have one year to meet the above standards once permanently assigned to a unit, or they face disenrollment.

Commanders who have a soldier not meeting one of the above standards may request a waiver under certain circumstances. One example might be a soldier who consistently scores high on the APFT, has a temporary profile, and cannot take the APFT. Once a soldier

Continued on Page 47

Regenerating Combat Power at the National Training Center

by Lieutenant Colonel Wayne D. Taylor, Major Tina Johnson, and Captain Clay Hatcher

The Nightmare: Combat Power Has Slipped Away

The Armor task force executive officer (XO), "Earthquake 5," stood at the base of the Arrowhead in the middle of his Unit Maintenance Collection Point (UMCP) shaking his head. The combat power of his task force — his M1/2/3 fleet — had just dropped to 58% after the move from force-on-force to live fire at the National Training Center (NTC). He had received his 0500 combat power update from his Battalion Maintenance Officer (BMO) that morning and was shocked at the 22% decrease. Before the move, his combat power had been 80%, but now he had 24 non-mission capable (NMC) M1 and M2/3 armor combat systems. He reflected on the past six days to try to identify what had gone wrong.

The combat power of Earthquake 5's task force had degraded slowly at first. He was down 8 to 10 combat systems per battle since the move-out day. The maintenance teams had repaired more than six vehicles each day, but the rugged terrain of the NTC consumed an equal number of vehicles daily. Arrival of parts was slow, and his BMO had not set up the UMCP in one place long enough to completely diagnose all the systems reported NMC. Now the situation had become much worse. After performing the fire control checks required prior to shooting ammunition during NTC live-fire training, it was painfully obvious that the crews' Preventive Maintenance Checks and Services (PMCS) during the force-on-force training had not included M1/2/3 turrets.

Although the XO was shocked at the steep fall-off in his combat power, his predicament occurs all too often at the NTC. His battalion's combat power had shrunk because of several serious but addressable problems in his maintenance and repair parts distribution operations. For the past 12 months, the Forward Support Battalion (FSB) logistics trainers, called the Goldminers, have worked with maneuver task force trainers to document systemic maintenance failures of the rotational units, as well as a number of crucial activities that lead to higher combat power across a rotation.

We begin this article with an overall view of the Army's maintenance and repair parts distribution "process" in the deployed, austere environment of the National Training Center. We then present recent data on how well, on average, units have made this process perform to provide combat power. Throughout, we provide examples of proven techniques and procedures that will lead to significant improvements in maintenance and repair parts distribution at the NTC. Key among these techniques is the preparation for an effective Brigade Combat Team (BCT) maintenance meeting, which we address in some detail. The payoff for implementing these suggestions is increased combat power, and more fully mission capable M1s and M2/3s crossing the Line of Departure (LD) in each battle.

Maintenance and Distribution Process: The Big Picture

Figure 1 represents the brigade maintenance process. (The illustration is generic — particular units may have variations on this basic scheme.) This process starts when the crew performs Preventive Maintenance Checks and Services (PMCS) and identifies a NMC fault. This fault is noted on the maintenance forms 2404/5988E. The maintenance process ends when the fault is repaired or a part is applied to the combat system to render it FMC. Although this appears simple at first glance, the process has many substeps that can strongly affect the time it takes to regenerate combat power at the NTC.

Based on a 12-month analysis of available data at the NTC, it takes an average of 6.7 days from when a com-

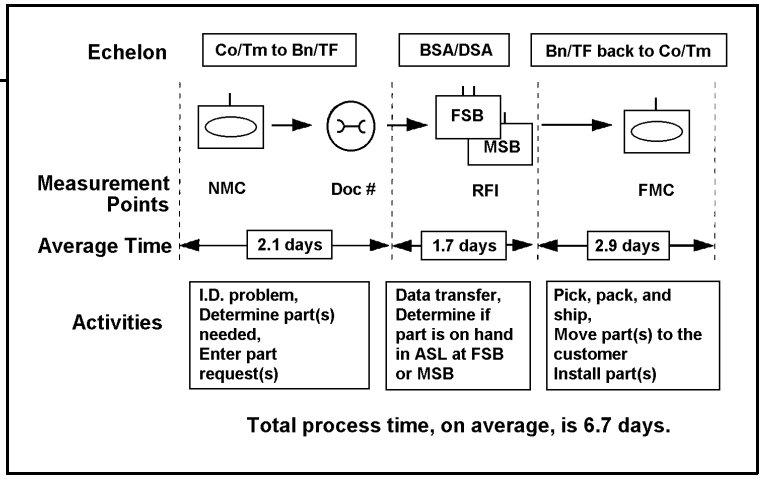


Figure 1. The maintenance and distribution process at the NTC.

bat system is observed NMC until it is observed FMC. This time breaks down into three measurable segments: NMC to the document number (2.1 days), document number to release for issue (RFI) (1.7 days), and RFI to FMC (2.9 days). This analysis is based on a sample of 50 randomly selected, high-priority repair part requisitions from each of the past 12 NTC rotations. For a requisition to be included in the sample, the requested repair part had to be on hand at the FSB or MSB. Thus, in this average of 6.7 days, we have not included backorders, shipments from a rotational unit's home station, or depot-to-NTC deliveries.

A system that performs at this level, supporting vehicles operating in a rugged environment like the NTC, has a major impact on combat power in the course of a 14-day NTC rotation. Figures 2 and 3 show the average M1 and M2/3 combat power, based again on 12 NTC rotations. Note the dip in combat power at training days 6 and 7, when the change to live-fire training normally occurs. This is where we left a stunned "Earthquake 5" contemplating his situation.

By studying the maintenance processes of 12 units at the NTC, we have documented a number of key problems that lead to poor performance and grouped them into four categories:

- Poor or no initial maintenance planning.
- Poor adherence to unit SOPs in preparation and communication of maintenance information via 2404/5988E (PMCS reporting).
- Poor visibility over Class IX repair parts flow.
- Poor synchronization and management of maintenance activities, including ineffective BCT maintenance meetings.

We will address these general activities as we work through the different segments of the maintenance pipeline pictured in Figure 1. Along the way, we will not only discuss how the system should function, we will also discuss the errors made by Earthquake 5's task force, and specifically what actions could have minimized the loss of combat power. We will end with a summary of the ways in which maintenance operations at the NTC can be decidedly more effective — which means more vehicles FMC, and thus more combat power.

Critical Points in the Army's Maintenance System at the NTC

Our segmentation of the maintenance process at the NTC is based on the critical points where the Goldminers can make observations and collect hard, reliable data. These observation points also mirror the SOPs of virtually every rotational unit. Below, we examine each of the three segments.

NMC to Document Number

The first segment for analysis is the piece of the process that begins when a combat system is observed NMC and ends when a document number is produced in the Unit Level Logistics System (ULLS) box and the ordering process is initiated. This segment is expanded in Figure 4. On average, combat systems at the NTC take 2.1 days

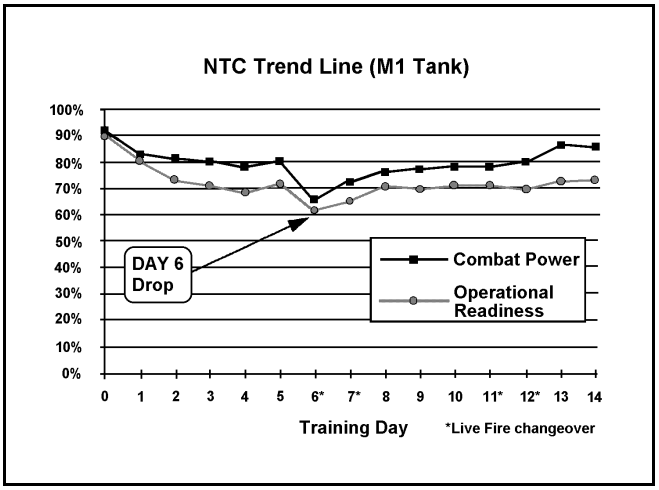


Figure 2. M1 Operational Readiness and Combat Power as a Percentage of Mission Capable Vehicles ("Combat Power" includes both FMC and "Circle X" vehicles).

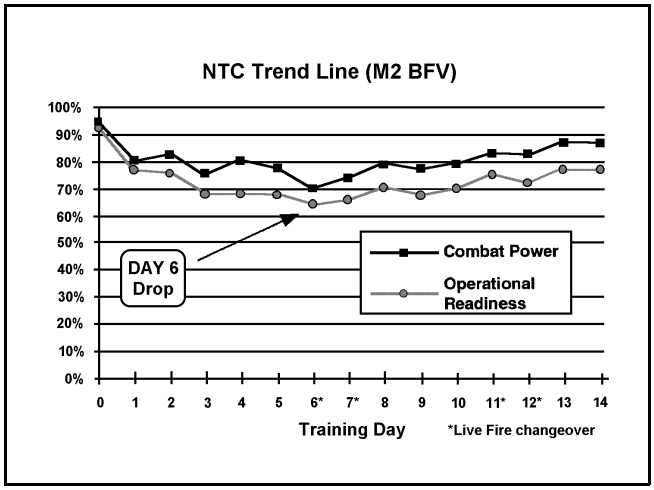


Figure 3. M2 Operational Readiness and Combat Power as a Percentage of Mission Capable Vehicles (again, "Combat Power" includes both FMC and "Circle X" vehicles).

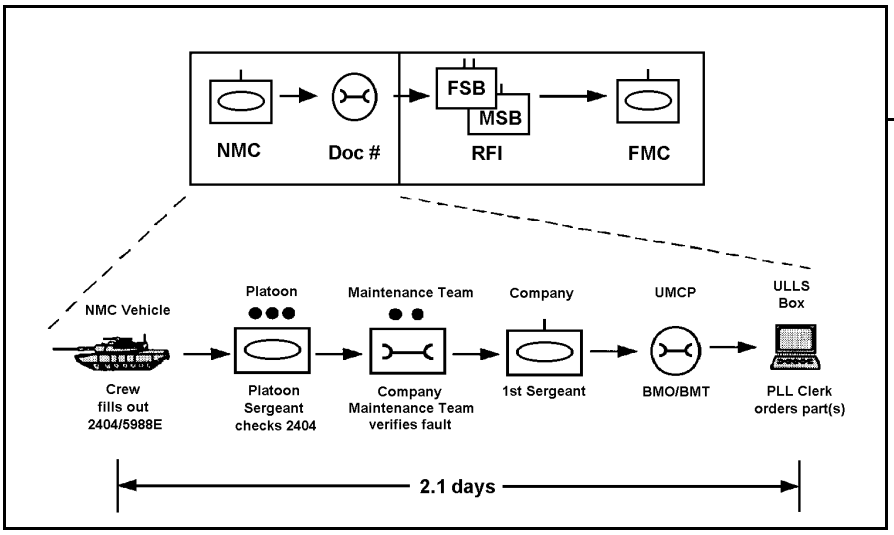


Figure 4. Maintenance process segment from report of fault to requisition.

from the time they are observed NMC by trainers until a Class IX requisition document number is produced in the ULLS box. The 2.1 days are further subdivided into 1.4 days for the combat systems to gain visibility on the task force DA Form 2406 (deadline report) and 0.7 day for fault diagnosis, troubleshooting, and inputting a Class IX requisition document number to the ULLS computer.

Several factors contribute to the 2.1-day time. First, battalion XOs and BMOs at the NTC routinely do not know how many 2404/5988Es are required per day, per combat system. Their SOPs usually specify one per day; however, there are no systems in place to check the efficiency or performance of this turn-in requirement. Our experience is that units turn in an average of 60% of the required 2404/5988Es per day. Of those turned in, only 63% are "to standard," that is, containing the information required to get the part successfully ordered. Common shortfalls include no National Stock Numbers (NSNs), missing bumper numbers, operator faults with no action taken, and no fault verification and NSN identification by mechanics. Not only do units not enforce reporting standards, (both frequency and completeness), task force operations orders never establish a specified time to perform PMCS.

This reporting is the foundation of the maintenance process. Missing or incomplete PMCS or 2404s add unnecessary time to the repair cycle, and obscure the visibility of combat power to higher echelons.

Also contributing to the problems with reporting and diagnosing faults are decisions about the movement of the UMCP. On average, the UMCP moves every other day. This does not allow adequate time for mechanics to troubleshoot and diagnose NMC combat systems. It appears that XOs and BMOs choose to move the UMCP this frequently because they are not effectively planning and carrying out forward recovery of vehicles. The price of such frequent UMCP movement is a less stable and less effective maintenance operation.

Another area for improvement by crews is to focus better on preventive maintenance as part of the PMCS process. If a part that is beginning to fail can be detected and reported, a replacement part can often be enroute to the vehicle *before* the fault deteriorates to the point where the vehicle becomes inoperable. Repairs can then be made without a long wait for parts to arrive, and in some cases this could also avoid the need to recover the vehicle to the UMCP.

Finally, there are substantial inaccuracies between what the Goldminer trainers observe as combat power and what is reported to the brigade maintenance managers. When trainers compare what the task force reports NMC at the Brigade Combat Team (BCT) maintenance meeting, there are, on average, eight combat systems inaccurately reported by each task force. Poor reporting and failure to conduct continuous updates (verbal or hard copy 2406s) to FSB maintenance managers hinder their visibility of the necessary Class IX repair parts requirements. Such reporting inaccuracies also result in an inaccurate report of combat power to the maneuver commanders.

In sum, problems with reporting faults and requesting parts in this segment of the process fall into the following categories:

- Poor planning for and enforcement of accurate and timely reporting of faults.
  Fix: Specify a time in the operations order for PMCS and establish a quality-control system that systematically tracks the quality and reliability of 2404 turn-ins.
- Too-frequent movement of the UMCP to allow maximum diagnosis and repair time.
  Fix: Move the UMCP only when forward recovery and FM communications are beyond their capacities.

- Not identifying and reporting problems before the vehicle becomes NMC.
  Fix: Ensure that soldiers are properly trained in accordance with the "-10" manuals, and enforce key "leadership" involvement by section sergeant, platoon sergeant, platoon leader, company commander.

Once a part is on order, the next segment of the process begins. The requisition passes from the ULLS computer to the FSB or MSB, and the part is released for issue.

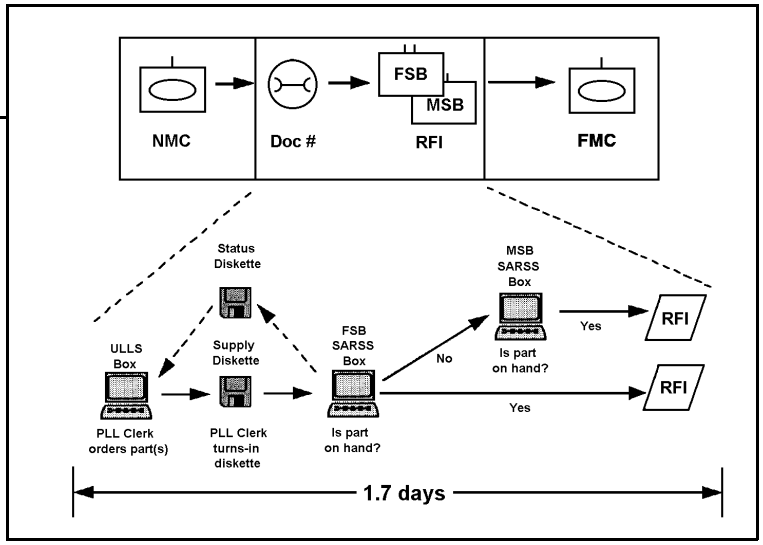


Figure 5. Maintenance process segment from requisition to when the part is released for issue at the first available source of supply.

Document Number to Release for Issue: Moving Information

The next performance measure is the time it takes to move information from the UMCP to the final source of supply. Figure 5 represents this segment of the process. On average, this segment takes 1.7 days from the initiation of the ULLS requisition document number until there is an RFI at the FSB or MSB.

The primary system failures that lead to 1.7 days for this segment are:

- low numbers of ULLS supply disk turn-ins.
- no reconciliations of parts received from the units, FSB, and MSB automation sites.

The NTC average over a year is that 52% of the required ULLS supply disks are turned in to FSB Tech Supply each day. Command emphasis at the brigade and task force level has a dramatic impact on a higher percentage of disks turned in. A recent rotation had an 85% turn-in rate of ULLS supply disks when senior commanders recognized the importance of ordering parts. Many BCTs have no mechanism in place to check the performance of this task. The SOPs of a typical rotational unit direct the turn-in of two disks per day, per ULLS box. Compliance with the SOP is a critical action to synchronize efforts to build combat power. However, brigade maintenance managers seldom have a mechanism in place to check daily disk turn-in performance.

Delays also often occur when PLL clerks drop off ULLS disks but do not stay and verify that their Class IX requisitions are 100% downloaded to the Standard Army Retail Supply System (SARSS) box. By not waiting, they miss the first step in the Class IX reconciliation process. Without this initial check, the requisitions not processed at the FSB SARSS box will not be reconciled until 24 hours later, when the ULLS status disk is processed back into the ULLS box. In addition, the PLL clerks receive a hard copy DMMC-generated C110 report, which reconciles the previous day's requisitions with the document control register (DCR). Additionally, this automated status, downloaded from SARSS, updates the ULLS DCR, the ULLS commander's NMC report, and eventually the SAMS2 C026, which is the BCT consolidated maintenance document.

More frequent movement of requisitions from FSB to MSB can also help speed this segment of the process. We have observed that units who use communications technology (i.e., tactical FAX machines, FM, and EPLARS) to send information between the FSB and MSB tend to have faster movement of repair parts.

Without this critical step, many parts are not posted via the automation system. Observers found that only 41% of parts had status posted by automation, which forces the FSB SPT OPS to manage this critical Class IX status "offline." Manual status management slows down the Class IX process and breeds distrust and frustration with the automated systems.

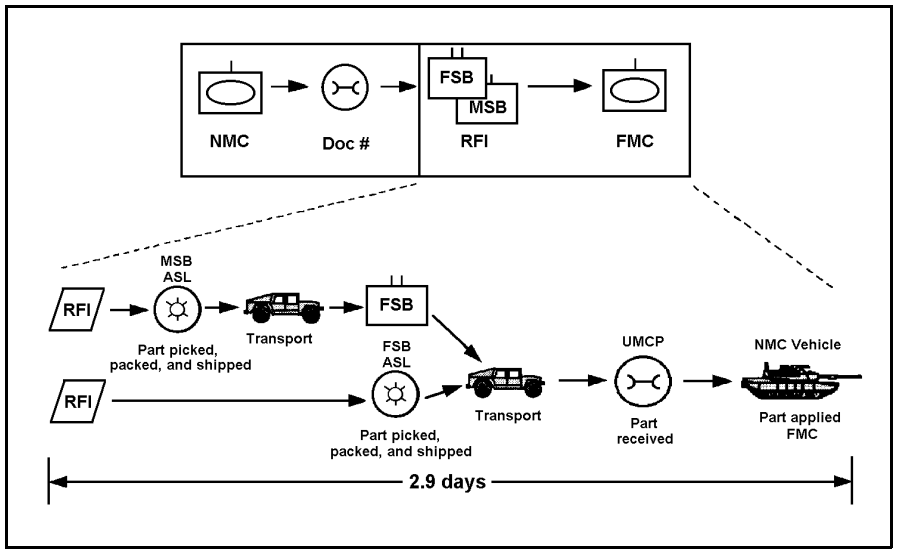


Figure 6. Maintenance process segment from issue of the repair part to installation on the vehicle and FMC status.

Improved performance in the document-number-to-RFI segment of the process includes addressing the following problems:

- Low ULLS supply disk turn-ins.
  Fix: Establish, track, and enforce requirements for daily ULLS disk turn-ins.
- No reconciliations of parts requests received from the units, FSB, and MSB automation sites.
  Fix: Require and enforce verification of ULLS downloads to SARSS at Tech Supply.
- Infrequent movement of requisitions from FSB to MSB.
  Fix: Use electronic data transfer for multiple "forward-to-main" SARSS transfers per day.

RFI to FMC: Moving the Part Forward and Completing the Repair

The final segment of the process is from RFI to FMC: getting the part picked, packed, shipped, received, and installed. This segment, as shown in Figure 6, involves the movement of information, the physical movement of Class IX repair parts, and the final repair activities.

The NTC trend over the past year shows that this is the most time-consuming segment in the process. It takes 2.9 days from RFI until the combat system is rendered FMC. The primary system failures are:

- Poor visibility over forward flow of repair parts.
- Poorly planned synchronization of automation for batch processing and information movement.
- Poor management of UMCP and brigade maintenance operations.

Transportation and manifesting of repair parts are critical for the visibility of combat power regeneration. The DMMC maintenance managers, FSB SPT OPS maintenance managers, and the task force BMOs must gain visibility of the critical Class IX parts and expedite them to those who will repair NMC vehicles. Manifests often do not accompany the parts during movement, and the FSB has no visibility of their movement forward from the MSB.

Once the transportation carrying the repair parts and manifests from the MSB to the FSB arrives, the Tech Supply often does not reconcile the parts physically shipped against the manifest document. Rarely do we see maintenance managers at the FSB receive advance copies of the manifest via FM, EPLARS, MCS, or MSE tactical fax. A knowledge of what critical repair parts are on their way allows the FSB managers to be proactive in planning how to move the part to the appropriate UMCP as quickly as possible. This might include having unit personnel and transportation meet the shipment at the FSB to move the part as quickly as possible to the NMC vehicle.

Optimal procedures for transportation and manifesting 02 PD parts include:

- Fax advance copies of manifests to the FSB.
- Report back to the DMMC manifested 02 PD parts not received for research.
- Notify BMO of 02 PD requisition arrivals.

These steps are often attempted but rarely conducted to standard. Failure to communicate "ahead of the part's arrival" forces maintenance managers to spend an exorbitant amount of time looking for 02 PD parts for combat systems; often they bypass the FSB and go to the MSB to expedite the parts flow.

Movement of the parts is a large portion of the 2.9 days of RFI to FMC. We do not have access to accurate data to break out the exact times spent in movement and repair; however, applying the part to the combat system and UMCP maintenance management both play critical roles in the RFI to FMC time. We have observed that BMOs are not well trained to anticipate and manage the large quantity of NMC combat systems generated by the OPTEMPO and rugged terrain at NTC.

Organizing UMCP priorities of work becomes an essential task for BMOs. This organization could take the following form:

- Conduct daily maintenance meetings that address:
  - Organization of workload (which mechanic or maintenance team is tasked to repair each combat system).
  - Analysis of cross-leveling/controlled substitution.
  - Determination of parts on hand (what parts are available to repair which combat systems the most quickly).
- Develop FM reporting system between company maintenance teams and the UMCP.
- Perform 2404/5988E tracking and quality assurance.
- Using ULLS automation to build the task force 2406 report.

Poor ability to provide this management is a major weakness in UMCP operations.

Improving this final segment of the maintenance process involves solving several important problems:

- Poor transportation and manifest tracking of the critical 02 priority requisitions.
  Fix: Ensure that manifests accompany parts from MSB to FSB to maintain visibility of parts flow.
- No visibility of what is coming forward to the SPT OPS managers.
  Fix: Use electronic communications (Tactical FAX, FM, and EPLARS) to send advance copies of manifests from MSB to FSB to allow preparation for expedited onward-movement of critical parts.
- No visibility of what arrived at the FSB Tech Supply.

	Task Force Managers	FSB Managers	Brigade Managers	DMMC Managers
WHO:	Task Force BMOs & XOs, Separate COs XOs, FSB BMO & XO	FSB CDR & SPT OPS, Tech Supply, Shop Office	S4, Maintenance Manager	Bde representative, CL IX representative
Maintenance Management Reporting Information	ULLS CDR NMC report Task Force 2406 - Updated - Status	C026/2406 report - Updated - Status	C026/2406 report - Track combat system status	C026/2406 report - Updated - Status
Parts Status Information	02 part status - C110 reconciliation - Face-to-face reconciliation - Total due-out reconciliation	02 part information: - AMDF of each 02 - Trans/status TCMD		02 part information: - ILAP of each 02 - Trans status/ TCMD
Recoverable Status	Reconciled recoverables	Reconciled recoverables, provide Unmatched Recoverable list		Unmatched Recoverable list
Disk Turn-in Monitoring	Daily disk turn-in records for: - Maintenance disks - Supply disks	Daily disk turn-in records for: - Maintenance disks - Supply disks		
AOAP Monitoring	AOAP turn-in record	AOAP turn-in record	AOAP turn-in record	AOAP turn-in record
Parts Availability	PLL status list	Forward ASL list		Main ASL list
Automation Status	ULLS box operational status	SARSS & SAMS status		

Table 1. Daily Homework Needed For Effective, Efficient Maintenance Meetings

Fix: When parts arrive, reconcile the manifest against parts shipped and report discrepancies to the DMMC.

- Units not notified of available parts at Tech Supply.
  Fix: When advance copies of manifests are received from the MSB, SPT OPS should notify units of anticipated parts and arrival times.
- BMO's UMCP maintenance operations unfocused.
  Fix: Conduct an effective internal UMCP daily maintenance meeting to coordinate activities and prioritize work.

Daily Maintenance Meetings: Balancing Needs and Resources

BCT maintenance meetings are the "battlesight zero" for maintenance managers to regenerate combat power. All levels of maintenance managers gather to share information and ensure all are aware of repair parts status and maintenance posture. The meeting's primary purpose is to get a clear understanding of what vehicles are NMC and who has the resources to make the repairs. The effectiveness of a maintenance meeting depends strongly upon the "homework" done by its participants. The homework completed by BMOs, SPT OPS officers, brigade S4s, and DMMC/brigade maintenance managers provides the necessary maintenance management information from their respective areas. Table 1 shows the suggested participants and the homework that each should bring daily to the maintenance meeting.

The ability to shave NMC time off combat systems also depends upon the maintenance managers' ability to synchronize assets with resources to regenerate combat power. Critical for this synchronization is a well-thought-out plan for coordinating batches of information and materiel. An example is to ensure that the pulling of repair parts at the MSB is timed to be completed shortly before a convoy leaves the MSB for the FSB. Such attention to coordinating batches can save hours, and sometimes days, of NMC time for the weapon system awaiting parts.

Strong Maintenance Practices Deliver Increased Combat Power

Earthquake 5 glanced back at his UMCP: there were still 24 NMC combat systems. This wasn't a bad dream. The embarrassment of having to report 58% combat power to his higher headquarters was extremely irritating and certainly not the kind of visibility he needed from the brigade and division commanders. The unexpected drop in combat power forced him to accept that he had been managing in a vacuum and wasn't sure where his maintenance team had failed. He recognized that he had no daily maintenance indicators that would allow him to catch and forestall problems before they had turned into a catastrophe like the one he was facing. He would now have to immediately focus the task force on its maintenance posture and develop systems to regenerate combat power quickly. Because of poor planning and follow-up, Earthquake 5 had a very long, exhausting eight days of rotation still to go...

If Earthquake 5's task force effectively had planned and executed its maintenance activities, it would have stood a far greater chance of being a high-performing unit at the NTC. The OPFOR is always tough to beat, but it is certainly even tougher to beat if you are only at 75% combat strength because of the poor performance of your maintenance systems. Units should aggressively pursue improved maintenance planning and practices before their NTC rotation, and they should practice these maintenance activities as part of their home station training:

- Carefully plan for maintenance activities and explicitly allocate time to carry them out.

- Establish standards and enforce adherence to them for preparing and communicating maintenance information via 2404/5988E.
- Synchronize maintenance management.
- Prepare for and utilize daily maintenance meetings as the "battle sight zero."

Commanders demand maximum combat power for each mission if they are to defeat the opposing forces at the NTC. Maintenance managers and soldiers are currently using the full 24 hours of the day to regenerate combat power but continue to struggle with operating their systems — and continue to achieve less than satisfactory performance. Units must find techniques and procedures to shave time off the 6.7 days by working smarter, not harder. The problems and solutions we have outlined are areas to start the search for the highest combat power available for battles at the NTC and ultimately prepare task forces for future deployments. Success in maintenance is not measured in wins or losses, but in the time it takes for units to regenerate combat power.

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Force XXI and the Death of *Auftragstaktik*

by Captain Robert L. Bateman

What are the leadership implications of the current military technical revolution? Organizational and doctrinal changes are in store for the Army of the twenty-first century, but where do the leaders fit into the developing scheme of things? We must analyze today what the effects of these changes may be on our leaders and how they lead, before we are surprised by the unanticipated effects of our decisions. This paper addresses the issue of information processing and the possible results of the explosion in available information upon leaders and leader development in Force XXI.

> *"In my own mind, we are at the beginning of a revolution in the way we will command soldiers and tactical units in battle."*
>
> *LTG Frederick Franks*

Force XXI and the digitization of the battlefield can give maneuver commanders at the tactical, operational, and strategic levels an unprecedented ability to "see themselves." Concurrent with this development is the continuation of an ongoing effort to break open the information "stovepipes" which allow us to see the enemy. These changes may allow friendly information and data on the enemy situation to be seen and known by all with the correct hardware configuration and communications assets.

As postulated by the Tofflers in their books, *The Third Wave* and *War Anti-War*, we are at the edge of a new type of society, and by extension a new type of warfare. This information-based society and method of war depends largely upon complete saturation of communications technology within the target element. However, unless great care is taken to avoid it, this information explosion may result in the devaluation of at least one level of command, and the eventual weakening of the very fabric of our leadership development. The endstate where we may find ourselves is not the anticipated dynamic, decisive, and lethal leader-information combination, but a crippled force with indecisive leaders overwhelmed by information they have not been trained to assimilate.

"In the term 'Maneuver Warfare,' maneuver refers to an entire style of warfare, one characterized not only by moving in relation to the enemy to gain positional advantage, but also — AND EVEN MORE — to moving faster than the enemy, to defeating him through superior tempo."[1]

"The Tenets of Battle Command: A commander's success on and off the battlefield depends on his ability to operate in accordance with nine basic tenets: initiative, agility, depth, integration, versatility, flexibility, judgment, intuition, and empathy."[2]

"Auftragstaktik is composed of four essential elements — obedience, proficiency, independence of action, and self-esteem. In order for auftragstaktik to exist, all four elements must be present."[3]

Executing mission orders (*auftragstaktik*) requires a mind-set and an imbedded system of values which support the independent thinker, the decisive commander and risk-taker. *Auftragstaktik* has been heralded as the key to successful maneuver-based warfare since the publication of Rommel's *Attacks* in 1937. This linkage, between a system of warfare (maneuver vs. attritional) and the command process required to successfully execute it (mission tactics vs. orders tactics) is well established and supported by historical evidence.[4]

In the industrial age of warfare, there has never been a technological solution that allows commanders to "see" better when they operate farther from the front lines. In the era of mechanization, the decisive point for the maneuver commander has always been forward, preferably in a position from which he can personally observe and thereby issue commands which may influence the course of the battle. Communications advances have freed the commander from static locations and placed him on the battlefield with the means to issue orders to geographically separated units, allowing him to bring them or their effects to the decisive point on the battlefield. The ultimate example of this style of warfare and leadership within the American Army may have been embodied by Major General "P" Wood, commander of the 4th Armored Division during the breakout and exploitation phases following the Normandy Campaign and Operation Cobra. General Wood's personal leadership style and forward location are hallmarks of the maneuver commander in the Second World War.[5]

Auftragstaktik was a needed doctrinal leadership development to execute maneuver warfare for one great reason — it was assumed, and is generally true, that the commander forward knows more about the current situation than any higher commander not on the scene. This implies that orders are written with full understanding that, should the situation not meet expectations, the commander on the ground has the ultimate authority to modify the plan as he sees fit in order to accomplish the higher commander's intent. Mission and commander's intent are the overriding considerations; everything else is a means to an end. The empowerment of the junior leader and the reliance upon that leader's judgment are paramount, because it is assumed that only at the lowest levels can a leader see through the "fog of war," if only for a short distance. The assumption is that the lower the commander, the better he

can "see himself" and know his immediate threat; therefore, he is better equipped to make decisions. If a higher commander wanted to influence the battle, then he also must move forward to where he can personally observe the operations and the results of those operations. But what happens when that higher commander is provided the means to "see" both himself and the enemy over the proverbial hill better than the commander who is on the ground in the most forward position?

Digitization and the Emasculation of the Subordinate Commander

Force XXI and the theory of informational warfare rely heavily upon the concept of "breaking down the stovepipe information structures."[6] Translated, that means that information which traditionally flowed vertically from one echelon to the next, due to system hardware or organizational processes, may now be accessed by a greater number of users spread horizontally across an organization without the requirement for formal distribution at each level. Any "user" who needs information can access this information from any other echelon, providing the data is somewhere in the system. Conceptually, this may greatly increase the effectiveness of our corps, division, brigade, and battalion staffs, both in garrison and the field. No longer will the battalion S3 wait impatiently for information on the upcoming operation. As soon as the divisional graphics are created, they are available to all clients within the net.

Parallel planning may begin immediately at both the brigade and battalion levels, even as the division staff works to complete the plan. Brigade planners may also have instant information regarding the status of their subordinate units as they work to create a tentative plan and select what element is best suited to be the main effort. Reporting of location, strength, and equipment status is available at the touch of a button for staffs and commanders to evaluate ("see") themselves. Planning cells, operating from digitally linked battle command vehicles (C^2Vs) may look up to a 30-inch monitor and view an accurate map that shows the superimposed locations of all vehicles within the command. Intelligence officers may "look up" to access strategic and national reconnaissance assets to "see the enemy," greatly enhancing the speed and accuracy of their SITTEMPs. Then, with another toggle, they may "look down and receive digital photos from scouts and units on the front line, which may refine their SITTEMP even more. Finally, the battalion and brigade commanders of this digital force may enter their command vehicles, personally process the visual (and audial?) information available from the screens and their staffs, and make a decision. This is, after all, what commanders are trained to do. But what about that most forward of commanders — the one in a turret, the one on the front line who does not have multiple large-screen monitors and a staff to help analyze the reams of information potentially available to him. What about that lowly company commander?

In his cramped hatch, he looks out over the battlefield from his position. To his eyes, the battlefield looks the same as it might have during WWII — largely deserted, potentially dangerous, and definitely lonely. He may have access to most of the information available to the staff and commanders above him, but to see it, he's going to have to squint. His little 12-inch screen, tucked in under the deck of his turret, can only access one piece of information at a time, providing that it works, is not splattered with mud or washed out by sunlight. Given a minute, he can easily access the same digital map, which shows the actual location of his team's vehicles on a map with the latest graphics. But, due to the size of his monitor, expanding the view beyond the scale of his company/team is not practical. The map gets too big and the pieces too small without that large screen. Of course, he may "scroll" the screen wherever he likes, but he then loses the big picture. His problem is not information overload, but not being able to access enough information simultaneously. For the first time in history, the front line commander actually knows less about what is going on in his *immediate* area than does his higher commander.

This may not be all bad. After all, it is only at the battalion level where any synchronization begins to occur. The front line commanders receive their missions, move out, and draw fire. Theirs is the mission of closing with and destroying, and they may operate using *auftragstaktik* as their guiding principal. After all, when the operation kicks off, their plan becomes a guide, and the commander on the front line, who will *see* the situation in real-time, is expected to react as he sees fit to accomplish his commander's overall intent. But wait, what about that higher commander at battalion and brigade (and division?). In our industrial age army, that commander's place has always been up front, so that he too can see what his company commanders see and mentally orient himself on the enemy, decide on a course of action, and act. But in the information-based Force XXI, the best place to see the battlefield may be from within the command post vehicle. Now that battalion or brigade commander, if he wants access to all information, has been tied to a C^2 vehicle, that is, if he wants to stay ahead in the OODA (observe, orient, decide, act) cycle. Not only that, but because he *does* have better information, faster than his own subordinate commanders, he may end up telling them how to maneuver their subordinate units!

Imagine the scenario: A battalion equivalent task force moves forward from its tactical assembly area into a meeting engagement. The battalion commander, in his BCV, simultaneously surveys three large screens displaying the entire area of operations, with graphics and actual vehicle locations, confirmed enemy locations, and critical logistical information in a user-friendly format. His company commanders, bouncing across the terrain, have little time to look at their own displays unless one of their lieutenants wanders off into the mist again. Instead, they rely upon their senses and voice commands. Of course, their senses are degraded, not physically, but due to the increased area which the new digital force covers. Companies which once could only spread out over a mile now cover several miles; they will not get lost or separated since they are digitally "aware" of each other. Suddenly, in the BCV, the battalion commander observes a new icon on the screen — enemy tanks have just started their engines and been detected by one of the UAVs through thermal emissions. The enemy tanks are on the immediate flank of one of his company's platoons; he immediately broadcasts the warning directly to that platoon leader (who is himself separated by miles from his company commander during the approach movement), de-

scribing the threat and the immediate actions he must take. The lieutenant does not question his battalion commander, nor is there time to confirm with his company commander; he ACTS. It is only after the threat is avoided and the action well under way that the company commander has time to look at his display, rewind to see what happened, and mentally confirm that the battalion commander gave the correct orders to one of his platoons.

Still, the task force moves forward. Again in the BCV, the battalion commander sees what his commanders on the front line cannot. As the breach is initiated and supporting fires lay a smoke screen for the engineers, the commander notices another downlink, this time from a JSTARS platform. The enemy reserve has not been pinned or delayed by the FASCAM fired on their location, and are in fact moving forward from their concealed positions along an unexpected route. Again, the commander has beaten the enemy in the OODA cycle; he orders his own reserve to move forward and occupy a position on a shelf which is over the next hill from their current location. The reserve company commander protests. What shelf?, he asks. On his monitor the resolution cannot pick out the gap in the contour intervals and he is leery of placing his command in an exposed forward slope position against what to him is an unknown force.

The battalion commander knows better and repeats his orders. He has seen this ground through the UAV and confirmed that it is an ideal location to meet the attempted flanking counterattack. From his swivel chair he turns and directs the FSO to place fires in the grid where he has placed his cursor. The cursor becomes a fire mission even as the enemy counterattack arrives. The breach is successful and the task force rolls on. The battalion commander has learned that information is power, and he has certainly acted upon that information with lethal effects. But back to those other commanders, the dirty ones in the turrets. What of them? They have learned a lesson as well — obey orders from on high. Higher does know better. The information stovepipe may have been broken open, but they do not have a large enough bucket to catch all the information flowing out to them. They have seen their platoons issued direct orders by a higher level and they have themselves been forced to execute missions which, based upon their personal observations, appeared irrational, but were in fact the best in a given situation. Their commander knew as much about each of them as they themselves knew... and knew it at the same time. While moving, they had little time to look down, manipulate their computer interfaces, and access the same information sequentially that their commander could see simultaneously. Most importantly, they rarely got the chance to make an independent decision regarding the employment of their own command.

Implications for the Future of Force XXI

In the scenario described above, the decisive force on the battlefield was the battalion commander. *Battle Command* Draft 2.1 states that technology has the potential to revolutionize the way we command in battle by becoming "the tool that will allow the commander to move freely about the battlefield to where he can best influence the action without separating himself from his staff and other sources of information, communications, and control." To that might be added the realization that, on the digital/information battlefield, "moving freely about the battlefield" might not literally mean physical movement of the commander. Instead, he moves only his "eyes" (the UAV and various downlinks and uplinks from other assets) to where they can best see for him. He himself has become tied to the information node from which he will command. Another example to illustrate the point might be an experiment of sorts. Place a battalion commander in the Training Analysis Facility (TAF) at the National Training Center. Allow him full communications with his battalion, and observe how his command becomes centralized around him. This may not be all bad, by the way. It almost certainly is an effective method to increase our own decision cycle speed beyond that of any potential enemy and, therefore, it may save lives.

The Army currently has enough leaders with the proper characteristics to assimilate vast amounts of information rapidly and make timely decisions; after all, this is what we have been teaching our leaders for years. But what kind of commanders will those officers who "grow up" under this system make? They have learned NOT to question orders and operate according to their own assessment of the situation to accomplish their commander's intent. Instead, they will have developed under a system in which control is central and higher knows better. Their company "commands" were really glorified platoon leader positions, while the battalion or brigade micromanaged their actions in an effort to increase speed, bypassing the company as an independent element. *Auftragstaktik* will have died with the last non-digital company command.

In the original definition of the term, *auftragstaktik* had four components: obedience, proficiency, independence of action, and self-esteem. However, if any one of these components was considered paramount, it was the tradition of independence of action. This tradition cannot survive on the digital battlefield. And neither will *AUFTRAGSTAKTIK*.

Notes

[1]Lind, William, "The Theory and Practice of Maneuver Warfare," *Maneuver Warfare: An Anthology* (New York: Doubleday) 1994.

[2]*Battle Command*, Draft 2.1, Department of the Army, Battle Command Battle Lab, Ft. Leavenworth, Kan., April 1994.

[3]Bashista, Ronald, "*Auftragstaktik:* It's More Than Just a Word," *ARMOR*, November-December 1994.

[4]Arquilla, John and Ronfeldt, David, "Cyberwar Is Coming," *Comparative Strategy*, April-June 1993.

[5]*Tiger Jack* (Ballantine Books, Inc.), 1976 edn.

[6]Sullivan, Gordon R., GEN, "Force XXI: Digitizing the Battlefield," *Army RD&A Bulletin*, November-December 1994.

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M1A2s, Smart Ammunition, And Time and Space Theory

(Or, Why I Would Not Want To Be the Threat)

by Captain Mike Pryor

As if simply reading about digital command and control (C^2) enhancements was not enough excitement for one tanker to stand, along comes Major Bruce Held's March-April 1995 *ARMOR* article on future smart munitions. Like a fish stuck on a trout line, I snapped at his call to explore tactical ramifications of the new ammunition's use. The result is this article's bottom line: a digital tank platoon in the defense, using Smart, Target Activated, Fire and Forget (STAFF) ammunition, can destroy an attacking motorized rifle battalion (MRB). Read that as an **11.5:1** kill ratio. Further, the digital platoon can do so with less than one basic load of ammunition and still retain at least 1800 meters of standoff distance from the lead enemy element. Given some assumptions, this theory can be proved both in time and space.

Assumptions

Using the acronym METT-T as our guide, here are the assumptions necessary to set the scene that makes the above theory possible:

Mission. A digital tank platoon must defend a battle position to allow no penetration of the phase line to their rear by the first MRB to enter their sector.

Enemy:

- The attacking MRB is BMP and T-72 equipped, is at 100% strength and executes standard Threat doctrine.
- The MRB is in battle formation with motorized rifle companies (MRCs) in pre-battle formations, two MRCs forward and one back.
- MRB elements move at a constant speed of 20 kilometers per hour (or 20,000 meters every 3600 seconds).
- The MRB maintains maximum doctrinal intervals (50 meters between vehicles, 300 meters between platoon columns and 800 meters between MRC formations).
- For purposes of this article, enemy air is not introduced.

Time (and Space):

- All tanks in the digital platoon fire at a constant rate of one round every nine seconds.
- We want to spread out our platoon as far as possible so that the flank tanks begin engagements four kilometers from the lead, flank vehicle of the far, opposite MRC. (See Figure 1.)
- Do not let any enemy vehicles closer than 1800 meters.

Troops and Equipment:

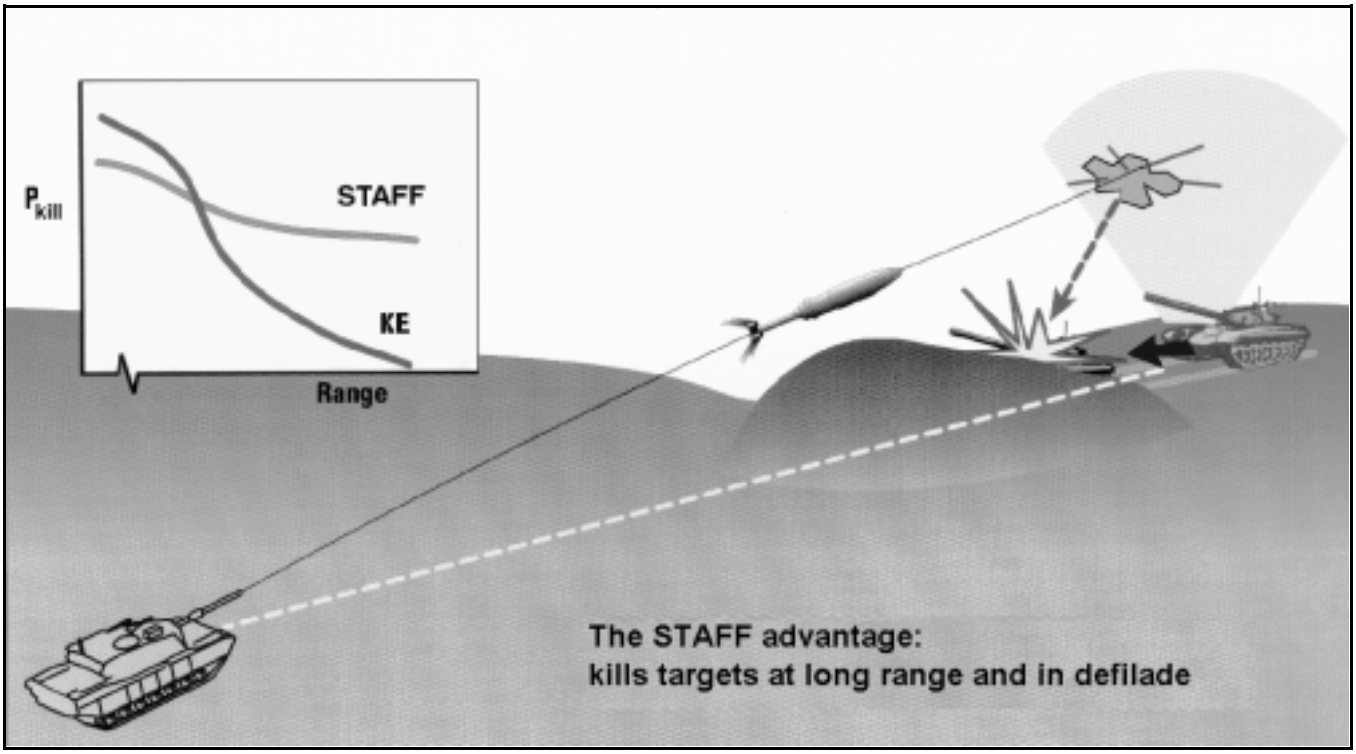
- We lead an M1A2 tank platoon at 100% strength.
- Each tank has a combat load of 40 STAFF rounds.
- All tanks have a proper boresight.
- No tanks experience a weapon system malfunction.
- No tanks in the platoon are lost to enemy fire during the engagement.
- We will engage lead MRCs by section with a cross pattern of fire and the trail MRC by platoon frontal pattern of fire.
- STAFF rounds kill with a constant 40% probability of kill (.4 Pk) over any distance out to 4000 meters.
- Enemy locations are initially reported by intelligence assets forward of our platoon and downloaded onto our IVIS.

Terrain. The enemy avenue of approach is approximately four kilometers wide, allowing the enemy to maintain formations.

Doing the Math

Looking at Figure 1, several factors become obvious. First, the MRB is deployed with two MRC's forward and one back. There are 800 meters between the inside flanks of the lead MRCs and the same distance from the rear of those MRCs to the front of the trail one (per above assumptions).

Second, straight-line distance from our digital platoon to the nearest MRC is 2900 meters when we open the engagement. Defensive placement, however, is designed for engagement by tank section in a cross pattern of fire, with a goal of spreading out as far as possible for force preservation. Since engagement range must be within 4000 meters, the outside (flank) tank in each section must be able to range 4000 meters to the outside flank of the opposite MRC; the inside wingman must be able to fire no farther than 4000 meters to the MRC's center mass. Our platoon



battle position (BP) enjoys a frontage of 3000 meters, a depth of 800 meters and 1000 meters between tanks! Presently, we do not use this as doctrine. But with an open mind, you can discern the following:

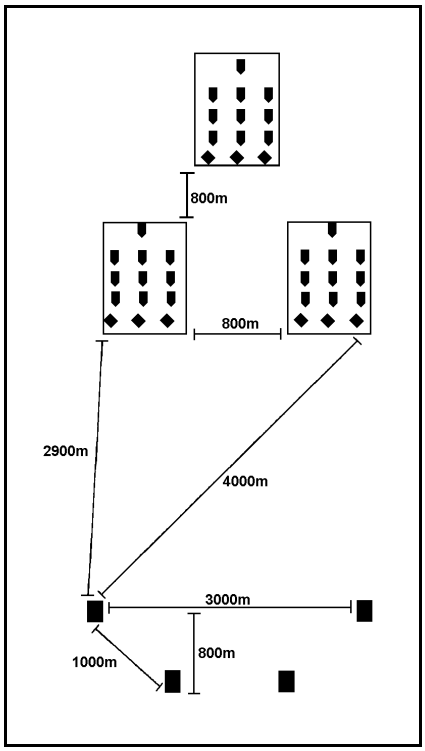


Fig. 1

- Platoon tanks will still 'see' each other via their Commander's Integrated Display.
- This is an excellent example of mass as defined at the head of "Direct Fire Planning" (*ARMOR*, November-December 1993). *"Massing of fires is not all 14 vehicles destroying one target. True massing of fires is 14 vehicles destroying 14 different targets...."*
- So dispersed, our platoon is a very demanding artillery target, increasing force protection (nearly impossible to take out without precision weapons or using MRLS-type systems).

But what about time and space? To prove the hypothesis, we must answer this key question:

An MRC with a tank platoon forward has 15 combat vehicles moving one kilometer every three minutes (or 1000 meters every 180 seconds). If we fire two STAFF rounds every nine seconds with a .4 Pk, how long will it take to destroy the MRC and how close will it get to our BP?

This problem is not as daunting if we take it one bite at a time. First, we must determine how many rounds it takes to destroy the MRC:

[**X** (rounds)] [.4 (Pk)] = 15 (kills)

X = 15/.4

X = 37.5 (or 38 for safety's sake)

This tells us how many rounds it takes to destroy the MRC, and we know we can fire two rounds every nine seconds with our method of engagement. Next, we must determine how long it will take to destroy the MRC:

$$\frac{38 \text{ rounds}}{2 \text{ rounds}/9 \text{ seconds}} =$$

$$38 \text{ rounds} \times \frac{9 \text{ seconds}}{2 \text{ rounds}} =$$

$$\frac{342 \text{ rounds/seconds}}{2 \text{ rounds}} = 171 \text{ seconds}$$

(or 2 minutes, 51 seconds)

With the time to destruction known, we can calculate how far the MRC advances in that amount of time:

$$\frac{20{,}000 \text{ meters}}{3600 \text{ seconds}} = \frac{\mathbf{X} \text{ meters}}{171 \text{ seconds}} =$$

$$\frac{3{,}420{,}000 \text{ meters seconds}}{3600 \text{ seconds}} = X$$

X = 950 meters

So, we have the following answer to our question: at an expenditure of 19 rounds per tank, a digital platoon can destroy an MRC in 2 minutes, 51 seconds and not allow them to advance more than 950 meters. Simple subtrac-

tion then tells us the closest any of the lead MRC's vehicles will come to our platoon is 1950 meters.

But what about the trail MRC? After destruction of the lead MRCs, the trail MRC has advanced to within 3100 meters of our platoon. We would then change our method of fire distribution to a platoon frontal pattern. With four tanks firing on this MRC, its destruction occurs twice as fast as that of either lead MRC. For an additional 10 rounds per tank, in 1 minute, 26 seconds and within 475 meters, this MRC is eliminated 2625 meters from our BP.

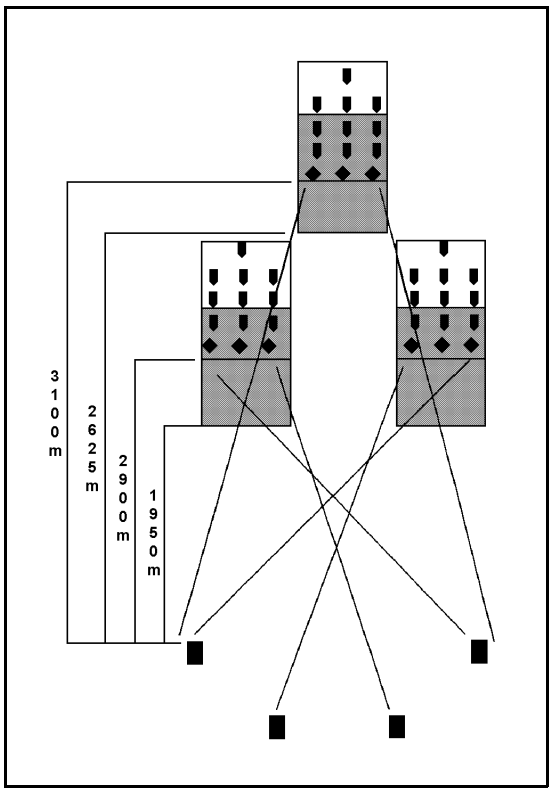


Fig. 2

All told, the entire MRB is destroyed in less than 4½ minutes with 29 STAFF rounds per tank. (See Figure 2 - destruction of the MRB is indicated by shaded boxes.) But does this hold for other formations?

MRB in a Column, MRCs in Pre-Battle

Here, our platoon's task is easier. If the enemy remains in column, an MRC is destroyed every 86 seconds/475 meters. (The MRB dies in 4 minutes, 20 seconds.) But surely, no one is that ignorant. So, if each trail MRC deploys around an opposite flank of the lead, dead MRC, we have our original example in reverse. The lead MRC expires in 86 seconds/475 meters, and the remaining two in an additional 2 minutes, 51 seconds/950 meters. (If we open the engagement at 4000 meters with our platoon on line, the enemy never gets closer than 2575 meters.)

If the MRB commander deploys his two remaining MRCs around the same flank of the lead MRC, we have the same type of engagement as if he remained in a column of MRCs, except that we must shift our platoon's fires.

The above examples imply that the greater the depth of the enemy formation, the easier our task becomes. So what happens if the MRB chooses the formation with the least depth?

MRB with MRCs On Line in Pre-Battle

This would be our platoon's most difficult task. If we maintain a cross pattern of fire, this means our flank tanks initially engage opposite MRCs by themselves, while their inside wingmen concurrently engage the center MRC. (See Figure 3.) To engage in this method, our BP frontage shrinks to 1000 meters, with a depth of 100 meters and 325 meters between tanks. Engaging the enemy as expressed above yields their destruction in the following manner:

We open the engagement with the enemy lead element at a three kilometer straight line distance from our flank tanks. After 2 minutes, 51 seconds/950 meters, the center MRC is destroyed with 19 rounds per inside tank. Our flank tanks have destroyed seven enemy vehicles each with 19 rounds within the same 950 meters. The inside tanks now shift to a cross pattern of fires by section and complete destruction of the flank MRCs with 10 more rounds per tank in 90 seconds/500 meters. In a total of 4 minutes, 21 seconds/1450 meters, the MRB is destroyed for 29 rounds per tank.

In checking our spatial relationship, however, our flank tanks are within 1550 meters of the enemy if they remain stationary throughout the engagement. The platoon would have to displace to subsequent fighting positions to retain our 1800 meter space cushion from the enemy. This, by definition, changes our mission to a defense in sector. A defense in sector would not necessarily expend more rounds to destroy the MRB. It would, however, take longer, require more battlefield space (depth) for the platoon, greatly limit our platoon's dispersion within the BP and create C^2 problems for us not present if they attack us as in the original example. However, in doing the math, you can see that it is still theoretically possible for a digital platoon to destroy an MRB in this formation.

Observations

Our use of smart munitions coupled with digital C^2 enhancements in this manner allows us to make certain observations, both from our, and the enemy's, perspective.

Our Digital Force.

- The mathematics of this theory indicates a pronounced correlation between our, and the enemy's, depth and frontage:
  - The greater the enemy's depth and narrower his frontage, the greater our BP depth and frontage, and the lesser battlefield space we require.
  - The shallower the enemy's depth and wider his frontage, the lesser our BP depth and frontage and the greater battlefield space we require.
- For this theory to work, someone or something must be able to constantly spot the enemy, provide BDA, and download enemy positions to our IVIS system.

- An intelligence asset 'handing off' targets to our tanks seems to call for the M1A2 using the POSNAV system to assist with target acquisition.
- After destruction of the MRB, our platoon would have to resupply their combat load of ammunition.
- By extrapolation of the 11.5:1 kill ratio, a tank company can destroy a regiment and a tank battalion a division. (Once the infantry gets a non-line-of-site missile, it has the same capability, except they will need more time and battlefield space due to the limited number of missiles the BFV might carry.)
- There are many tactical ramifications inherent in this theory. I can think of the following:
  - In fighting his company versus a regiment, the commander needs to be prepared to move up his reserve platoon in time to cover the appropriate enemy avenue of approach as soon as 2-10 minutes after destruction of the first two MRBs. This demands that the company commander thinks of his battlespace as deep as we now think for brigades.
  - Since some form of intelligence-gathering asset must cover the company's increased battlespace, we either need more scouts or remotely piloted vehicles (RPVs) forward in sector under the company's control.
  - If the company has RPVs, who controls them? The XO? The first sergeant? A soldier assigned to a new duty position?
  - If a digital platoon forwards a call for indirect fire because he has line of sight to the enemy, something is seriously wrong. This may mean that artillery becomes primarily a counter battery and enemy second echelon element fighter if we defend in this manner.
  - CS and CSS elements need to be prepared to conduct business over a much wider frontage. Does this mean that they need to have beefed-up TO&Es? Do they need more mobile and faster vehicles?

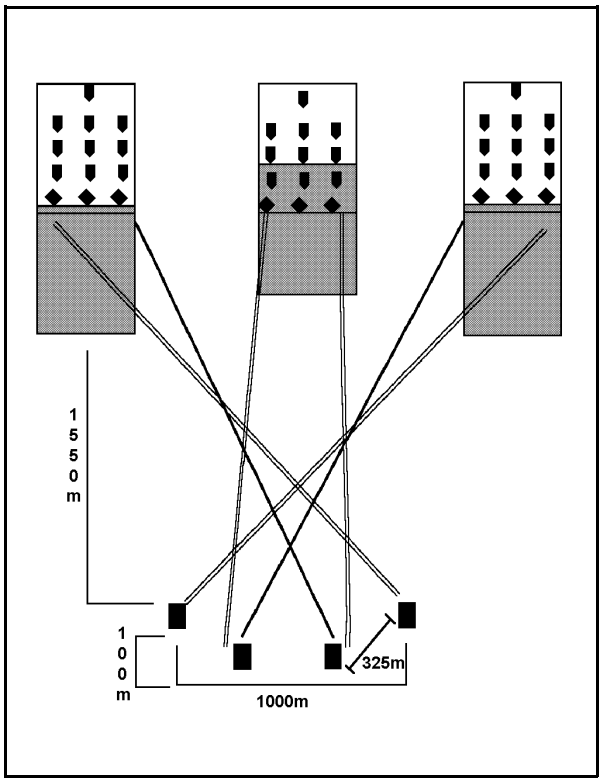


Fig. 3

The Enemy's Perspective.

- Because of the problems it causes us, is the enemy likely to attack with three elements forward and none back in their first echelon?
- Is the enemy more likely to attempt to improve the combat speed of his vehicles in order to provide the means to close the distance with our forces faster?
- Because of the STAFF round's footprint, is the enemy less likely to spread out his formations? (Doing so may make targeting his vehicles easier due to less ground clutter or less of a need to choose between multiple targets within the footprint.)
- Because of the destructive capabilities of digital units with smart ammunition, will the enemy be encouraged to use more obscurants, directed energy weapons or even weapons of mass destruction to achieve his aims?
- Because our electronic intelligence-gathering assets are designed in large measure to find vehicles, will the enemy use more dismounted infantry to set up the conditions for success of his mechanized forces?

Conclusion

Amazingly, our new digital systems coupled with the use of smart munitions may allow us to defend against an enemy at an 11.5:1 ratio. This is truly a technological revolution that provides us with several tactical advantages and the enemy with multiple dilemmas to solve. I believe the possibilities presented in this article equate to deterrence. You cannot find deterrence in any of our Mission Training Plans at any level. But deterrence, being a more noble and much more demanding task to master, is preferable to the expense of blood on any battlefield.

Captain Mike Pryor was commissioned in Armor from the New Mexico Military Institute's Early Commissioning Program in 1984. He completed his bachelor's degree in political science from the University of North Texas. He is a graduate of AOBC (Cavalry), SCCC, TCCC (M60A3 and M1), TLIC, NBC Defense, IMPC, the III Corps MOUT Trainer's Course, AOAC and CAS^3. He has served as a cavalry platoon leader, troop XO, S3 (Air), adjutant and troop commander with 1-124 Cavalry, TXARNG, and as an S3 (Air) with 1-156 Armor, LAARNG. He is currently the commander of Company C, 1-156 Armor, LAARNG.

THE EXTERNAL GUN TURRET: "Often a Bridesmaid, Never a Bride"

by Don Loughlin

Over the years, I have seen a number of articles about the external gun turret (EGT), or external gun mount, in military magazines. As the saying goes, "There is less to the idea than it appears." When someone does build one in a one-off experiment, it ultimately goes away; whether it be a Tank Test Bed, an AMX-ELC, a UDES-19, a Surrogate Research Vehicle, or whatever. The reason that they go nowhere is because of the very serious limitations of the concept**:**

1. Commander and gunner have been removed from the turret and buried in the hull where system survivability is poor due to lack of direct vision.

The idea of burying the crew down in the bowels of the hull, where the commander has no direct vision from the top of the turret, is a *very great net loss* to survivability! The crew may be better protected there from a hit, but the loss of the commander's direct (eyeball) vision from the highest point of the vehicle means that they are much more likely to blunder into a disaster; be it a minefield, a steep vertical drop-off not detected by indirect vision (whether it be 'hard optics' or electronic sights), an unseen, well-camouflaged antitank system, or any other undetected disaster. Even in a conventional turret, it is difficult to detect these hazards on a clear day with 20-20 vision from a position 8-9 feet high, especially when moving rapidly. It's worse if there is heat haze, maybe dust from wind and other vehicles, and perhaps smoke from muzzles, explosions, or smoke generators.[1]

Another bad idea related to the 'crew buried in the hull' is placing them in a row, where a single penetrator can take out all three at once. The designers may suffer from a death wish, but they shouldn't impose it on the crew.

Contemporary thermal imaging sights are marvels of technology, and I wouldn't want to be without them, but they can't *replace* the human eye in three respects: resolution, field of view (and the combination of both), and its marvelous working with the brain. For example, try this experiment: focus on a specific point at long distance and try to remember just where it is. Then close your eyes and turn your head away as far as it will go. Next, with your eyes still closed, turn your head back to where you think you were originally looking, and open your eyes. You should be looking right where you started.

ON HULL SEATING:

"The crew may be better protected there from a hit, but the loss of the commander's direct (eyeball) vision from the highest point of the vehicle means that they are much more likely to blunder into a disaster..."

Consider next just how complicated, large, and expensive it would be to manufacture a sight to do that — and you already have the capability, 'for nothing.' (This has been called 'kinesthetic orientation,' which is a great expression, and I wish I knew who created it.) Remember also that, when you opened your eyes, you had a view combining excellent, detailed resolution at the center with a very wide field of view. This is what you have now, supplemented by hard optics and electronic sights. Should you give it up and be without that eyeball at the top of the turret? Not likely!

I tried for a long time to understand how such a fundamentally wrong idea as having the crew buried in the hull could last for so long; when it shouldn't have survived the first user conference. I finally remembered that it was originally sold as part of the early days of the Armored Systems Modernization (ASM) study, got high level support because of its association with ASM, and became an article of faith in a theology that is dubious at best. Once it became politically correct, who would challenge so central an element of orthodox dogma? Certainly not someone who wished to remain in business! And certainly not someone who would like to be promoted at least once more.

Since I am now retired, and more politically incorrect than ever, I say to the world**:** "The emperor has no clothes!" What we should do is to defrock ASM (if not done so already) and let individual ideas compete on their merits. When we have reached that point, dissenters will no longer run the risk of being accused of blasphemy or heresy, and we can start engineering again.

The winning entry of the 1993 *ARMOR* Magazine Tank Design Contest, Western Design Corp., was a clever design that wisely avoided the pitfalls of the elevated gun, but still bought into the bury-'em-in-the-hull syndrome. Too bad! Otherwise, it looked good, except for all those goodies that they claim will fit inside it. If they can really do that, and still meet the volume and weight claims, then we should put them to work on solving the problem of the national debt.

Among many vehicles that have explored the concept of external guns were the General Dynamics Armored Gun System candidate, above, and the HIMAG (High Mobility Agility) vehicle, shown at left being tested in 1980.

2. Elevated gun position decreases survivability due to high silhouette and exposed mechanisms.

In a conventional turret, the turret need not be much higher above the hull roof than the vertical height of the gun. Since the gun breech of an EGT can not ordinarily drop down below the hull roof (unless a depression is built into the top of the chassis, which will need a cover to keep out water and contaminants, including dirt and debris[2]), the trunnions must be raised accordingly, which raises the gun height.

The elevated gun position means that all kinds of mechanisms that would ordinarily be under turret armor are now exposed, where they are vulnerable to shot, bullets, blast, fragments, weather, and the occasional tree branch, small and large. By the time the system is detail-designed (as compared to that nice, clean generalized paper concept picture), there will also be all kinds of reentrant angles and surfaces to accommodate various sights, coax MGs, hatches, and access doors, etc., that will make the turret a mobile shot trap and generalized rain catcher. It will be an especially good rain catcher when it gets on in years, the seals are compressed or torn, and the hatches and latches don't work that well anymore. Think how well the re-entrant surfaces will trap and leak CBR contaminants, and how they will then leak into the interior. Think about the difficulty of decontaminating that surface. The caustic decontaminating chemicals will also get inside the vehicle, where they will cause their own unique problems.

3. Excessive complexity due to the need to remote the operation of subsystems.

As an example, let's review the coax MG installation in a conventional turret as compared to an EGT. In a conventional turret, a turret crewman can replenish the coax ammo supply, clear gun stoppages, change barrels, help to adjust boresight or zero, and do other tasks. But, in an EGT, there is no direct access, so these operations must be remoted at the expense of increased complexity, accompanied by increased weight, volume, and cost. And you may be certain that none of this complexity will be revealed in concept drawings or magazine articles describing how great the idea is. (A nice feature of concept drawings is that one can label a component or subsystem as being present with a barely existing volume and weight allowance.) Don't forget that the complexity will increase the maintenance and logistic burden, as well as decrease reliability. The coax is just *one* simple system. Now consider all the other subsystems that must be remoted and you will have another reason why you don't see any EGT in production.

As another example, let's look at the turret drives, which must have a manual backup mode. An EGT that is remoted (the gunner and commander are stationary in the hull, and do not rotate with the gun) must still have manual turret drive. Manual turret drives for such an turret are feasible, but are complicated, meaning heavy, bulky, and expensive. Manual turret drives for an EGT that is not remoted are less complicated than for the remoted turret, but still more complicated than for a conventional turret.

4. Loss of interior volume and mounting surface area.

These are some of the worst features of the EGT, and are, unlike the issues described above, the only problem areas that I haven't seen commented on before. The EGT proponents say that what we need to do to have an 'advanced' vehicle is to get rid of the heavy turret and cram the crew and a bunch of other stuff that used to be in the turret (well, approximately half of the turret crew's volume was in the turret) into the hull. The hull was already

All That Stuff Has To Go Somewhere...

An M1A1 crew from 1-35 Armor pauses during Desert Storm. Note the external turret stowage space unavailable in an EGT design.

crowded, and the alleged advantage of eliminating the conventional turret basket volume in the hull (with its fictional free volume) for the remoted

ON STOWAGE LIMITATIONS:

"The proponents of the external gun turret seriously underestimate both the internal volume needs of any combat vehicle, as well as underestimating the impact of the loss of turret wall surface for mounting all the items they don't talk about."

EGT is an illusory advantage. The space in the basket that was previously occupied by seats, ammo, turret drive motors, pumps, control handles, a bunch of electronic control boxes of varying sizes all interconnected with cables, and only half of the volume of the turret crew's body, will now have to accept the volume of all those same items (minus the volume of the gun breech when the muzzle is elevated), plus now the entire volume of the turret crew's bodies and a lot of the componentry that used to be in the turret — more control boxes, cables, control panels, fire control items, etc. Combine that complexity with the fact that the EGT will impose its own set of additional complexities. There is just not enough volume to be able to do all that and still have a credible design approach.

Another aspect of turret and vehicle system design in which the EGT unnecessarily degrades the designer's options is the lack of turret surface mounting area, *external as well as internal*. All those turret control panels and handles, electronic boxes, and other gadgets listed above must all be attached somewhere; and all that material shown on the OVE and OVM lists must be stowed somewhere, inside or out. Where will it go on a vehicle with an EGT? The top of the hull cannot be used, as it would block gun motion. On a conventional turret, the turret bustle area is normally used, but its use would eliminate many of the claimed advantages of an EGT.

The photo above shows a typical M1-series Tank in DESERT STORM, all dressed up and ready for a fight, with all kinds of things on and in it that are not on the OVE/OVM lists. Note how cluttered the real vehicle is.

Where would we put all that material on a vehicle with an external gun turret? The proponents of the external gun turret seriously underestimate both the internal volume needs of any combat vehicle, as well as underestimating the impact of the loss of turret wall surface for mounting all the items they don't talk about.

Conclusion

During the design phase of a new turret, or a new vehicle system, the experienced designers in the business (those who are left) examine many different approaches for meeting the user's requirements for performance, reliability, survivability, weight, and cost. The EGT has not yet passed that test, and that is why it is still "Often a Bridesmaid, Never a Bride."

Notes

[1]An experienced turret designer who reviewed this paper made the comment "...Have you ever seen an animal that didn't have its eyes either at, or very near, the top of its head? Even a flounder has both its eyes on the top of its body!" A good point.

[2]The resulting product will probably look and operate like a poorly designed turret.

Don Loughlin retired from the defense industry in 1992 after a 35-year career as an ordnance engineer. Prior to that, he was a Marine armor officer for five years. Loughlin holds degrees from the University of Pennsylvania and Johns Hopkins University and is a 1953 graduate of the Armor School. He now lives in Bellingham, Washington.

A U.S. soldier on patrol in Grenada encounters one of those unique situations typical of low-intensity conflict.

Training a Divisional Cavalry Squadron for Operations Other Than War (OOTW)

by Captain John A. Nagl and Captain Tim Huening

"For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill."

-Sun Tzu

Operations Other Than War Is Here Now

Field Manual 7-98, *Operations in a Low-Intensity Conflict*, opens with the Sun Tzu quote above. It then dryly continues, "The possibility of U.S. troops becoming involved in a low-intensity conflict (LIC) is ever increasing." The thousands of American soldiers currently deployed to Haiti, Turkey, Macedonia, and countless other "hot spots" around the globe would tell the author of 7-98 that the possibility is a reality. Thousands more, deploying to the former Yugoslavia to enforce the peace treaty recently signed in Paris, will face that "possibility" every day.

The end of the Cold War, and of the "balance of terror" with which the superpowers kept national ambitions and ethnic rivalries in check for fear of escalating a local conflict into global war, has completely changed the international security equation. Soldiers who spent their careers training to fight conventional war in Europe, and deployed to fight a conventional war in Southwest Asia, now face the near-certainty that their next real-world deployment will involve something less than all-out ground combat. The low-intensity conflict which American forces will face will be characterized by "the indirect versus direct application of force," according to FM 7-98. The new situations which American combat forces will face "present a unique challenge." However, "a disciplined unit, with soldiers proficient at individual skills who are operating under a clear expression of the commander's intent, can perform successfully at the tactical level in this environment."

Properly trained, equipped, and organized, American combat forces can accomplish national military objectives in any level of conflict, as our recent successes in Haiti and our continuing success in Macedonia demonstrates. However, the "increasing possibility" of low-intensity conflict necessitates certain changes in our training and organization in order to provide our forces with the best possible chance of success.

USAREUR, the CMTC, and OOTW

The Combat Maneuver Training Center at Hohenfehls is in the forefront of U.S. Army Training for Operations Other Than War. A ten-day rotation for a tank or mechanized infantry battalion begins with three days of pure joy: training for Operations Other Than War through the creation and enforcement of a Zone of Separation between two ethnic groups that have recently signed a peace agreement ending a civil war. The Blueforce unit is required to establish a lodgment area, operate checkpoints regulating passage through the Zone of Separation, escort and protect humanitarian relief convoys, negotiate hostile checkpoints, deal with accredited and unaccredited media, establish and run civil-military working groups, and in general deal with many of the situations which units can be expected to perform successfully in real-world deployments. This training is exceptionally difficult, putting severe strain on command and control systems and on junior leader initiative and understanding of the political situation and the commander's intent. The purpose of this article is not to detail exactly how excruciating this training at the CMTC is, although the authors would like all tank company commanders in CONUS to spend six hours attempting to negotiate passage of a UN convoy through one of the belligerents' checkpoints before telling him how much more challenging an NTC rotation is. "Gunner, HEAT, checkpoint" is not the approved solution.

Training for OOTW at CMTC is so challenging — and such a realistic portrayal of what units can expect to face when deployed on peacekeeping operations or other LIC missions — that the 1st Squadron, 1st U.S. Cavalry has developed an Operations Other Than War Tactical Standard Operating Procedure ("OOTW TACSOP") and a challenging OOTW training scenario which has been incorporated into gunnery Table XII. Both the OOTW TACSOP and the Cavalry Table XII scenario are constantly being revised and updated based on the results of training at Grafenwohr, the CMTC, and at home station; however, we feel that the lessons we have learned in training for Operations Other Than War may be of benefit to other Army units facing the "increasing possibility" that they may deploy into a LIC environment.

1-1 Cavalry OOTW TACSOP

The OOTW TACSOP builds on the tactics, techniques, and procedures found in FM 7-98 and other sources of Army doctrine. It is a derivative document; its value rests in its small size and easy reference for the proper accomplishment of the critical OOTW tasks identified by the commanders of V Corps, the 1st Armored Division, the 3rd Infantry Division, and the 7th Army Training Command. The OOTW TACSOP thus provides task, condition, and standard for the following critical tasks:

- Conduct Patrols
- Establish and Operate an Observation Post
- Establish and Operate a Checkpoint
- Plan for Media
- Conduct Liaison/Negotiate
- Escort a Convoy
- React to Ambush
- React to Indirect Fire
- Establish a Lodgment Area
- Secure a Route
- Mine Clearance
- Provide Command and Control

Many of these tasks are inherent in all military operations; in OOTW, they are accomplished by squad leaders and tank commanders. The OOTW TACSOP provides these junior leaders with a ready reference for both training and real-world performance of the critical tasks which will determine success or failure of our next deployment to a LIC environment. The TACSOP includes detailed checklists and OPORDS for such tasks as convoy linkup, inspection procedures, LIC rules of engagement, and weapons control status, which are not often trained in most units. It has been issued to every tank and BFV commander in the squadron, and has proven to be an invaluable document.

Cavalry Table XII: Training for OOTW

The OOTW TACSOP was the base document used to create the observer/controller checklists and tasks/conditions/standards which 1-1 Cavalry trains its platoons on as Day 1 of a two-day Cavalry Table XII scenario. Borrowing heavily from the CMTC, 1-1 Cavalry creates a Zone of Separation in the vicinity of Grafenwohr's Range 301 CALFEX training area. Tank and scout platoons are trained and evaluated on their performance of all of the OOTW critical tasks listed above. The squadron uses its Lighthorse Humvee Scout Platoon as dedicated OPFOR to replicate the warring ethnic factions, presenting a number of challenging OOTW scenarios to the platoon leaders and section sergeants who would face them in an actual deployment. It is an intensive exercise in leadership, command and control, and discipline; none of the evaluated platoon members are sorry to hear that the peace agreement has broken down as a result of continued Sowenian aggression, requiring the platoons to move to high-intensity conflict on Range 301 to restore the peace.

OOTW at Home Station

As in all training, the most important lessons learned at Cavalry Table XII are brought out at the AAR. These lessons — incorporating changes to the OOTW TACSOP, to the organization and evaluation of Cavalry Table XII, and to internal platoon command and control, organization, and equipment — are further trained and refined at home station. OOTW is the ultimate in Sergeant's Time training: METL-focused and trained at the lowest level of supervision, just as the OOTW tasks would be performed on actual deployments. The TACSOP is a great reference for section leaders planning training, given that it is built around the tasks, conditions, and standards for tasks designated as critical to the success of the unit in OOTW by the V Corps commander.

Operations Other Than War are increasingly likely to be the situations which American units face when deployed in harm's way. Disciplined units composed of soldiers who are proficient in their basic skills and are operating under a clear expression of the commander's intent can succeed in a low-intensity conflict environment. However, it is our duty as leaders to ensure that they have the best possible training, organization, and equipment to ensure their success. The OOTW TACSOP and training in OOTW tasks, at training centers, during gunnery, and at home station, are ways to give our soldiers the edge they deserve so that they do not have to fight and win one hundred battles, but can subdue the enemy without fighting at all.

Copies of the 1st Squadron, 1st U.S. Cavalry TACSOP and the Cavalry Table XII packet are available from the Squadron S3, 1st Squadron, 1st U.S. Cavalry, CMR 401, APO AE 09076.

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Captain Tim Huening is a 1992 graduate of Ohio State University. He has served as scout platoon leader and as assistant S3 in the 1st Squadron, 1st U.S. Cavalry, 1st Armored Division, and was the primary author of the 1-1 Cav TACSOP and OOTW TACSOP. He recently served as the squadron S4.

Fishtanks or Kangaroos?

by Lieutenant Colonel Martin N. Stanton

Recently, while watching the news, I was treated to the rather nauseating spectacle of seeing M48A5s, M60s, and M60A1s being dropped into the ocean to make "artificial reefs." Although realizing that these vehicles were obsolete as tanks and that we are near to completing M1 transition, it seemed so wasteful.

Instead of dumping the tanks into the ocean, we should be looking at alternate military uses. Specifically, we should look to reconfiguring them as turretless armored personnel carriers and engineer vehicles, as was done in WWII. In the last year of the war, the British and the Canadians used tank hulls with the turrets removed as armored personnel carriers (called "Kangaroos"). These APCs afforded their embarked infantrymen greater protection than the APC of the day (the M3 halftrack) and were just as mobile as tanks. The Israelis have done much the same thing with old Centurion and Patton hulls. As these vehicles were replaced by Merkava, their automotively sound hulls were used for a myriad of functions. Their availability solved the problem of an APC's vulnerability to RPG and other light antitank weapons fire.

The M60 hulls would be perfect for combat engineer units in many respects. They would offer an increased degree of armored protection for combat engineer squads engaged in breaching operations. In addition, they would have a greater ability to breach wire than the current M113. The modified M60 hull could also be used to TOW multiple MICLICs and could also be fitted with mine plows.

The proposed engineer tank hull APC would have hatches both on the top and bottom of the hull, allowing for quick dismount over the top of the vehicle or slower but more secure dismount through the bottom hatch. The vehicle would be armed with an M2 .50 Cal MG (with the old Vietnam ACAV turret) and two pintle-mounted 7.62 MGs, as well as smoke grenade dischargers. Stowage bins could be welded on to the hull for engineer equipment. The removal of the turret and ammunition stowage spaces would allow more than enough room for the nine-man engineer squad. The engineer vehicle could have additional armor welded to the front and sides, as well as side skirts over the tracks and drive assemblies. Each vehicle could also be fitted to take either a blade or a mine plow.

In addition to duty as a manned engineer vehicle, M60 hulls could also be used for robotic mine and obstacle clearing. With hardened robotic controls, mine plow/dozer blade and increased armor, the vehicle should be hard to knock out. A platoon of such vehicles could be created in the headquarters company of each mechanized engineer battalion.

Furthermore, the automotively viable M60 hulls could be stored and used for any number of future requirements. A whole family of "funnies" could be based on the M60 hull, not to mention any replacement tracked ADA system (in the same manner of the ill-fated SGT York). Additionally, all of these vehicles could be used as sources of spare parts for the conversion vehicles.

Another possible use for the M60-series tanks is that of OPFOR vehicles. With the end of the cold war, U.S. forces now face a plethora of weapons systems, including many of our own. It will not be uncommon to see M48- and M60-series vehicles in the hands of our opponents in some future conflict. The addition of M60-series vehicles to the OPFORs of the NTC, JRTC, and CMTC will reflect this. It would also have the advantage of giving the OPFOR a vehicle that many tankers are familiar with and that more PLL exists for than the M551 Sheridan.

If nothing else, the tanks currently consigned (but not delivered) to Davy Jones locker could find a more useful end to their existence as targets. The hard targets on many ranges have been long shot to pieces. What better way to present realistic target arrays than to actually present entire tank companies as targets. This would be especially useful on USAF ranges in that it would give TACAIR pilots valuable practice in attacking actual large armored formations (albeit stationary ones). If the M48s are too long in the tooth to be effectively utilized in either foreign aid or alternative armored vehicle development, then this is by far a more militarily useful end than pushing them into the ocean in order to look politically correct.

"Waste not, want not" is a philosophy we had better get used to if we are to be successful in the incredible shrinking military. Pushing automotively viable tank hulls into the water for what amounts to a photo op is wasteful. These vehicles could still provide useful service to the U.S., either as conversions, as OPFOR, or as targets. We are no longer a military that can carelessly discard. The time may come in the not too distant future that we may have a use for our fishtanks.

Lieutenant Colonel Martin N. Stanton received his Infantry commission in 1978 from Florida Tech. He served as a company XO with 1st Infantry Training Brigade at Ft. Benning; rifle and TOW platoon leader with 1-9 Infantry in Korea; assistant G3 staff officer with 9th ID, and commander, D Company, 2-2 Infantry, both at Ft. Lewis, Wash. He served as company and S3 observer/controller at the NTC at Ft. Irwin; senior brigade advisor, 2d Saudi National Guard Mech Brigade, Hofuf, Saudi Arabia; and as S3, 2-87 Infantry, Ft. Drum, N.Y. His combat service includes the Gulf War in 1991 and Somalia, 1992-93. A graduate of the College of Naval Command and Staff at Newport, R.I., he is currently assistant J5 Policy, USCENTCOM.

À Cheval

Equitation as Sport and Training at the French School of Armor and Cavalry

by Lieutenant Colonel John Moncure

The author began riding when he assumed his duties as the American Liaison Officer at The French Cavalry School. As of this writing, he has not broken any bones.

Nestled in the magnificent valley of the Loire River in northwest France, the School of Application of Armor and Cavalry seems at first glance to be a curious blend of old and new.[1] The Cavalry School conducts basic and advanced officers courses, reserve OCS, senior NCO courses, and all manner of specialized, armor-related technical courses. It contains a think-tank for armor doctrine and advanced computer simulations suites. Just across the street from a spanking-new, angular building of diamond-shaped steel girders and glass — the new home for instruction on the high-tech, digitalized, third-generation Leclerc main battle tank — is the riding complex. There one finds stables for 120 horses, two *maneges* (indoor riding halls), the *carrière* (a large outdoor riding arena), and the *Chardonnet* (an even larger arena). Behind the 18th century headquarters building is a special arena for dressage. It has not changed much since the end of the 19th century. The school also owns a 100-acre wood and field with trails for riding. The cadre of the school — even those who spend their days teaching the new Leclerc — often touch their roots at 7 a.m., exercising on horseback. The instructors of the *Section Equestre Militaire* (SEM) offer daily classes to student officer cadets, basic and advanced course students, officers, NCOs, and draftees of the cadre, and even cadre spouses and children. In 1993, the SEM taught 4,600 hours to officer and NCO students, 2,200 hours to dependents, and 2,000 hours to cadre (individual and in groups). Clearly, equitation is the glue that binds the diverse organisms of the school, as much with each other as with the past. More important, the French see the horse as a training device to teach the spirit of the cavalry, character, and leadership.

To introduce new officers to the spirit of the branch they have selected, the French cavalry school requires all basic course students to ride.[2] Usually, no more than half of the lieutenants have ever ridden before their arrival in Saumur in September. But by the end of their 10-month basic course, in July, they perform on horseback during an annual gala called the Caroussel.[3] Before 30,000 to 40,000 spectators, the young lieutenants jump meter-high barriers in unison, and charge full-tilt with lances to snare 12-inch diameter rings dangling from a platform. Others, carrying sabres at a gallop, skewer paper maché heads (looking curiously like their instructors) planted one foot off the ground.

At left, the opening ceremony in the Carrousel.

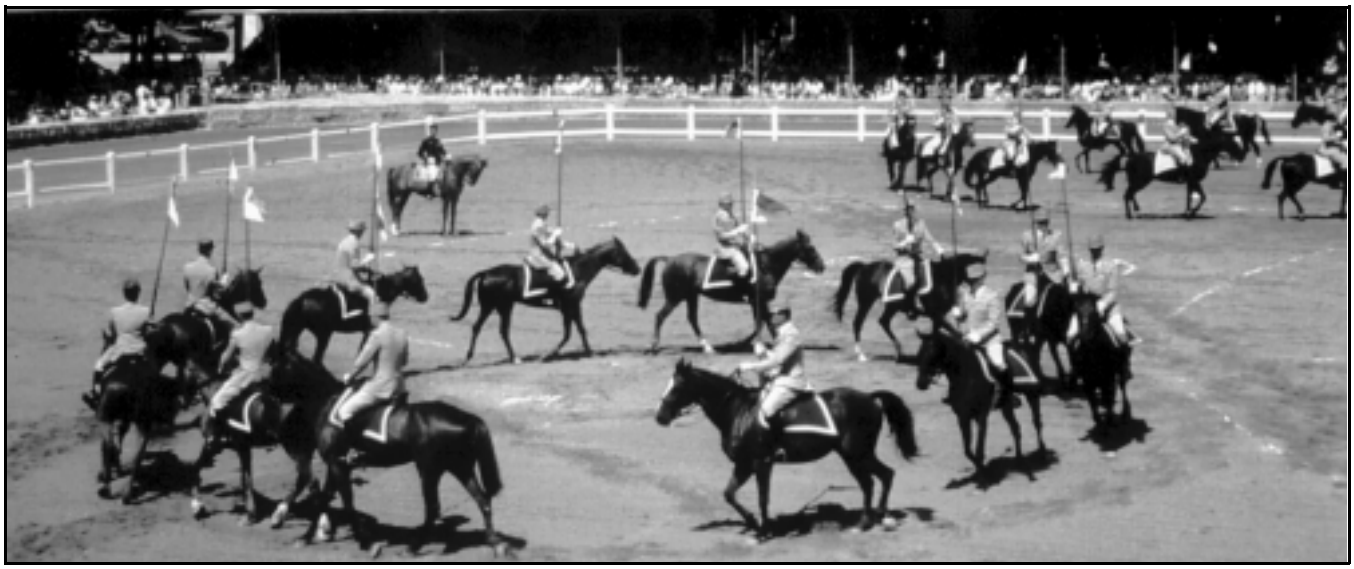
Above, a lieutenant prepares his horse in preparation for his riding lesson.

On the following page, a platoon of lieutenants performing during the Carrousel.

The course of instruction for lieutenants is organized by the *Écuyer en Chef* Lieutenant Colonel Patrick Mozat (the riding master on the faculty of the school), and conducted by his cadre of one captain, three NCOs, and eighteen military grooms, all of whom are specially trained at the Military Equitation Sports Center at Fontainebleau (CSEM). The curriculum includes 27 periods of instruction of one hour, and 19 more of two hours each. At the end of the first 25 hours the lieutenants conduct a *raid d'equitation*, an overnight exercise including a mounted land navigation event in which they are required to fill in a whited-out section of a photocopy of a 1:50,000 map. They also practice 40 hours for the Caroussel. More advanced riders may join the Club Wattel, named after a former riding master,[4] and enjoy additional hours of riding instruction to prepare them for competitive events elsewhere in France or internationally. By the end of the year, 85 percent of students reach the skill-level goal.[5] The robustness of the program suggests strongly that the emphasis placed on riding is an important instrument in the development of cavalry officers.

The equestrian program serves other purposes as well. Of course, riding is a sport. A beginning rider (*debutant* in French) who also runs regularly will experience significant soreness in the first few weeks of instruction, even at the pace of one lesson per week. The style is "classic" (English) — adapted to the French mentality, of course. Horsemen use the Danloux saddle[6] and all riders are required to wear the riding uniform: britches, riding boots, kepi. They do not actually "ride" as much as they become a component of a centaur: man and horse in a single being. The *trot enlevé* — rising trot in Britain or posting in the U.S. — requires the rider to balance on the stirrups, perform modified knee bends, and squeeze his calves into the horses' flanks to indicate acceleration, deceleration, change of pace, change of direction, or change of attitude of the horse (such as an oblique movement). While it is not as demanding in endurance as distance running, it requires considerable effort and coördinated skill.

During that year, the lieutenants not only get good exercise to supplement their other sports, they learn a skill viewed at the school as a measure of machismo, and they become confident in their abilities as well. Frequently, troops of horsemen ride into Saumur or its outlying villages, clattering purposefully along the narrow streets, or cantering through the nearby fields or woods. Sitting astride a 1200-pound



animal with its own mind is a daunting prospect to anyone who has not done it. The apprentice rider learns a new way to sit, to stand, to balance himself. He learns a suppleness in the saddle without which riding is not only uncomfortable and even painful, but a precursor to lingering back injuries. Enjoying the view five feet above the heads of pedestrians surely contributes to the value of the horse as an instrument of psychological conditioning for young cavalry officers. Just as the parachute badge gives a soldier a sense of accomplishment at having faced danger, so does an experienced horseman gain a general sense of presence and mastery from his horseborne feats.

But more than these more obvious purposes, the physically and psychologically demanding exercise of learning to ride a horse gives the young officer a sense of the relationship of the leader and the led. For the duration of a ride the horseman gives the horse direction, rate of advance, and pace. The horse is an enormous creature (much larger than it appears in Westerns) with a mind of its own. If it refuses to perform as requested (usually a consequence of inexpert directions by the rider) it can be forced. But it can also turn on its master when it has had enough abuse. A more experienced rider learns to operate in concert with the horse to defeat the obstacles that confront them both. He takes into account the horse's personality and character, his previous history, his physical aptitude, and his level of training. He teaches it with patience and clarity, but also with firmness. On horseback, in motion, he must rapidly read, understand, and react correctly to both the horse and the external situation.[7] This description should sound much like a platoon in the hands of its new lieutenant. The cavalry basic course officers — who are not made aware of these similarities — join their first unit with at least a subliminal understanding of some of the basic truths of leadership.

Thus, equitation at Saumur is not just a pleasant diversion for the idle rich. The mode of transportation for the predecessors of today's armor officers has been pressed into service in a new way. Coming to grips with the horse gives young leaders a hint of the intangible qualities that make cavalrymen effective in modern, high-tech combat. In 1913, the French riding master and author Gustave Lebon wrote:

It is interesting to note that the reasoned dressage of the horse serves the cavalryman as an exercise in intellectual gymnastics and character-building that no theoretical instruction could ever replace.[8]

Most modern armies have relegated the discipline of equitation to the confines of quaint, anachronistic tradition. By devoting impressive resources of time, energy, and funds to the sport, the leadership of the French Cavalry School — and the Army headquarters that funds it — have demonstrated convincingly their recognition of its continuing value in building the armor leaders of the future.

Notes

[1]I wish to thank Captain Dominique Siegwart for his helpful suggestions during the preparation of this article.

[2]Several hours of equitation are also required at St. Cyr, and offered at several other branch schools as well. Advanced course and NCO course students receive only 8 hours of instruction; thus, the principal thrust of the Riding Section is for the lieutenants.

[3]This, and other public events, offset the cost of horseback riding at the school. The army spends about $4.00 per lesson for its students.

[4]After commanding the 2nd Tank Battalion in 1918, General Wattel returned to Saumur to be riding master of the famous Cadre Noir. He took the business of armored warfare seriously, announcing, "I take the same care of my tanks that I do of my horses!" Général Decarpentry et Jacques Perrier, *Les Maitres Écuyers du manège de Saumur* (Paris, Charles-Lavauzelle, 1993), p. 95.

[5]"Activities de la Section Equestre," unpublished document, prepared in 1994 and furnished to the author by LTC Mozat.

[6]The Danloux saddle looks generally like an English saddle, and is named after General Wattel's successor as riding master at Saumur.

[7]Capitaine Pascal Bayle, "L'Equitation au Programme de la deuxième division d'instruction de l'Ecole d'Application de l'Arme Blindée et de la Cavalerie: Tradition onereuse ou necessité comtemporaine?" Unpublished manuscript [n.d., 1985?], paras. 221, 222.

[8]Gustave Lebon, *L'Equitation actuelle et ses principes* (1913), 136.

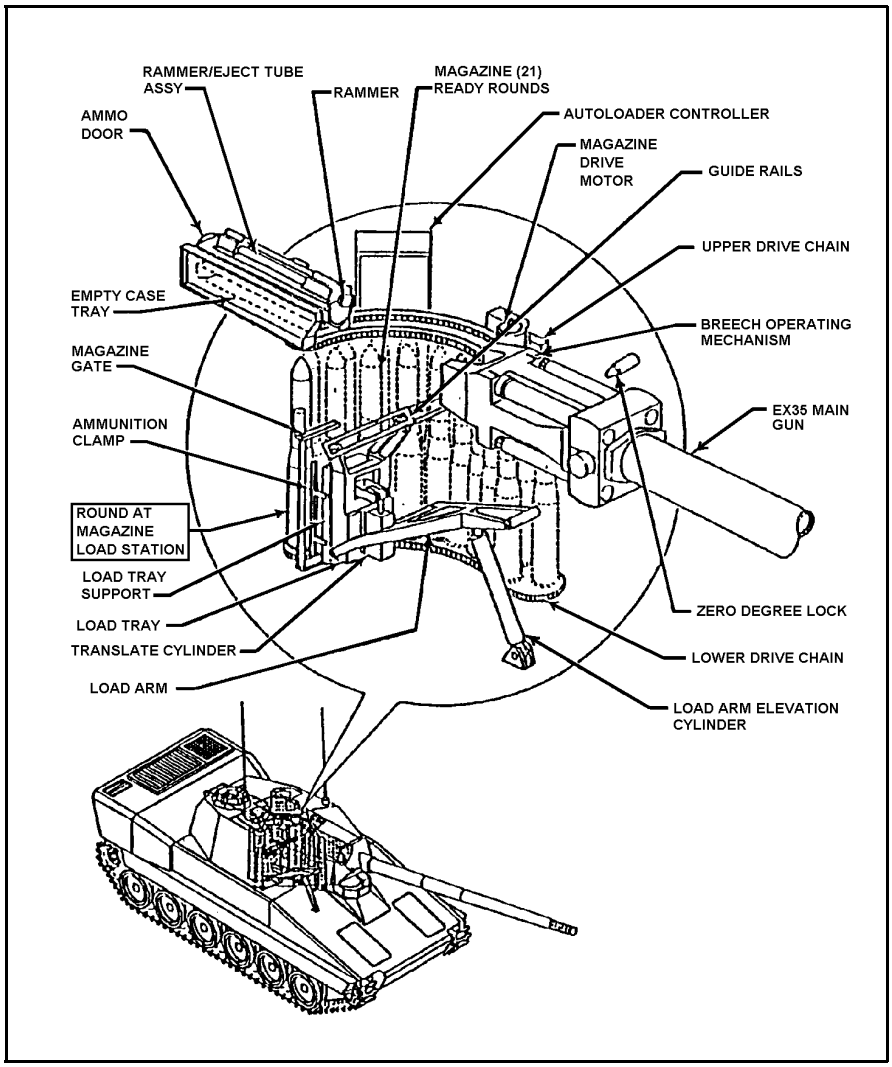
Lieutenant Colonel John Moncure is the American liaison officer to the French Cavalry School. He was commissioned from USMA in 1972 and holds a Ph.D. from Cornell University. He has served in the 2nd, 3rd, and 11th ACRs, taught history at West Point, and was Professor of Military Science at Davidson College.

The Armored Gun System (AGS) Autoloader

by Lieutenant Colonel George E. Mauser

A recent article ("Ammunition Loading Systems for Future Tanks" by Sharoni and Bacon, *ARMOR* March-April 1995) clearly outlined many of the issues associated with automated loading systems and reduced crews in combat tanks, as well as providing an informative survey of recent U.S. autoloading concepts and engineering demonstrators. The following additional information discusses the related subject of the Armored Gun System (AGS) autoloader (A/L) which will be the first production autoloader for a large caliber direct fire weapon system to be fielded by the U.S. Army.

Let us remember that the interest in autoloaders is a natural progression flowing from the steady trend toward crew reduction throughout the history of armored fighting vehicles. During WWI, the British Mark I Male tank had a crew of eight, while the German A7V carried 18 men. WWII and the Korean War-era tanks had five-man crews. Remember the bow gunner? Those now on active duty or with recent tanker experience know the close knit teamwork of the four that crew M48s, M60s, Sheridans, and Abrams. Now, we are at the point of serious investigation and adoption of automated ammunition handling and loading capabilities in future large caliber weapons systems with crews of three and possibly two members.



As a strategically deployable system for use by early entry and contingency forces, the AGS has specialized air transportability requirements for delivery by airlanding and Low Velocity Air Drop (LVAD) (parachute delivery). Note that air transportability considerations tend to drive designs to be "small" and "light," which is in direct competition with the tendency to build armored vehicles "big" and "heavy." So, while being small and light, the AGS must be reliable and robust enough to operate in the severe ground combat environment, as well as support the weight and firing shock of a high-pressure 105mm cannon. An autoloading system was selected for use in the AGS, based on the need to build AGS within the weight and size envelopes dictated by the capabilities of available USAF tactical transport aircraft.

Design specifications for the AGS autoloader essentially describe a mechanical assistant to the gunner and commander that provides capabilities far exceeding the physical performance of a human loader. An autoloader offers the sustained rate of fire and system flexibility permitting a reduced crew of three to successfully adapt to and fight in rapidly changing battlefield conditions at least as well as a four-man crew. A collateral result is that smaller crews minimize the number of personnel placed in harm's way, reducing potential casualties.

Replacing the fourth crew member with an autoloader provided opportunities to optimize the system for rapid, flexible rates of fire. AGS will be one of the deadliest armored vehicles for its size, because it can load, fire, and reload more quickly, over harsher terrain at higher speeds for a longer period than vehicles that depend on human

loaders. This gives the AGS commander the tactical agility to acquire, engage, and defeat multiple targets very quickly while stationary or on the move.

Significantly, the space needed for the autoloader is much less than that of a fourth crewman, thus the interior protected volume is less. Consequently, less structure and ballistic protection is required to protect the autoloader mechanism than would be required to protect a crewman. Another advantage is the ability to allocate conserved space and weight to increased armor and on-board ammunition or other stores. The AGS autoloader provides a weight savings to the total design of about 1500 lbs. In terms of volume, the autoloader, with 21 ready rounds is equal to a crewman, all of his equipment, and only nine ready rounds.

The autoloader — the "robotic crew member" — is capable of maintaining the desired 12-rounds-per-minute rate of fire and allows the commander and/or gunner to rapidly select the appropriate round for the identified target from the mix of standard 105mm munitions loaded in the magazine. The AGS has demonstrated sustained rates of fire of 12 rounds per minute. (Practical limitations on rates of fire will still be dictated by crew target acquisition and engagement skills, target obscuration and the need to follow basic principles — mutual support, overwatch, disciplined fire distribution, ammunition conservation, and use of good terrain movement techniques, including use of cover and concealment, as well as alternate and supplemental positions.)

The autoloader control system in the AGS provides the crew full flexibility to select a round from the magazine, load it, unload it, re-stow it as a ready round, and select another in less time than it takes to describe. Ammunition selection, loading, firing, and ejection commands can be ordered at both the commander's and gunner's weapons control panels, with the commander having the option of final override on all actions from his control panel. Upon firing, the autoloader ejects the spent casing from the vehicle and can load the next round automatically or on command. Should a misfire occur, the autoloader extracts and ejects the misfired round to prepare the gun for another round, or extracts and presents the round for re-stowage, if desired. Under normal engagement conditions, the crew does not handle ammunition or empty cases.

Should the autoloader fail, a crew member can easily get into the autoloader compartment and manually load from inside the turret. Manual loading under armor provides the crew redundant capabilities and reinforces their confidence that they will always have a means of self protection. A positive lock-out at the access door shuts off hydraulic power so that the autoloader and main gun drive mechanism won't operate while the crew member is in the compartment. The door is part of a bulkhead that segregates the autoloader, magazine, and gun from the crew compartment as an added measure of protection for the crew if there is a threat penetration and a subsequent ammunition detonation or fire. This compartmentalization is a proven technology feature modeled upon that used in the Abrams tank.

The AGS carries thirty 105mm rounds — 21 ready rounds in the autoloader magazine and nine more in hull stowage below the turret ring. Each ready round is inventoried and its type and magazine location registered in the autoloader controller and displayed on the computer control panel during autoloader replenishment. If necessary, the inventory function can be reviewed during operations to confirm the type and location of each ready round or to account for rounds manually replenished. During a replenishment function, the autoloader control system indexes the magazine by evenly distributing the rounds of each type to ensure a maximum firing rate. A byproduct of this indexing is maintenance of an optimum spacing of like rounds to improve survivability and evenly distribute the weight of rounds. Replenishment of the autoloader magazine with a full complement of 21 rounds, including inventory entry and verification, has been regularly accomplished in less than two minutes.

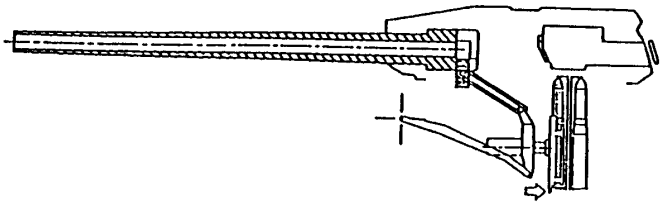
Autoloader status is reported to the gunner's computer control panel at power-up and during operations by a Built-In Test (BIT) capability through the autoloader computer controller. Autoloader status is constantly reported in a message cue at the computer control panel. Fault messages notify the crew to initiate isolation via on-board diagnostics to determine whether a system fault can be corrected in the turret or if it will affect the mission.

The primary software development challenge for the management and control of the autoloader was its proper integration with the total vehicle system under all combat and training conditions, in conjunction with providing on-board diagnostic capabilities.

Design of the autoloader to withstand LVAD without excessive weight presented some very unique challenges. To be immediately combat-ready once on the ground, the autoloader structure had to be capable of surviving LVAD landing forces with up to 10 rounds of 105mm ammunition loaded in the magazine. The loading system components had to be robust enough to handle the stresses of parachute landing and yet function reliably. To accomplish this, all autoloader components are designed for, and have demonstrated survival of, a 15G vertical shock — the damped loading imparted to the autoloader upon parachute landing. The design underwent extensive stress analysis to ensure maximum performance at minimum weight. This resulted in numerous structural design changes for strength and weight reduction and judicious selection of materials best suited to the task such as stainless steel, titanium, and composites. An autoloader unit alone and also one mounted in an AGS have undergone static drops to replicate airdrop shock. On both occasions, the autoloader units functioned correctly immediately after the drops. Automated functions used after LVAD include control and meas-

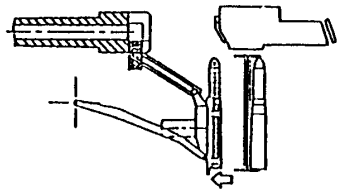
A. INDEX AND ACCESS SELECTED AMMUNITION

- OPEN LOAD TRAY AMMUNITION CLAMPS
- EXTEND LOAD TRAY TO MAGAZINE



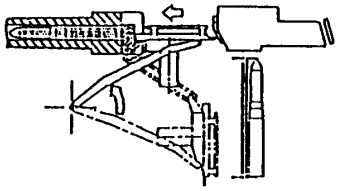
B. REMOVE SELECTED ROUND FROM MAGAZINE

- CLOSE LOAD TRAY AMMUNITION CLAMPS
- OPEN MAGAZINE GATE
- RETRACT LOAD TRAY



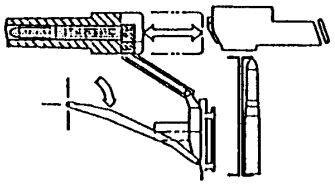
C. TRANSPORT ROUND TO GUN BREECH

- RAISE LOAD TRAY TO GUN
- LOWER RAMMER/EJECT ASSEMBLY TO RAM POSITION
- OPEN LOAD TRAY AMMUNITION CLAMPS
- EXTEND RAMMER
- BREECHBLOCK CLOSES



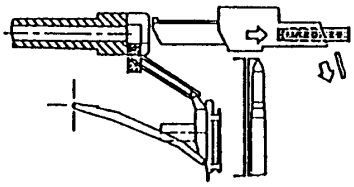
D. CLEAR MECHANISMS AND FIRE

- RETRACT RAMMER AND RAISE RAMMER/EJECT ASSEMBLY
- CLOSE LOAD TRAY AMMUNITION CLAMPS
- LOWER LOAD TRAY
- CLOSE MAGAZINE GATE
- FIRE, RECOIL, AND COUNTER-RECOIL



E. EJECT SPENT CASING

- EXTEND EMPTY CASE TRAY
- OPEN REAR AMMO DOOR
- OPEN BREECHLOCK TO EXPEL EMPTY CASE
- RETRACT EMPTY CASE TRAY
- CLOSE REAR AMMO DOOR
- INDEX NEXT ROUND TO LOAD STATION



urement of the autoloader hardware interfaces, system monitoring through BIT, automatic recalibration of the mechanism without intervention by the crew, and the ability to step-function the system to aid system diagnostics. A demonstration of LVAD with an actual AGS was conducted in June of last year as part of the Early User Test and Evaluation.

The autoloader also had to be designed to interface with the government-provided XM35 gun. This 105mm gun, designed by the U.S. Army's Benet Laboratories for use in lightweight vehicle applications, but not specifically for use in the AGS, has to be effectively serviced by the autoloader without overstressing it. A prime concern was the gun/autoloader interface, in which the autoloader pushes against the gun breech operating mechanism to open the breech and expel the spent case or unload a full round. Autoloader actions had to be tempered to protect the breech mechanism from excessive forces while still providing consistent operation over many thousands of operating cycles. This was accomplished by analyzing and tailoring the hydraulic forces and accelerations applied to the breech and modifying the gun with a positive breech stop.

Additionally, the gun and autoloader combination had to accommodate a wide range of available 105mm ammunition types with significant variations in trunnion forces produced, weights, overall lengths, structural robustness and centers of gravity. The gun and autoloader combination had to consider many variations in ammunition components, such as fuzes, primers, warheads, propellants, and metal cases. For safety, positive control of the munitions must be maintained by the autoloader during all phases of ammunition handling. As the 105mm ammunition family has been designed over almost a 40 year span, there is a wide variation in case materials and projectile designs. Case crimp design, and, most critically, wide variations in the case crimp yield strength, became a significant factor during development of the autoloader. Traditional ammunition design guidelines had never envisioned the forces that high rate automatic loading would generate when compared to forces produced by manual loading.

The autoloader incorporates a wide variety of common and innovative technologies. The turret electrical control box provides the autoloader with 28 volts DC power to the autoloader controller (ALC). The ALC is programmed to safely control the loader's ammunition handling and inventory functions. The ALC receives and transmits all communications from and to the fire control computer (FCC) and

	Use	Model	Type
Group A	Training	M490A1 M724A1	TP-T TPDS-T
Group B	Primary War Fighting	M900 M833 M456A2	APFSDS APFSDS HEAT-T
Group C	Special Purpose	M393A1 M393A2 M416 M456A2	HEP-T (Training) HEP-T (Service) WP-T APERS-T

105mm munitions undergoing qualification for use in AGS.

the computer control panel (CCP). The autoloader software currently has 12,785 lines of code and has 97.7 percent Ada language content.

The AGS autoloader is powered by a hydraulic system that incorporates features such as linear actuators, a servo-controlled actuator, and solenoid-controlled valve blocks found in state-of-the-art hydraulic systems.

All ammunition transfers (magazine-to-breech or breech-to-magazine) are accomplished via linear actuators. Each linear actuator is designed to control both the acceleration and the deceleration of the mechanism in motion. Additionally, the start and end position of each mechanism is exactly the same for each actuation/de-actuation cycle. The actuators are sized for the heaviest load, which compensates for variations due to round size, round weight, shock, vibration, and changes in environmental conditions. This approach ensures round-to-round repeatability and high reliability.

The autoloader magazine drive design incorporates a servo-controlled actuator. The servo-controlled design incorporates a servo valve, electrical feedback circuits, and software to control the acceleration, deceleration, velocity, and position of the magazine. This approach was selected to achieve high performance in positioning the desired round to the load station from any position in the magazine. The current design permits magazine rotation in either direction and for any distance or duration.

The solenoid control valve blocks incorporate individual solenoid valves and "shuttle valves" to transition low-level electrical control signals to high power hydraulic output drive signals. Each linear actuator and servo actuator are controlled through these valve blocks. Safety is provided and maintained by a fail-safe design approach on the main control valve block, which incorporates a solenoid that returns to an "Off" or "No Hydraulic Pressure Applied" condition upon loss of either hydraulic pressure or electrical power.

The design approach selected for the sensors was to use Hall Effect proximity switches and magnet combinations for sensing critical positions of the autoloader mechanisms. The magnet's field is sensed by a proximity switch when the two items are aligned within a specified gap/distance. This approach was selected because of the high reliability of proximity switches and improved service life gained by eliminating physical contact to actuate the switch. This feature makes the switch largely insensitive to external contamination from dust, dirt, and moisture. It is much more reliable than a standard contact switch or optical sensor. Additionally, since there are no moving parts internal to the proximity switch, reliability is enhanced. Proximity switches are also fail-safe since they do not fail in an "On" position. A disconnected switch is sensed electrically as a switch out of proximity, signals the electronic controller that an unusual condition exists, and halts operations for safety.

The autoloader hydraulic actuators and servo magazine motors are safety sequenced through logic and timers internal to the autoloader controller. Ammunition can be transferred from the magazine to the breech and from the breech to the magazine. This is possible because none of the mechanisms are mechanically linked to the next sequence, but are software-sequence linked to a specific operation. Sequence diagrams were developed for each desired operation (load, unload, eject) and the logic was programmed in software to achieve that result.

This feature of sequencing or synchronizing mechanisms to operations provides for an extremely fast loading rate as it allows for simultaneous operations. For instance, load tray and empty case tray motions can occur at the same time. This feature also provides for optimization of parts and multi-function of assemblies. The multi-function approach lowers weight and heightens reliability as it results in fewer parts, and the complexity of the system is reduced. A prime example of a multi-functional assembly is the Rammer/Empty Case Tray. This assembly actually performs three functions:

- Ramming the round to the breech during load operations
- Extending the empty case tray for ejecting cases or misfired rounds
- Buffering the round during an unload operation

The autoloader electronic controller sequences the autoloader mechanisms as described above, interfaces to the CCP and FCC, maintains inventory, and performs BITs on the autoloader.

While the controller manipulates the system, it also runs ALC background BIT, operational BIT, and operator requested BIT. The background BIT is active whenever electrical power is applied to the ALC and no autoloader motion is requested. Examples of this BIT are internal circuit board tests, cable connection tests, and power supply checks. Any faults found are sent over the 1553 data bus and displayed on the computer control panel.

The operational BIT is active whenever an autoloader operation is requested. Examples of this BIT are "autoloader stowed" as a condition to start, ammunition inventory checks as a condition to perform the desired operation, and proximity switch and solenoid safety interlock checks as a condition to complete the requested operation.

The operator-requested BIT is active or available for fault isolation and corrective action. Autoloader information available to the operator includes motion timing, fault history, cycle history, switch status, and solenoid status. The ALC also contains electrical and hydromechanical BIT tests that can be requested by the operator to help identify a problem, or determine the current status of the system. Options that can be operator-requested include:

- Electrical test — a test to see if the system's electronics are receiving messages and power.

- System test — a test to see if the system mechanical interfaces are operating in sequence and unison.
- Ammo hatch door test — a test to see if the door functions as programmed.

BIT is an integral part of the autoloading safety and self-protection system. If the software determines the condition detected by BIT to be dangerous to either ammunition, equipment, or personnel, the solenoids will be held in their last condition and hydraulic pressure is automatically removed from the autoloader. The unsafe condition must be corrected and the autoloader brought to a stowable condition before continuing operation. Immediate action drills have been developed, similar in concept to those used on automatic weapons such as machine guns, to facilitate quick recovery to full fightable condition if stoppages do occur.

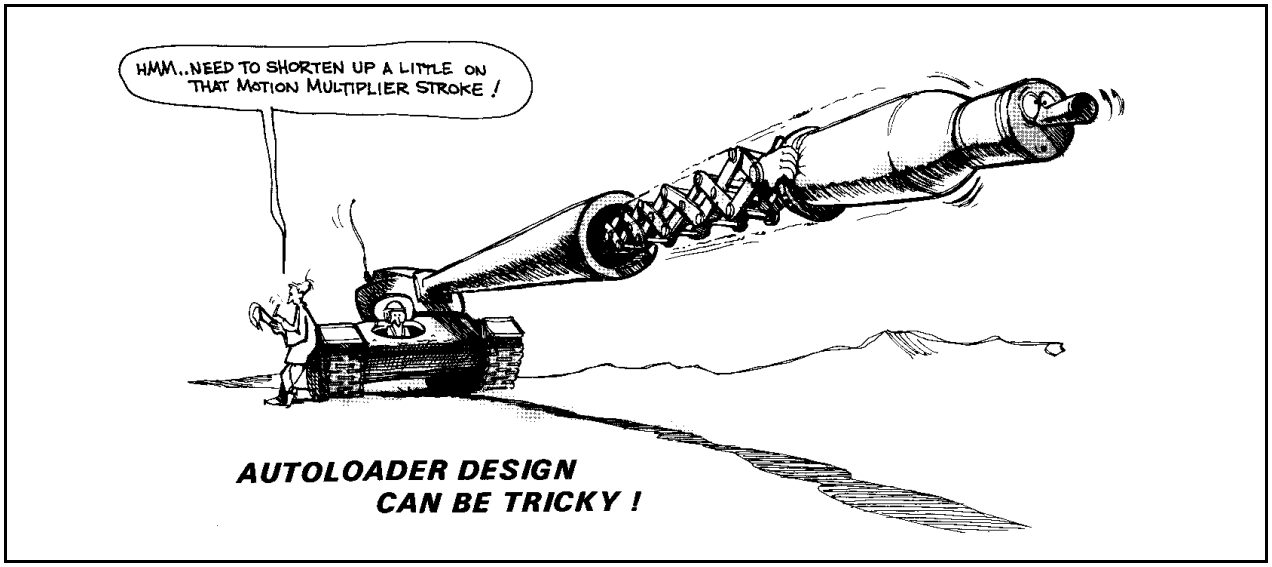
The functional design of the autoloader is complete and the contractor has delivered eight prototypes. The first two prototype autoloaders were delivered as qualification units. One was retained by the contractor for component/environmental qualification tests and the other was sent to Aberdeen Proving Ground to support ammunition qualification. The remaining six prototype autoloaders were delivered to United Defense Limited Partnership (UDLP) and are now installed in the six pre-production vehicles undergoing government technical and operational test.

The AGS autoloader environmental/component qualification test ended successfully in March 1994. Tests evaluated autoloader performance against parameters in the AGS program's Critical Item Development Specifications (CIDS) to establish the operational and survivability characteristics of the autoloader when subjected to external environmental conditions. The scope of tests performed consisted of operations under high temperatures, low temperatures, thermal shock, humidity, blowing dust, cleaning water spray, slope, random vibration, operational/non-operational shock, and air drop shock. Testing replicated the most severe field conditions, including heavy dust, mud, and moisture contamination, and was very successful. Any shortcomings discovered during the test resulted in component changes for subsequent application to the autoloader assembly and re-testing.

The second qualification autoloader is currently at Aberdeen Proving Ground (APG), Maryland, and is being used to support ammunition qualification testing. The ammunition qualification test is designed to determine the compatibility between the AGS and currently fielded 105mm ammunition types. Qualification testing consists of six subtests:

- Autoloader function
- Autoloader cycle
- Autoloader vibration
- Sequential life-cycle
- Sequential rough handling
- Ammunition airdrop

Each subtest is being conducted on each ammunition type to be fired by the AGS. In addition, each qualification autoloader is used to evaluate any design changes and their impact on ammunition handling. The autoloader undergoing government test at Aberdeen Proving Ground has completed over 16,000 cycles (vs. 10,000 cycle design life) with no major failures or overhaul. Like the Energizer Bunny, "it just keeps going and going." Indications are that the AGS autoloader system will exceed its original design life by a wide margin. Testing will continue through FY96.



The Lighter Side of Autoloaders

Larry Bacon, Director of Graphic Arts at Western Design, a California firm that develops autoloaders and ammunition-handling systems, amuses co-workers and customers with his cartoons when he isn't designing serious stuff like rammer assemblies and feed chutes. This one is from a humorous briefing entitled "Ammunition Handling Through the Ages."

The six pre-production vehicles (PV) are currently being used for technical testing, operational experimentation, and logistics demonstrations. Fully functional autoloaders are in each of these vehicles. One PV has completed the contractor 4,000 mile durability test, which includes autoloader cycling and live ammunition firing. Two PVs are at APG undergoing government performance and reliability testing. Another two PVs are being evaluated at Early User Test and Experimentation (EUT&E) now in progress at Ft. Pickett, Va. During these tests, the total requirements for the AGS are being evaluated. The remaining PV is currently at United Defense Limited Partnership (UDLP), the prime system contractor, and is being used for logistics demonstrations and engineering evaluations.

Informal observations shared by the ever-expanding population of those with exposure to the AGS autoloader are providing insight into its characteristics and suitability. Emerging information substantially supports the view that soldiers can be easily trained to operate the autoloader. It is simple and safe to operate; positively controls and safeguards ammunition; aids crew interactions; is robust, reliable, repeatable, and repairable; and meets its specified requirements. Definitive judgment about the autoloader and the AGS must await technical and operational test outcomes and official assessment by the appropriate independent evaluation agencies.

The AGS autoloader, designed and built by United Defense Limited Partnership, Armament Systems Division (UDLP-ASD) of Minneapolis, Minnesota, is supplied to United Defense Limited Partnership, Ground Systems Division (UDLP-GSD), San Jose, California, for AGS system integration.

Although not a main battle tank, the AGS will be the first U.S. production tank-like system with a reduced crew of three (commander, gunner, and driver) and an automatic loading system (the "robotic" crew member) in place of the traditional fourth crewman. AGS will provide the Army its first experiences in the transition from four-man crews. As such, the AGS will be the precursor of those future systems described by the recent article.

AGS is leading the practical adaptations to our operational and logistics support doctrine (as well as our Armor culture) and will influence future tactical operations with crews of less than the accustomed four members. This process has already started with the exposure of Armor soldiers and organizational mechanics from the 3rd Battalion, 73rd Armor, XVIII Corps. Hands-on experiences with production-like hardware have occurred during logistics demonstrations conducted over the last two years by soldier crews conducting technical testing at Aberdeen Proving Grounds, Md., and at tactical and gunnery testing now ongoing.

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The HHC XO

Tips on Organizing a Tough Job
With Responsibility for a Lot of Equipment

by Captain David A. Smith

One of the most difficult, and probably the least glamorous job, for an armor lieutenant in an armor battalion is the headquarters and headquarters company executive officer. He is responsible for the maintenance of over 130 vehicles of all different types and configurations. He is also responsible for monitoring supply matters for a company of over 300 and hundreds of property book lines. I was an HHC XO after being a tank company XO for 11 months. I had a good idea what a tank company XO did because I watched my XO while I was a platoon leader. The HHC XO job was one that I was less prepared to take and, therefore, I learned a lot on the job.

The first thing I learned was to use the personnel in the company. A tank company is really not that big, so I used to get away with doing some tasks myself or getting maintenance status straight from the tank commanders. The size of the headquarters company made that impossible. Personnel in the company have a wealth of experience. Your scout platoon leader was probably one of the best tank platoon leaders before he took the scouts, so he should be able to help you keep the scouts squared away. Your support platoon leader is usually an experienced lieutenant who can also help. In some sections, the leader is often occupied with other issues, so it is easier to find a point of contact for maintenance and supply issues. This does not necessarily have to be the leader of the section, but it has to be a responsible individual who can talk intelligently about the information you need. A competent point of contact in each section will make it easier to track status of the company.

The second thing I learned was that an HHC has much more property than a tank company. I was blessed with an excellent supply sergeant who ran a well organized supply room. If it is possible, the HHC commander should try and get the best supply sergeant in the battalion into the HHC supply room. If the HHC supply sergeant is overcome by the size of the HHC, then the XO will have to spend more time helping with the supply room.

"Since you have all the battalion's mechanics, you also have all the tool boxes that go with them. The XO should stress to the mechanics to keep accountability of their tools or expect to pay for them..."

The first step is to organize. Find enough black binders for each section that has a hand receipt. Gather the section's hand receipts together and put them in the binder. Use document protectors to separate the hand receipts in the binder. Put a number on each binder. Next, go through each line number in the property book and, next to the item, put the number of the binder where the hand receipt is kept. If you ever need to inventory a particular item, look in the property book and see, by binder number, which sections are signed for the items.

The second step is to ruthlessly inventory. Using the monthly ten percent inventory is the best way to keep track of the company property. The XO should help the commander by organizing these inventories ahead of his arrival, so all he has to do is look at a layout. The XO should locate all the property and set a layout time with the sections being inventoried. To keep the company property in order, the XO must follow through after the inventory and account for shortages. This is not the time to let hand receipt holders say, "Give me a few days, I'll find what I lost." The HHC has too much property, and it is very easy to forget about a lost wrench. The biggest supply headaches for the HHC XO are the sets, kits, and outfits (SKO). A HHC has many end items with component listings that are pages long. Soldiers can even make the equipment operate for years without some parts that were lost by a previous hand receipt holder. The trouble comes when you try to turn in that end item and the receiving agent wants it complete. Since you have all the battalion's mechanics, you also have all the tool boxes that go with them. The XO should stress to the mechanics to keep accountability of their tools or expect to pay for them. After conducting all inventories, update the shortage annexes and complete the adjustment documents.

The next thing I learned was that maintenance in the HHC is not as easy to perform as in a tank company. A

tank company will have at least two soldiers per tank to pull maintenance. Maintaining the tank is part of fighting the tank, so plenty of time is allocated to PMCS. The scout platoon is similar to the tank platoon because a scout also depends on his vehicle to do his job. The mortar platoon's maintenance problems centered on the age of their equipment. The M106s we had were over 25 years old and some of the mortar tubes were fabricated in the 1950s. Also, some mortar soldiers came from a light division background and were not familiar with track maintenance. The medical platoon might also be a problem. Medics do not spend very much time on maintenance training because they, as they should, spend more time in medical training. The medical platoon leader in my HHC admitted that he had only a few hours of PMCS training at his basic course. He was willing to learn, but it was hard to rely on him when it came to maintenance matters. The cooks were another problem. Cooks are up early preparing breakfast, and after that, they start on lunch. Their real-world mission of feeding the troops three meals a day does not leave much time to work on their trucks or MKTs. The battalion staff vehicles can be easily neglected. The drivers of the staff vehicles often have other jobs at battalion headquarters, so they do not see the motor pool very often. Battalion staff officers will claim they have more pressing matters for their soldiers to do besides maintenance. Sometimes this is true, but they will need their tracks for the next field exercise, so some maintenance needs to be done. Believe it or not, the worst maintained vehicles in the battalion are often the maintenance team vehicles. The maintenance team spends all of its time repairing everyone else's equipment and has little time to PMCS its own. During command maintenance, the mechanics spend all the time fixing their company's vehicles, leaving little time for their own maintenance.

How do you fix these problems? First and most important is a ruthlessly enforced Command Maintenance. The best way we found to control Command Maintenance was to have a battalion-level formation at battalion headquarters and then march the entire battalion to the motor pool. Commanders were the only ones who could authorize any absence. Command emphasis is extremely important. My battalion commander would walk through headquarters on Command Maintenance day and clear out everyone to the motor pool. This kind of emphasis makes the XO's job much easier. Ensure that during Command Maintenance, everyone is working on their own vehicles, including the mechanics. This might cause some friction with line companies, but you must make your mechanics off limits to allow them to work on their own vehicles. The afternoon of Command Maintenance is a good time to have maintenance meetings. Arrange a time for each section to meet with you and the maintenance team chief. This is an important face to face meeting to work out problems before mechanic work is scheduled.

The second way to help fix your maintenance problems is to go down on your line and look at the vehicles. Take a look at a HMMWV that doesn't look like it has been started in months; try and start it. Look at tire pressure and vehicle serviceability. Get a 5988E for a vehicle and do a PMCS. Check to see if parts are on order or if parts have been in the parts bin for two months. After a few months, you will know which vehicles are routinely neglected. Give the section a heads-up on the potential problems. Sometimes you might need help from the battalion XO to force sections to fix problems, but do this as a last resort.

The HHC is a huge unit. The best advice I can give is not to be intimidated by its size and just get to work. After a few weeks, you will know which areas need more attention. Get to know the platoon leaders; ask them what their problems are, and what help they need. Take advantage of the soldiers from different MOSs; learn new things from them; you will get a chance to see the Army from their perspective. My battalion maintenance sergeant had a quote up in the motor pool that I think emphasizes the importance of the HHC. "The HHC might not be the PRIDE of the battalion, but without the HHC the PRIDE DON'T RIDE." Being the HHC XO is a tough job, but the kind of job that Army officers should aspire to.

Captain David A. Smith is a 1990 graduate of the U.S. Military Academy with a BS in mechanical engineering. A graduate of AOBC, AOAC, BMOC, and CAS^3, he served as a platoon leader, tank XO, and HHC XO for 3-64 Armor in Schweinfurt, Germany. He is currently an assistant training officer for the G3, 4th ID, at Ft. Carson, Colo.

Battle-Focused Training in the S4 Section

by Captain James E. Moore Jr.

Although the rest of Bravo Bowl was a quagmire, the unusually sunny German day had baked the tank trails bone dry. HQ 4 left an enormous dust signature as it sped from the TOC back to the CTCP. The S4 looked at his watch. It was 1527. After a long morning of planning at the TOC, he had just enough time to check what was coming on the LOGPAC, conduct the CSS rehearsal at the LRP, issue the combat trains order, make the TF rehearsal, conduct a hasty combat trains rehearsal, and hopefully catch a few hours sleep before 0400 stand-to. As his HMMWV pulled into the combat trains, the S4 mused that all of the orders drills back in garrison had made this all fairly easy, and the task force would do well during tomorrow's movement to contact.

He eased up to the ramp of his M577, and cheerfully greeted his NCOIC. When the S4 asked for the LOGPAC checklist, the blank stare he received made the hair on the back of his neck stand up. After 15 minutes of fumbling through what seemed like thousands of pre-printed forms and duty logs, the S4 gave up to leave for the LRP, giving orders to get the track organized before he returned with the LOGPAC. At the CSS rehearsal, the S4 sheepishly tried to explain away the probing questions from company 1SGs who gave the S4 that look of men who knew they would be eating MREs tonight. The LOGPAC arrived within 15 seconds of its expected time. The S4 congratulated the support platoon leader on a good job and went to continue his troop-leading procedures.

The S4 wrapped up the combat trains rehearsal just before dark, and decided to see how the command post was running now. After a few short questions, he realized no one had any idea how to do much more than dutifully log reports on the DA Form 1594. The S4 comforted himself, knowing he had seen the LOGPAC arrive himself. At that minute, the calls flooded the radio: A Team needed one more fueler; C Team needed 300 sabot rounds; the engineers in B Company ate all of their MREs for dinner and needed resupply before morning; the mortars had no WP rounds for tomorrow's mission; and to top it all off, the generator at the TOC was down. Through careful application of emergency resupply, and forcing his support platoon leader to run a midnight LOGPAC, the S4 corrected all deficiencies.

As he drifted off to a 30-minute nap, the S4 cursed himself for not being more involved in Sergeant's Time training back in garrison. These problems could have been avoided if he had shared more of his knowledge with his soldiers. Now it was too late. His only comfort was that in ten days the rotation would be over. The O/Cs could make it harder, but they could not make it longer.

Almost categorically in heavy battalions, training in the S4 section is not battle-focused. Why is it that so often S4 sections go to the field and have to learn their missions as they do them? Certainly it is not the intentional fault of battalion S4s, for no officer wants his soldiers to go to war untrained. The same is true for the noncommissioned officers in the section. The problem seems to be that, unlike the tank platoon, there is no mission training plan for the S4 section. So as a new S4, how do you fix the problem?

Training management in the S4 section is no mystery. It is managed just like any other unit or section, except that the S4 must develop the tasks to be trained. Five steps for training management in the S4 section are:

- Develop a standard logistic system in the unit
- Develop a section Mission Essential Task List (METL)
- Develop collective tasks to support the METL
- Develop individual tasks to support the collective tasks
- Plan the training

A detailed discussion of the steps follows throughout this article, followed by tips for pre-execution checks and training execution.

Step 1: Develop a standard logistic system in the unit. Although logistic doctrine is standard in the Army, the actual execution of this doctrine varies from unit to unit. An example is Class I (subsistence) requisitions. Doctrinally, this is based on the number of personnel in the unit. Some units use the Personnel Daily Report to determine this figure. Others will use a headcount report to determine requirements, calling it a Yellow 1 or a White 2 report for example. A standard reporting system is essential in the unit's tactical SOP and is the basis for all S4 training. The new S4 should analyze his unit's reporting system, mirroring the brigade's system when possible, and establish a system in the battalion. These reports must cover all routine logistic procedures: resupply, maintenance management, weapons system replacement operations, and even casualty evacuation. Once this system is in place, the S4 section is ready to determine what to train.

Step 2: Develop a section METL. Just like a maneuver company, the section METL is derived from the battalion training guidance. Although a company is the lowest unit with a METL, it is unwieldy for HHC to list all of the tasks out of ARTEP 71-2-MTP, *Mission Training Plan for the Tank and Mechanized Infantry Battalion Task Force*, that the S4 section must accomplish for the battalion to be successful. Normally the battalion METL contains "perform combat service support operations." The new S4 must review the ARTEP 71-2-MTP and determine what his section must do to support this battalion essential task. This might include:

- Perform combat service support operations
- Operate the combat trains command post
- Operate the personnel administration center
- Establish a command post
- Move a command post
- Maintain communications

The list is not all-inclusive, nor does it necessarily constitute a METL that would work for all S4 sections. The S4 must do his homework and ensure that his METL supports the battalion, but

remains short enough to be manageable.

Step 3: Develop collective tasks to support the METL. Unlike a regular unit where collective tasks are defined, the S4 must now do some original thinking and develop the tasks that support his METL. The best method is to analyze the subtasks and standards of each of his METL tasks in ARTEP 71-2-MTP. Although all of the tasks will not apply to the S4 section, the ones that do will make up the collective task list. What follows is a sample collective task list for the METL task "Perform Combat Service Support Operations:"

- Coordinate Class I resupply
- Coordinate Class III resupply
- Coordinate Class IV resupply
- Coordinate Class V resupply
- Coordinate weapon system replacement operations
- Coordinate LOGPAC preparation with the field trains

The real challenge for the S4 is to now develop the conditions and standards for each of these tasks. For example, Coordinate Class III Resupply would look like this:

TASK: Coordinate Class III Resupply
CONDITION: The section is operating from the CTCP and has communications with all units, the Field Trains Command Post, and the Brigade Rear Command Post.
SUBTASKS AND STANDARDS:
1. The section receives requests from units with 100% accuracy
2. The section relays requests to the Field Trains Command post with 100% accuracy
3. The section relays requirements to the Brigade Rear Command Post with 100% accuracy.

As a final note, the S4 does not have to develop this all by himself. The noncommissioned officers in the section can provide invaluable experience on S4 operations and should be used to provide a "common-sense check" on all of the collective tasks.

Step 4: Develop individual tasks to support collective tasks. Now that the S4 has developed his collective task list, it is time to determine what the individual soldier must do for the section to accomplish the task to standard. This is the time to integrate the unit's standard logistic system (see Step 1) into the training management process. The individual tasks must reflect how the unit plans to conduct logistics. What follows is an example of an individual task list for Coordinate Class III Resupply from Step 3, above:

- Receive a BN/TF White 3 report.
- Send a BN/TF White 3 report.
- Prepare a BDE White 3 report.
- Send a BDE White 3 report.
- Prepare a LOGPAC checklist from a BN/TF White 3 report.

Again the S4 must develop conditions and standards. It is now essential he integrates his noncommissioned officers. They are the ones who will conduct the training, and their input is essential to make standards that are tough and realistic, while remaining "trainable."

Step 5: Plan the training. Now that the S4 has created a mission training plan for his section, training management is conducted as in any unit. Some specific points to consider are:

- Provide written training guidance. Although this may seem excessive for a six-man section, all of the day-to-day training distracters in the S4 shop make it very easy to lose focus. The training guidance provides a reference to continually plan and focus training.

- Hold weekly training meetings. The time of the meeting is dependent on the battalion and HHC training meetings. The S4 must gather his NCOs, close the door, and let someone else answer the phones for one hour. The meeting cannot become a "last week, this week, next week, let's go to the snack bar" meeting. The S4 must prepare for the meeting, and all must leave with a clear understanding of what, when, and how training will be conducted.

Pre-execution checks and training execution. What follows are techniques for training the S4 section.

- Train the Trainer. ANCOC for MOS 92Y does not fully prepare senior noncommissioned officers to run the CTCP. It is possible that the S4 will have an NCOIC who has never been to the field with a tactical unit. This gives the S4 the added responsibility of training his NCOIC to standard and adds to the training meeting's importance so that the NCOIC leaves fully prepared to train his soldiers.

- Incorporate the S1 section and Field Trains Command Post. In the field, it is imperative that S1 and S4 personnel can accomplish the other's role. The CTCP and FTCP are manned by both S4 and S1 personnel; the PAC NCOIC will process resupply requests, and the S4 NCO will submit Personnel Daily Reports. By training personnel from both sections and using both command posts, the S4 can more realistically simulate what will happen in the field.

- During the crawl and walk phases of training, send actual reports over the radio from the CTCP and FTCP. This can be done with both CP vehicles parked in the motor pool. Use the S4's HMMWV to simulate radio traffic from the companies and the brigade.

- To execute the run phase of training, use battalion JANUS and SIMNET exercises to generate traffic that simulates what the CTCP could expect during an actual fight. Force first sergeants to receive reports from their units, and send these reports to the CTCP. After the battle, conduct the radio traffic required to reconstitute the battalion to the standards found in the ARTEP 71-2-MTP.

- Incorporate tasks into the training schedule as they are complete. For example, once the tasks, conditions, and standards are complete for Coordinate Class III Resupply, incorporate it into the training schedule. Use the slack time to develop tasks, conditions, and standards for Coordinate Class V Resupply.

- The S4 must expect that, to conduct battle-focused training in his section, he will have to work very late. The day to day missions of the S4 usually keep him in the office past 1800 hours. The added requirement of planning training will take longer.

All of this will ensure his section is trained on executing the routine tasks battalion logistics requires. This frees the S4 to conduct mission planning at the TOC, forecast logistic requirements for upcoming missions, and focus his efforts on the innumerable "special" requirements that require the S4's personal involvement.

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Task Force Initiatives

by Lieutenant Colonel K.D. Boyd

The focus of this article is on the armor and mechanized infantry battalion task force (TF). It is a collection of ideas that worked well for Task Force "DESERT ROGUES," 1st Battalion, 64th Armor, 24th Infantry Division (Mechanized). The purpose for writing is to share techniques that worked during mounted combat in the Gulf War, enabling great soldiers to do their jobs a little better.

Task Force Movement

Until the final Operations Order (OPORD) was written and approved for release, there were few certainties about the enemy situation other than the Iraqi defense on the Kuwaiti border. It was this uncertainty that caused several assumptions and decisions to be made about TF movement and support structure.

Field Manual (FM) 71-2, *Tank and Mechanized Infantry Task Force,* outlines seven movement techniques: column, wedge, V, echelon, line, box, and diamond. All have advantages and disadvantages, but terrain is always a factor when selecting a particular formation. The key is to choose one that fits, train it to standard, and rehearse it until every vehicle commander understands it and can execute it regardless of conditions.

Task Force Desert Rogues consisted of two tank and two mechanized infantry companies. The task force commander chose task force diamond (Figure 1). The requirement for speed was the determinant in selecting this movement technique. This formation allowed the leadership to develop a few basic battle drills that the TF could quickly execute without losing momentum.

The belief that the field trains would/could not help the TF during movement determined their location with the forward support battalion (FSB) and consquently the structure of the support platoon. The support platoon was designed to carry as much Class I, III(B), III(P), and V as possible. The platoon was organized for rapid resupply of the TF; more on the support package later.

The scout platoon was 4-6 kilometers in front of the task force, spread over a 5-7 kilometer front. Each section used a Global Positioning System (GPS) for accurate position reporting. A tank company led the main body with mechanized infantry companies on the flanks and the second tank company trailing. The mortar platoon followed in the center, behind the lead tank company. The threat of enemy air was low but one Vulcan was with the tactical operations center (TOC), and another moved with the admin-logistic operations center (ALOC).

The TF commander's guidance was to minimize the number of wheeled vehicles, except for HEMTTs, in the formation. Therefore, only five wheels moved forward with the combat elements: two in the support platoon (platoon leader and sergeant); one in each aid station with trauma kits; and one carrying the Stinger platoon sergeant moving with the support platoon.

During hours of daylight and good visibility, the trail tank company moved in front of the support platoon and recovery section to facilitate fast battle drills to the front or flanks of the formation. At night, the support platoon moved in front of the trail tank company for greater protection. The recovery section always trailed.

Support Platoon

The support platoon was the lifeblood of the task force. Any item required for battle was on a combat vehicle or in the support platoon. The field trains carried all non-essential equipment and traveled with the forward support battalion (FSB). The support platoon was organized as shown in Figure 2. Vehicle modifications were the first order of business during Operation DESERT SHIELD. The lead HEMTTs received radios.

This allowed the platoon leader or platoon sergeant to talk to any lead vehicle, which was always commanded by a noncommissioned officer. The two wreckers (5 and 10 ton) already had radios (MTOE authorizations). Spare tires were in the 1½-ton trailers. We learned this lesson the hard way late in the ground war after abandoning several trailers because we had no assembled spare tires and no time to stop and repair them. Pulling trailers with flat tires quickly caused damage to the prime mover.

Refuel on the move (ROM) was a critical battle drill rehearsed innumerable times. This subject warrants a separate article, but each column of the support platoon was designed to support a company during a ROM. Each column was independent and tailored to a specific type company (i.e., tank or mech). This was particularly true of peculiar Class V and Class III(P) requirements. However, each column also had sufficient generic stocks to support any company in case of vehicle loss or breakdown.

Within each column, cargo HEMTTs (M977s) carried tailored Class V packages. The scouts, mortars, and HHC(-) were also supported with specific vehicles. Cargo 1½-ton trailers were loaded with Class III(P) products tailored to the type of vehicles being supported (Abrams vs. Bradley). Vehicles carrying Class III(B) (M978), water, and a limited number of Meals Ready to Eat (MRE) rounded out the supporting column.

The platoon leader and sergeant each controlled two columns. The ALOC kept track of fuel consumption using reports from the companies. The TOC monitored the status and plotted future ROM sites. After the commander approved a recommended ROM site, the TOC would issue the order to the ALOC, which in turn would order the support platoon to execute a ROM. In hours of daylight, each first sergeant (traveling in the company maintenance M113) would drop back to the trail tank company, pick up his support column, and guide it forward to his company. At night, they moved to the center of the diamond formation and met up with their column in the vicinity of the TOC. To simplify identification, each column of HEMTTs fixed two colored glow sticks to the front of each vehicle, helping the first sergeant find them; different colors were used for

Continued on Page 47

In white hat, yellow bandanna, and yellow suspenders — none likely to have been official issue — the late John Wayne leads the charge against the bad guys. He autographed the photo for a staffer on a visit to *ARMOR* years ago.

The Cav Hat

From John Wayne to Robert Duvall, The "Cav Hat" Has Become a Hollywood Legend... Unfortunately, the Truth Was a Little More Complicated

by Major Mark Farrar

"That smell...That smell like gasoline...."

I am sure all of us are familiar with that famous scene from the movie, *Apocalypse Now.* What a scene! Robert Duvall, the mad air cavalry commander is kneeling in the sand on a Vietnam beach, extolling the virtues of napalm.

What makes this scene so memorable? Was it the topic? Was it the backdrop of exploding napalm? Well, for me it was neither. What I remember was the pristine black Cav hat with the gold cord rakishly perched on Duvall's head!

Others must have felt the same way. When I joined the Army, I frequently saw exact copies at clubs and social events. Most of the owners assumed they were wearing a direct copy of a relic from the Indian Wars. It wasn't until I started doing research on the subject that it became clear just how much Hollywood had created its own image of the Cavalry, and in particular the Cav hat. In fact, from the pictorial and written evidence left to us, there were very few, if any, pristine-looking Cav hats, the most popular one wasn't black, and very few had a gold hat cord!

The true story behind this famous piece of Army headgear is much less glamorous than Hollywood has led us to believe. From 1872 to 1912, when broad brimmed hats were worn as combat attire, there were only three official models. They were the 1872 Campaign Hat, the 1876 modification of the 1872 hat, and the most popular, the 1883 model.

Trial and Error: The 1872 Campaign Hat

In 1872, the Army clothing board wanted to provide troops with a hat that was multi-purpose, provided an adequate sun block, and could be folded. To accomplish all this, the Army approved an elliptical-pattern hat with an extremely wide brim. The material was black fur felt, despite the clothing board's request for light colored material to reflect the sun. It was ornamented with an inch-wide silk band around the base of the crown.

Here is how the hat was described:

"The crown of the fatigue hat is made lens-shaped, so as to fold with the crease in center lengthwise of the hat. The brim turns up at each side and is

hooked at the outer edges in front and rear of body of the hat, thus giving the outline a sweep nearly semicircular from extreme point of front to extreme point of rear. The brim is flat and is 4½ inches wide — outer edges slightly concave where the hooks and eyes are sewed."[1]

The hat was doomed from the start. The material was so shoddy that the hat literally came apart after only a few days in the field, according to troop reports. These complaints were not just limited to the lower ranks. MG Edmund Schiver, the Army Inspector General, commented: "Ridiculous in design and faulty in manufacture....better suited to a wet nurse than a soldier...."[2] The condemnation was universal. Less than three years after the 1872 model was issued, the Quartermaster General told the Secretary of War: "The campaign hats adopted for the Army have not been received with favor, and measures are being taken to procure suitable ones for adoption in their stead."[3]

The 1876 Campaign Hat

One of the weaknesses of the '72 model was its fur felt construction. After much deliberation, the clothing board decided that a wool hat would be more durable. This was the material used in the 1876 model, which had a round brim turned over and stitched along the edge, for durability.

It also had a truly novel innovation — crown ventilators, one on each side. It was officially adopted by the Quartermaster Department on 14 June 1876. The '76 model had a relatively long lifetime, from 1876 to 1887, when supplies ran out. There were few real complaints about this model, other than the color. Despite the improvement in design, the hat was basically an ugly, utilitarian black hat.

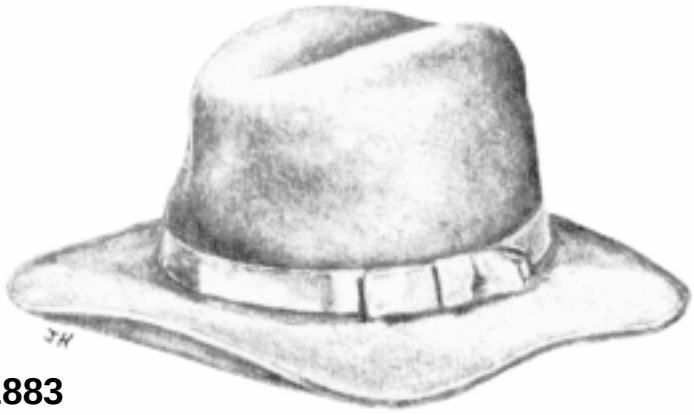
This was the description of the 1876 hat in Army specifications:

Mixture - to be of clean wool, of fine grade, equal in quality to XXX fleece. No waste or shoddy to be used in mixture.

Evolution of the "Cav Hat"

1872

1876



1883

Weight: hat bodies to be weighed out, five and one-half (5½) ounces heavy, of clean wool.

Shape: The 7⅛ - size to be six inches deep to center of tip, and five and one-half (5½) inches deep at front and rear. Other sizes in proportion, varying one-sixteenth (1/16) of an inch to each size.

Brim: Edge of brim to be turned over three-eighths (⅜) of an inch on the upper side, and stitched down with two (2) rows of stitching, and to measure two and a half (2½) inches in front and rear and two and five-eighths (2⅝) inches in width at sides.

Trimming: Trimmed with eight (8) ligne Union Braid, same quality as on sample hat; to be sewed on by sewing machine.

Sweat to be brown Japanned leather, turned on top, one and three-quarters (1¾) inch wide, and sewed in hat by sewing machine. Two of "Bracher's Patent Ventilators," one on each side of crown, three and one-half (3½) inches from brim. The hat to be velvet finished, soft and pliable, same as standard sample. Not more that six (6) hats to be packed in each band-box.

Adopted, 1876. M.C. Meigs, Quartermaster General.

A detail from Remington's "A Cavalryman's Breakfast" shows troopers wearing the 1883 hat with brims up, the most reasonable mode when firing a rifle. Remington's "Old Bill," for many years the symbol of the U.S. Armor Association, also indicates this style of wear was common.

The 1883 Model

Despite the durability of the 1876 model, criticism continued over the color. Troops in the Southwest felt that a lighter colored hat would be more practical. So, on 14 December 1883, the Army adopted the "Drab" campaign hat, which proved to be the most popular hat of the three. It remained in service until 1912, when the Army adopted the "Montana peaked" hat for general wear, the hat we know as the Drill Sergeant or "Smoky the Bear" hat. Most of the Frederick Remington, Russell, and Schrevogel paintings were done when the drab hat was popular. Hollywood would later mistake the color depicted in these paintings and outfit the Hollywood cavalry in white hats. Even the great John Ford made this mistake.

The 1883 model was worn on some of the last great campaigns of the Indian Wars, in the Boxer Rebellion, and in the Spanish-American War. It should be familiar to most readers as the hat worn by "Old Bill" in the Remington sketch.

Note that on the 1883 model, the original intent had been for the brim to be blocked "up" (i.e., brim slightly dipped towards the crown) in the front and back. The specifications for the hat were as follows:

Mixture: To be composed of two-thirds best coney (rabbit) *and one third fine blown nutria.*

Weight: hat bodies to be weighed - 4¾ ounces heavy.

Shape: Block to be 5¾ inches deep to center of tip.

Brim: To be 2¾ inches wide in front and rear, and 3 inches wide at sides; to double thickness, and to have two rows of stitching, as shown on sample.

Color: To be a drab or other suitable color, as per sample.

Trimmings: To be trimmed with 8-ligne union band — same quality as on hat — to be sewed on by hand. Sweat to be an imported lined leather, 2¼ inches wide, sewed to the reed by zig-zag stitch. A wire gauze ventilator to be on each side of the hat, 3¼ inches from brim — to be of size as on sample. To be packed three hats in each bandbox.

Adopted December 14, 1883. S.B. Holabird, Quartermaster General, U.S.A.[4]

Another historical error frequently made by Hollywood costumers concerns the shape of the Cav hat. As evidenced in *Apocalypse Now* and other films, they seem to think the traditional Cav hat sloped down in the front and back. Actually, most hats, particularly the 1883 model, were originally blocked so the brim would slope towards the crown. The reason was very simple: a hat that slopes down impedes vision (it is almost impossible to fire a trapdoor Springfield with a hat in your way). Despite the best intentions of the Army to maintain a uniform hat block, soldiers would still alter their hats from the original shape.

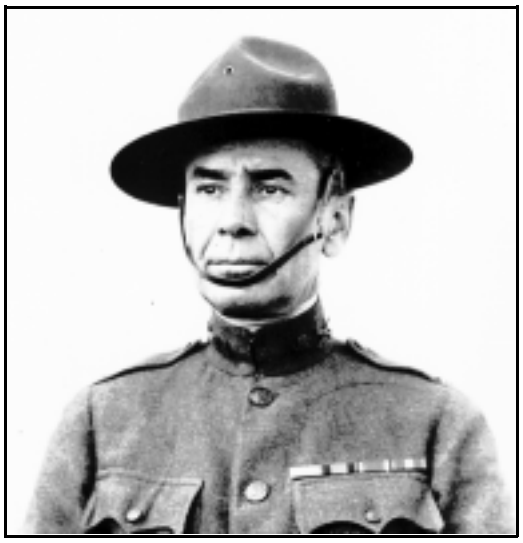
Apparently, things came to a head in 1899. On July 10, 1899, the Adjutant General ordered: "The wearing of these hats (drab campaign hat) in any other than their original shape is prohibited."

Remington's painting, "A Cavalryman's Breakfast," shows all the subjects wearing the 1883 model campaign hat. Remington very accurately portrayed the condition that the hat could be reduced to after extensive field use. All the subjects in this painting are very obviously choosing to ensure that the brim of their campaign hats are up.

Hat Cord and Letters

Hollywood has perpetrated many cavalry uniform fallacies, such as the yellow scarves (which were never issued) and yellow elastic suspenders (which were not issued until 1883, and were not yellow, and only the back strap was elastic!). Another fallacy is the depiction of cavalrymen with gold hat cords and bright gold crossed sabers. It is

true that yellow hat cords existed, but they were not popular. This fact is obvious in contemporary photographs and paintings, which seldom show the cord. Two reasons for this might be that the hat cord would have a tendency to fall off, unless it was tied on to the hat (this happened with the 1912 model), or until the Army became firm about the wear of regulation items. In fact, the "cords and tassels" were so unpopular that the Quartermaster General made this report in 1887:



The "Montana Peaked" hat, first issued in 1912, is still in use in the Forest Service and by drill sergeants. Seen here is Colonel Julien Gaujot, commander of the 1st Cavalry, in 1919.

"From the requisitions of clothing and equipage received at this office during several years past, ...there was scarcely any demand for hat cords and tassels. Only 3,049 were issued during the last fiscal year. It is recommended...that those on hand be issued gratuitously to the enlisted men. Notwithstanding this free issue, there is scarcely any demand for them."[5]

The official origin of wearing hat cords and brass letters/insignia on campaign hats can be traced to General Order No. 128, which required all enlisted men to wear the campaign hat "of drab colored felt with worsted hat cords conforming in color to arm of service, with letter of troop or company and number of regiment in front...."

This regulation was issued **after** the Spanish American War, when the practice had already become the norm.

Other Hats

So, what accounts for the wide variety of campaign hats seen in nineteenth century photograps. The fact is that, despite the gratuitous issue of hats, many soldiers chose to buy their own. Most people make the mistake of looking at one old photo and assuming that the subject is wearing an official hat, but before 1883, many troopers deliberately went out of their way to avoid wearing an issue model. This practice continued unabated almost until the twentieth century.

Also, oddly enough, straw hats were quite popular, so popular that the Army eventually made it legal to wear them: "During the warm season department commanders may authorize an inexpensive straw hat of such pattern as they may prescribe to be worn by officers and enlisted men...."[6]

Major Reno of 7th Cav fame (or infamy, depending upon which side of the argument you're on) wrote this after the Bighorn campaign: "Previous to us leaving the mouth of the Rosebud, I had been wearing a felt hat, and it was dusty and dirty, and some of the officers went on a boat to where a trader sold some broad brimmed straw hats, which we paid 25 or 50 cents for. They had no band, but they were a very shelter from the sun. I wore one of those."[7]

Conclusion

The photographic and historical record regarding the "Cav" hat is quite different from the Hollywood version. Although it may be uncomfortable for some to acknowledge this fact, the pursuit of truth and accuracy should always be the primary objective of both the amateur and professional historian. Even though the campaign hat is just a minor contribution to Army genre, in this age of revisionism and reinterpretation of Army history, the correct depiction of even small items such as the Cav hat is, nonetheless, important.

Notes

[1]*Army Journal,* Quartermaster report, 1872.

[2]Comments of Quartermaster General.

[3]Excerpt from *Army Journal* dated 1876.

[4]*Army Journal,* 1883.

[5]*Army Journal,* 1887.

[6]General Orders No. 128, para. 46.

[7]Recollection of Major Reno.

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Major Mark A. Farrar, MI, is currently the Military Intelligence LNO at the Mounted Battlespace Battle Lab. He graduated with a BA in History from Moravian College in 1981, before enlisting in the Infantry. He has served with the 3d U.S. Inf (Old Guard) Tomb of the Unknown Soldier, 3d ID, 1st Cav Div. as well as commanding in the 504th MI Bde. He is very grateful to the Army for underwriting the opportunity that allowed him to research this article (Fort Leavenworth - while attending CAS[3]). He has been active in various forms of living history (both in the U.S. and Europe) since 1974.

Trends in Israeli Tank Development

by Lieutenant Colonel David Eshel, IDF (Ret'd)

Israel is a country which is still constantly at war. According to General Israel Tal, there is not a single day when a tank does not fire somewhere in anger, a quite unique situation. In fact, over nearly fifty years of conflict in tank fighting under ultra-modern combat conditions, Israeli tankers have survived to gather combat experience second to none, although most are not professional soldiers. Such knowledge cannot be gained better in any other way, even with the kind of sophisticated computer simulations most armies now use to train under near-realistic conditions. But, as experience shows, nothing can replace real combat. When the chips are down, those who have it under their belts usually survive to live for another day, provided of course, that luck is on their side.

According to carefully collected statistics, some 32,000 tanks fought each other in the Arab-Israeli wars. This is an incredible number, surpassing anything in former conflicts. Over the years, some 4,300 tanks were knocked out by fire. In the Yom Kippur War of October 1973, more than 7,000 tanks fought in some of the most vicious combat action since Kursk, in summer 1943. Yet, during the first Arab-Israeli war in 1948, only 16 obsolete tanks were in action.

Thus, although much has changed over a short period of less than fifty years in this region, the arms race goes on relentlessly, with each side aiming to improve not only its arsenal, but also to develop sophistication in soldier training so as to gain superiority on the future battlefield. It is here that Israel is making most of its efforts to retain its edge over its opponents.

It begins by carefully selecting tank crew candidates and training the basics in realistic training programs. Gunnery has, over the years, become top priority in Israeli tank crews. Israeli tankers, using their high-tech equipment with top efficiency, perform with superb results on the battlefield and ranges; they are second to none among professional gunners in foreign armies. One must remember that nearly all Israeli tank crewmen are either youngsters under 20 serving three years compulsory service or reservists. But most have at least some combat experience in sustained low-intensity conflicts. Even now, as the Middle East peace process seems to gain momentum, Israel is constantly on full alert to any possible changes that might turn the political tables in this turbulent region. The entire nation is geared to the national security effort, with over 20 percent of the nation involved in security matters in one way or another, be it in active service, industry, or reserves. It is a heavy burden, but a compulsory price that a small nation like Israel — surrounded by hostile elements — must bear to survive.

Two main elements still dominate Israel's deterrence. They are airpower, using highly sophisticated weapon systems, and high alert, fast-moving armored forces, working with a well balanced combined arms combat team. These are still the only viable tools to safeguard Israel's strategic aims under acceptable conditions and with minimum loss rates, the latter a dominant consideration given Israel's small population.

To conserve human lives in combat is one of Israel's top priorities, and has been since the creation of the Jewish State in 1948. Following a high loss rate during the first days of tank combat in the 1973 War, Israeli tank designers have invested relentless efforts to improve survival under the most stringent combat conditions. Realistic data gathered by countless battle experiences became invaluable. Top experts carefully examined each battle casualty. Knocked-out tanks, which mostly remained in Israeli territory, were subjected to close scrutiny and rigorous high-tech analysis. The information thus gleaned by thousands of hours of field work was stored into a computerized information bank, which became invaluable during the decision-making process that shaped the Merkava project. It remains one of the most ambitious tank designs ever attempted in terms of crew survivability. The massive amount of ballistic data compiled by the Israeli experts provided, for the first time in military history, a unique opportunity to achieve realistic design parameters for safety and combat efficiency. General Tal and his highly skilled team became leading authorities, their experience in modern tank design going far beyond the borders of their realm. In fact, American experts trying to realistcally assess the results of the 100 hours of ground combat in Kuwait and Iraq in 1991 consulted Israeli tank experts on their assessment methods, which made their own field work much more effective. But while large numbers of tanks were destroyed by highly sophisticated weaponry during the Gulf War, the results gleaned were of mostly limited value. Most of the combat actions were one-sided, and the real effect of hits by the friendly fire that destroyed a number of tanks was insufficient to draw wide-ranging technical conclusions. While the real capability of the ultra-modern Russian 125-mm tank gun can only be estimated, as only single guns fired with effect at tactical range, General Tal's crew of expert analysts have at their disposal ample information from analysis of countless wrecks destroyed or damaged by a large variety of ATGWs, high-velocity tanks guns of all calibers, and ammunition of all kinds.

A lot has been learned since the days of the Yom Kippur War in 1973. One of the first efforts made by Israeli de-

signers was to find a way to defeat the lethal chemical energy (HEAT) warheads of shoulder-fired antitank weapons and the notorious Russian SAGGER missiles. At the time, the SAGGERs seemed to dominate the battlefield in the Sinai during the first few days of the war. Later, it was clear that the wire-guided missile was not as deadly as many thought at the time, yet it still represented a considerable threat to conventionally armored tanks of that period. Only a few years later, Israeli technicians found a remarkably simple solution — explosive reactive armor — that was to save the lives of many Israeli tank crewmen in the 1982 Lebanon war. Israeli M-60 tanks received an add-on BLAZER suite of reactive armor that provided highly effective protection against the close-in fired RPG and the SAGGER. Losses dropped dramatically. BLAZER came as a complete surprise and was soon copied by other armies, including the Russians, who used it extensively in Afghanistan to survive their own, hitherto lethal weapons! It was only through ill-luck that Russian experts were able to lay their hands on one of those BLAZER-fitted Pattons, abandoned by its Israeli crew, and learn the secret, which allowed them to copy the system.

The Merkava Mark I model also faced its first combat test in the Lebanon War in 1982. It performed with astonishing results under the most stringent combat conditions. Its spaced armor provided excellent survivability, even during close-in urban fighting, where engagements were at near-zero range, and where AT teams fired on tanks from upper floors in buildings along narrow streets. Although some 50 Merkava Mk1s were hit by various weapons at different ranges, only nine crew members were killed, mostly those working with open hatches. Surprisingly, of the 50-odd crewmembers wounded in Merkavas, none were burned! In any other type of tank, far more burn injuries could be expected under the same conditions.

No wonder that Merkava battalions became the dream assignment of every tank crew in the Israeli armor corps! Very little detail of ballistical data on Merkava is unclassified, but it is known that not one Merkava was a total loss in Lebanon, and all were restored to active service, including one tank that was hit by no less than 20 rounds of antitank fire. This is a remarkable feat achieved by Tal's design team, and a real morale booster if ever there was one.

Merkava Mk3, with Modular Armor

Above, General Tal, center, with two members of his staff in front of a new Merkava Mk3, with modular armor suite. The bolts that anchor the armor pack can be seen on the front slope.

At left, a closeup of the modular armor sections that protect the front and sides of the Merkava turret.

Photos by the author

Since 1982, the Merkava received two basic modifications and one complete alteration which amounted to a new model of AFV. The Merkava Mk2, the immediate result of the Lebanon experience, included an improved survival kit. But the Merkava Mk3, which currently makes up the majority of tanks in the active service force, is a totally new design. Although quite similar in shape, it embodies a new, ultra-modern, modular armor concept, and integrates a new, powerful 120-mm smooth-bore, high-velocity gun firing a set of indigenous developed ammunition. But the Mk3's most impressive asset is its new armor suite, a near-revolutionary design of modular cast steel armor designed especially for this model by Tal's experts. This unique approach to armor protection makes the Merkava highly flexible. Instead of equipping the tank with a fixed set of armor that cannot be exchanged over the life span of the tank, the modular armor can be exchanged for new designs, if and when new armor technologies emerge. Using modular components also makes it easy to replace damaged parts whenever the need arises, even by crews working under field conditions. Since this modular approach uses parts that are bolted on, instead of welded, an entire armored suit can be removed and fitted at will. Aside from being highly cost-effective, this method allows a force to reduce the weight of the vehicle for air transport, an inherent strategic mobility advantage. Currently, following the demise of the Cold War period, most Western armies face the challenge of both rapid strategic and tactical long-range movements. In most cases, future out-of-area engagements will have to cope with contingencies which may well include threats from modern armored forces, even by hostile elements of the Third World. This threat will have to be countered by friendly armored elements. Under present circumstances, it seems highly questionable that heavy or even medium tanks can be transported by existing or even future air assets to provide substantial

A heavy armored personnel carrier, based on a captured T-55 chassis. The turret has been removed, the engine compartment has been redesigned, and a hatch has been added to the rear for troop access. Other obsolete tanks have been converted to engineer vehicles.

firepower for engaged ground forces in distant areas. While the problem of firepower can be solved by low-caliber high-pressure tank guns or even future ammunition technologies, the problem of armor protection may well persist until a complete breakthrough is made in armor metallurgy. Relatively lightweight tanks with high-powered guns can improve, if not solve, the inter-theater mobility problem, but it is highly doubtful those tanks will be able to survive a close-in battle with enemy medium tanks at acceptable loss rates to their crews. A workable solution could be the addition of modular armor to upgrade lighter tanks AFTER they have landed at their destinations by air, while the add-on armor packs follow separately by air or by pre-positioned sea assets soon after. A near-revolution in superior protection can be achieved with cost effective and logistically flexible means without loss of maneuverability in the field. While current modular armor is entirely passive in its nature, future technologies could envision active armor packs that could well revolutionize armor protection, enhancing the overall protection of the tank from all directions, and solving the problem of TOP ATTACK, which remains one of the greatest vulnerabilities in most modern tanks today.

One of the Israeli armored force's most precious assets is the close cooperation between designers of Tal's expert team and the men in the field who depend on his solutions for their virtual survival in combat.

Most armies live on "Red Tape," which is a natural part of any bureaucracy, but General Tal, who is a soldier's general, has managed to circumvent this phenomena by establishing a direct link between his team and the tankers in the field. The result is a unique and remarkable process of decision-making which has already come up with several modifications which are the immediate outcome of tank crews reporting on the performance of their weapon systems in combat. The Merkava project is a constantly changing process. With two major upgradings, a large number of improvisations have been included in older models at low cost and carried out in the field by specialist crews at battalion level. These shortcuts have already resulted in lives saved. Tank crews are highly appreciative as a result, which encourages further cooperation at all levels. Thus, General Tal and his team try to remain one step ahead, a constant challenge which has no equal anywhere. In Lebanon, a savage war of attrition is in process daily. The Shiite fanatics use every conceivable weapon to combat Israeli troops day and night. Tanks, and especially the Merkavas, are the cornerstones of this fighting.

Survivability is the order of the day, with Israeli forces facing constant threats from well-placed ambushes and demolition charges cunningly situated on narrow tracks and mountain roads. The Merkava has demonstrated remarkable adaptivity to this type of warfare. Its superior armor protection has withstood most ground attacks from different ranges. Scores of antitank rounds, some of them advanced ATGWs, failed to penetrate, even when fired in salvoes. On the other hand, Israeli gunners have managed to destroy Hezbollah rocket launchers by direct fire as the missiles were still in-flight! Accurate tank gunnery more than once made the difference between life and death.

Tal's expert team has done more than design tanks. The fighting in Lebanon, some of which is done under most difficult conditions, calls for some unique solutions to enhance survival. Older tanks, like the M-60, have been upgraded with modular armor. Armored personnel carriers, such as the M113, have been given advanced armor protection against ATGWs, and now sustain most attacks. Obsolete tanks, such as the Centurion and captured Russian T-55s and T-62s, have been redesigned into a variety of APCs, armored engineer vehicles, and especially up-armored carriers capable of withstanding large demolition charges which would have totally destroyed lighter armored vehicles.

These trends in Israeli armored designs will undoubtedly continue, and some future breakthrough in tank design can certainly be expected over the next years, as the need will remain top priority. Israel still very much needs its Armor Corps, and the Corps needs the best tools to do its job.

Lieutenant Colonel David Eshel was born in Dresden, Germany in 1928, and emigrated to Palestine in 1938. After serving for a short spell with the British forces after WWII, he became one of the founding members of the Israeli Armoured Corps in 1948 and served as a career officer with the Israel Defence Forces for 26 years.

Educated at the French Cavalry School at Saumur, he later held various command and staff assignments, and fought in all the Arab-Israeli wars up to and including 1973, when he served as Chief of Signals of the Armoured Corps. His last assignment was lecturer on tactics at the IDF Command and Staff College. He studied history at Tel Aviv University and served for 12 years as editor of an Israeli-German based defense journal. He now acts as a freelance journalist and defence analyst for several leading American and European military journals.

Driver's Seat (Continued from Page 5)

is accepted into Excellence in Armor, his DA Form 2-1 should be annotated as discussed earlier.

Now for the benefits! Incentives for Excellence in Armor soldiers with exceptional performance are as follows:

- OSUT commanders may promote 10% of their class at the completion of Basic to PV2 and those 10% may be promoted to PFC at the completion of the Military Occupational Specialty (MOS) specific phase. Statistics show that the greatest number of these promotions go to Excellence in Armor soldiers, primarily because they have proven themselves to be overachievers.
- A sergeant who is a Basic Noncommissioned Officers Course graduate may request to take the SCCT/ TCCT II through his local TCO or TSO.

It is a comprehensive two-hour test on Skill Level 3 and 4 tasks. If he passes with a score of 70 or higher, he is eligible to receive 50 promotion points in Military Education for his SSG promotion packet. This is in accordance with Army Regulation 600-8-19, *Enlisted Promotions and Reductions.*

- All senior NCO promotion boards are briefed that Excellence in Armor identifies an Armor soldier as a "cut above." On the last SFC promotion board, there were more Excellence in Armor soldiers selected for promotion to SFC than any other category in CMF19. Being an Excellence in Armor soldier certainly has its advantages, not only by increasing your chances for promotion, but also in recognizing you as a cut above everyone else.

The proof of the program has been seen in CMF19 promotions. During the first year that the original OSUT Excellence in Armor enrollee was eligible for promotion to SSG and SFC, 75% of SSG promotions and 74% of SFC selections were Excellence in Armor. Commanders are selecting, and promotion boards are recognizing, the highest quality soldiers.

But the program cannot survive and flourish without command involvement.

Leaders have four responsibilities when it comes to Excellence in Armor: first, identify and challenge incoming Excellence in Armor soldiers; second, establish and support a unit Excellence in Armor program; third, accelerate SPC/SGT/SSG promotions and school attendance for Excellence in Armor soldiers; and fourth, maintain quality in the program! If a soldier no longer meets the standards, disenroll him.

Finally, if you have any questions about Excellence in Armor, you can direct them to the following address:

Commander
U.S. Army Armor Center
ATTN: ATZK-ARP (SFC Berg/Ms. Graham)
Fort Knox, KY 40121-5000

Or call DSN 464-1368/3188 or Commercial (502)624-1368/3188.

Keep Charging!

Task Force Initiatives

(Continued from Page 39)

each column. The support platoon leader and sergeant were responsible for getting the columns to the two mentioned link-up points. After completion of resupply (task force goal of one hour), the process was reversed.

Battalion Maintenance Section

This section was leader intensive. It included the battalion maintenance officer (BMO), the battalion maintenance technician (BMT), the battalion motor sergeant (BMS), and several of the best mechanics. Vehicles consisted of three M88 recovery vehicles and the direct support (DS) maintenance team M113 vehicle equipped with secure, dual net FM and GPS.

Maintenance sections at company and battalion level, were task organized and their equipment and repair parts organized around time lines. The specific items carried were based on the requirement for the mechanics to replace any item within 15 minutes. If the vehicle could not be repaired within that time, it was left with its crew for the BMO traveling behind the trail tank company. Each company formation included its M113 maintenance vehicle and M88 recovery vehicle with several mechanics. Selected line items from the prescribed load lists (PLL) were stored on both vehicles.

Battalion maintenance vehicles also carried selected PLL lines. Their timeline for vehicle repair was 45 minutes. If the vehicle still could not be repaired (15 minutes by company and 45 minutes by BMO), it was left with its crew for the HHC commander leading the field trains (part of the brigade support area) approximately three to fours hours behind the task force.

Task Force TOC

One modification was done to the M577 command post carriers in the TOC and ALOC. Four 5-ton cargo truck driver's seats were installed in all M577s (Figure 3). This initiative was a lifesaver to all occupants who traveled the 370 kilometers into Iraq. They had comfortable seats, well positioned to post maps and write reports, and in a position to catnap when appropriate. Everyone wore a Combat Vehicle Crewman (CVC) helmet to monitor an assigned net. This minimized noise and confusion inside the vehicle and maximized individual concentration, future planning by the second in command, and battle captain battle monitoring.

Summary

There is nothing magical about any of the ideas or initiatives performed by Task Force Desert Rogues. Hundreds of innovative techniques were used by many superb units. The successes of Operations DESERT SHIELD and DESERT STORM are attributable to those magnificent units and their leaders and soldiers.

All the ideas presented in this brief article worked. They involved training to a standard, a few inexpensive pieces of materiel, and the adherence to established doctrine.

Lieutenant Colonel Kenneth D. Boyd is currently the U.S. Army Exchange Officer at the Canadian Forces Command and Staff College. He served as the XO of 1st Battalion, 64th Armor, 24th ID(M) at Ft. Stewart, Ga., during Operations DESERT SHIELD/DESERT STORM.

LETTERS (Continued from Page 3)

During the Vietnam War, commanders struggled with the role of command and control helicopters. Some battalion commanders flew over their company commanders fighting on the ground, directing their every move, while brigade and division commanders flew above the battalion commander, giving him the benefit of their experience. This environment left very little room for the company commander to apply the latest battlefield information and accomplish the battalion commander's mission and intent. Similarly, enemy tanks firing sabot rounds look quite different to soldiers on the ground than they do as icons on a SAT terminal. If deliberate control does become the standard for command and control on the digital battlefield, then how will the second lieutenant learn the lessons that will prepare him to be a division commander?

There is a great deal of excitement across the Army as it becomes more digital and fields new systems. While the focus presently is to gain seamless conductivity between systems that were seemingly developed in a "stovepipe" fashion, there remains a need for equal emphasis on preparing the doctrine, tactics, and leader training necessary to fight in the information-laden environment of the digital battlefield.

ROSS A. BROWN
CPT, Armor
Ft. Hood, Texas

Ratings Should Be Tied To Tank Qualification

Dear Sir:

I think that this letter will start some controversy within the Armor community. This subject has been avoided for a good number of years.

I want to ask one very simple question: Should a tank commander's rating (OER or NCOER) be more closely tied to the qualification of his tank?

Twenty or more years ago (before the M1 and master gunners) tank commanders took a great deal of pride in the fact that they knew their weapons, that those weapons worked, and that their crew could shoot. Today, I see tank commanders who blame their tank for their poor performance. There are tanks that require constant "tweaking" to make them work properly. I see units where it is much more important to pull months of red (duty) cycle, than it is for the unit to properly train and conduct gunnery.

This all leads to the tank commander's yearly report card. I wonder, how can a rater honestly give an excellence rating in competence and leadership to a tank commander who cannot qualify his tank. I ask this because I feel that one of the primary duties of the tank commander is to fight his tank and win. One of the traditional measures of that primary duty is Tank Table VIII.

I know that there was a conscious effort to de-emphasize Tank Table VIII in the late 1970s. I wonder if that has really served us as well as it should have. I remember in 2-81 Armor in 1973 tank commanders like Platoon Sergeant Cables and Sergeant Hardy, who really knew their tank and crew. They put lots of time and effort into training and preparing their crews to fight the M60 tank and to qualify the first time on Tank Table VIII.

These tankers did that in a spirit of friendly competition within the company and battalion. Those few who could not qualify had to suffer through a lot of reminders about "boloing," on Tank Table VIII. You can surely bet that they did the work required to train their crews up to a fight-and-win standard.

Should crews who cannot qualify be allowed to re-fire specific engagements from Table VIII until they can meet the standard? Should a tank commander who consistently fails to qualify his tank be considered for promotion to sergeant first class?

I would submit that if he cannot train his crew and fight his tank, he just might not be able to train his crew, fight his tank, and mentor other tank commanders to train their crews and fight their tanks.

As I said at the beginning of this letter, this might start some controversy within the Armor community. If it does, good! I really feel that a better tank commander can come out of a discussion of this issue.

CSM HALFORD M. DUDLEY
1-66 Armor
Fort Hood, Texas

Computers Won't Solve Combat Development Problems

Dear Sir:

As usual, your July-August issue was chock-full of fine articles, and what was especially nice to see was the number of articles written by company grade officers, the individuals who, when the fat is in the fire, have to put the fire out.

They provided some great observations and experiences based on real day-to-day life as a tanker that I hope are being read, heard, and understood by our current technologists and acquisition czars. A case in point was the fine letter by 1LT Brannon of C/112 Armor, TXARNG, written in response to an earlier article on tank main gun autoloaders. His point was very clear, and that was that four crewmen on a tank have many tasks to perform in order to keep their tank operational 24 hours a day, 7 days a week, for however long it is in combat. It is not just a matter of loading the main gun. More importantly, 1LT Brannon provided us with a most important part of the development process for any new equipment — user input.

Unfortunately, it appears that the Army has been caught in the trap, that if we automate and digitize everything, we can win the next war from the CP with four soldiers and a computer. Ah, if this were only true. But, it appears that many in uniform today do believe it to be true. I do not mean to imply that automation and digitization is all bad; but as with every new idea or technology, one must understand how that idea or technology fits into the larger picture as well as many smaller ones.

When TRADOC was formed back in July of 1973, its first commander, General William DePuy, understood the need to have the field soldier's input in the development process. Therefore, he put the responsibility for combat developments (CD) at a level in the chain-of-command where such input would be most visible and effectively applied — at the individual branch level.

From that year until Desert Storm, the TRADOC combat developers modernized the U.S. Army. If you do not believe that, walk around any tank park, motor pool, airfield, supply room, or arms room and count the percentage of things that predate 1973. Desert Storm was witness to the success of General DePuy's decentralized combat development process to the branch level. The ultimate user, the soldier, had direct input to the end product. And those working directly in the CD process at the individual branch centers were green suiters who also had lots of field and hands-on experience. Communication lines hummed in all directions, and coordination from center level to individual action officers within the DA staff took place on a daily basis. The same communication opened between industry and the various Army laboratories.

But the lessons of history are soon forgotten, and that appears to be what is happening today within the Army, and particularly TRADOC. Downsizing over the past four-five years has about destroyed the Combat Developments functions at each branch level. It almost seems as if no one at the senior leadership levels understands the development and acquisition process.

Our future needs will not be solved with a computer, nor by a half dozen battle labs which are actually doing nothing more than what was done in the past under the combat developer's charter, the only difference being that the battle labs have more computers and simulation to assist them in their studies. But the acquisition process is still guided by DOD's 5000-series regulations. Any proposed new program must still comply with these regulations, and the HQ DA, DOD, and Congressional questions, con-

cerns, and biases must be answered before funding will be forthcoming. Likewise, industry still needs to understand the environment of the soldier in the field, and the soldier in the field needs to have a handy conduit to what is being proposed by industry. That proven conduit is, and has been, the branch combat developer, the user's representative with industry, DA, DOD, and the Congress.

Abolishing combat developments, or consolidating all CD functions at a higher level than the individual branch level, is a lose-lose proposition. Lost is the individual branch interface and understanding with industry and the technology being proposed by industry and the laboratories. Lost, too, is the capability of close, routine coordination, interface, and understanding between the ultimate user in the field and his representative, the combat developer, and his boss, the individual branch chief.

Lieutenant Brannon's comments concerning industry and the technologists needing to understand the working environment of the soldier, before trying to solve a problem with technology where a problem may not exist, needs to be raised to the top of the flagpole. We may save a lot of personnel positions on our TO&Es by great technological ideas on paper today, but the real question remains to be answered, and that is: Will it really save us on the next battlefield or cause us to be less effective? The Army and TRADOC under General DePuy's foresight saw that the Army was not developing the right equipment to win on the next battlefield because the user and his branch chief were not directly involved in the process until the item under development was ready for testing or fielding. Hence, many of those soon-to-be-fielded items never were, because they did not meet the operational needs of the real users in the field. Today, our military museums are filled with many of those great ideas for new military equipment that never made it — because in the end it was not the item that the soldier wanted or needed to accomplish his mission on the battlefield.

CLARK A. BURNETT
COL, Armor, Retired

Adding Vehicles Would Deny Light Forces Their Mobility

Dear Sir:

In "Making the Case for an Airborne Infantry Fighting Vehicle" (September-October 1995), Stanley Crist echoes the views of many "heavy" proponents in arguing to "heavy up" the Army's principal force projection forces — its airborne units. In so doing, he reveals the same overreliance on our experiences in the Gulf War that has captured not only the Army's mechanized/armor communities but much of our senior leadership as well. We should be very careful about drawing lessons from a desert war — which showcased and highlighted our heavy forces in conditions which optimized their awesome capabilities — and then applying them to the force as a whole in conditions which do not.

If Crist is right, then our doctrine and our senior leadership is wrong in stressing heavy-light and light-heavy operations. Light and heavy forces can work well in many kinds of terrain despite the significant mobility differential. The experience of 3-325 Airborne Battalion Combat Team during its recent CMTC rotation is one example.

During the rotation, the ABCT fought a pure tank battalion with attached artillery, motor rifle, antitank, and engineer units. 3-325 controlled two tank and two Bradley platoons, as well as its organic heavy weapons company (with 20 TOWs) and a mechanized engineer platoon. In rolling terrain interspersed with wooded and built-up areas, 3-325 killed 60% of the opposing force in its movement to contact and 70% (including 24 of 29 tanks) in the defense. In the attack, the ABCT seized all four of its assigned assault objectives. In each engagement, the combat team's rifle companies or HMMWV-mounted TOWs accounted for more than 75% of its kills. 3-325 was not supported by any CAS or Army aviation.

These results are significant because the OPFOR, in addition to its inherent advantages, fielded a force with vastly greater firepower and mobility. 3-325 offset these advantages by moving infantry on helicopters and trucks when out of contact and by denying the OPFOR freedom of movement with obstacles, pre-planned fires, good use of terrain (including natural choke points), massed fires in pre-selected engagement areas, and extremely aggressive close combat antitank tactics.

Crist states that "infantry needs the same degree of mobility as tanks," and cites COL Donald Elder's view that "anything less than the mounted combined arms team" provides "by no means the most capable combat force." These are veiled : and not very thinly veiled — calls for the mechanization of the Army's force projection forces.

Those of us who have made a career in those forces are less enthusiastic, for two reasons. First, we know that we can fight heavy forces successfully in all but the most open kinds of terrain, and that means most of the world. Fighting with our standard task organizations, which includes Apaches, field artillery, engineers, and air defense — all supported by CAS — airborne and air assault forces, which field large numbers of TOWs and Dragons, are formidable tank killers. Second, we know that giving us mechanized vehicles robs us of the very thing that makes us strategically useful, and that is our strategic mobility. I know of no one who thinks that mechanized airborne forces can realistically deploy by air given the current or projected state of our airlift fleet.

Few units are more aware of their limitations than the Army's airborne forces. We require the same approach to combined arms warfare as any other force and the same kind of intelligent application of METT-T as anyone else. But we are more than riflemen with rocket launchers. Come visit us on the German plains and you'll see what I mean.

MAJ R.D. HOOKER, JR.
Deputy Commander
3-325 ABCT

Key to the Assault: Suppressing AT Weapons

Dear Sir:

The July-August 1995 edition of *ARMOR* had an extensive and informative article, "Crisis in Battle" by MAJ David Lemelin, describing techniques for assaulting a platoon position. Many excellent points were brought out in this article, but I think a major one was missed.

The "crisis" of an assault is not so much in the actions against the enemy infantry position being assaulted as against enemy AT weapons and tanks around the objective that can engage the assaulting force — they must be destroyed or suppressed to isolate the objective. If this precondition is achieved, the assault can be relatively easy.

A competent defender sets up a combined arms defense. Against an armored force, a defense is built around tanks and AT weapons sited in depth to continuously engage the attacker from multiple directions. Obstacles, infantry positions, and artillery support this defense by protecting AT weapons and by driving and holding the attacker in areas where AT fires are effective. AT weapons are the key to this defense, not the dismounted infantry.

More attacks fail because of a failure to successfully deal with mutually supporting enemy AT weapons, rather than an inability to deal with the defending enemy infantry and BMPs being assaulted. "Tunnel vision" or "target fixation" is a common problem, where the attention of the attacker is focused inward on the position being attacked and all-around security is not maintained.

In the scenario presented in MAJ Lemelin's article, a tank-heavy company team was given the mission of assaulting a forward enemy BMP infantry platoon. In such a situation, adjacent elements of the task force could probably suppress adjacent enemy positions that would engage the team as it initially approached the enemy posi-

tion. However, as the assaulting team closes with the enemy position, fires from in-depth enemy AT reserve, company, and battalion second-echelon and adjacent company AT weapons, moved to "switch" positions, can catch the attackers in cross fires. Because many of these fires would come from reverse slope, keyhole, and in-depth positions, initial support by fire positions become less and less effective in dealing with them, and the assaulting force itself becomes more and more isolated.

This aspect of effective protection of the assaulting force from surrounding AT fires is critical, but difficult to achieve. The concept and execution of the operation must focus on this aspect, and it deserves emphasis as the key to successful assault.

As a final point, I agree with MAJ Lemelin that better training on assault techniques is needed. Once the attacker is in the enemy position, the fight often breaks down into small, close-range fire fights. These are like "dog fights" and close tank-infantry cooperation, and "quick-draw" type reaction fighting skills in close terrain are needed but can be gained only by focused, frequent practice.

JAMES C. CROWLEY
LTC (Ret.), Armor
Peachtree City, Ga.

Once a Master Gunner, Always a Master Gunner

Dear Sir:

I went to Master Gunner School, Class 5-81, as a young hard-charging SSG. At least that's what the 1SG told me was the reason I was selected. I graduated and returned to Germany, ready to defeat Graf. Whether I did well or not, two years later, I was a master gunner instructor at Fort Knox, the best job in the world for a master gunner with the ability to share his knowledge. A short three years later, I am on the border in the 2ACR as a SFC platoon sergeant — not a master gunner, a platoon sergeant. We had a young hard-charging SSG master gunner, who felt like I did six years earlier.

For the next seven years, I filled those positions talked about in promotion guides, platoon sergeant, first sergeant, and operations sergeant — and yes, the promotions came. Because I worked hard at being good at those jobs, I didn't have time to be a master gunner also. Then came the surprise. After seven+ years of letting those hard chargers do their jobs as master gunners, while I did mine, I arrived at Ft. Hood at USASMA, class 43 graduate, MSG, and was told I was going to be a battalion master gunner! When I went to see the division CSM for my interview, I told him the last tank I was a master gunner on was an M1, and I wasn't prepared to be a master gunner again. I wasn't snivelling, I was being honest. Needless to say, I was talked to like a private, and told if I didn't want to be a master gunner, I should have dropped my ASI years ago! Get your #!@ down to that unit and do your job! So I became a master gunner again. That was a year ago. Now I am the division master gunner (new division CSM). Thanks to some young hard-charging NCOs, I am almost current again.

The meaning of this story: After three years as a drill sergeant or a recruiter, both of which get you extra money and a badge (for life), nobody expects you to do that job again unless you want to. As a master gunner (no money, no badge), you have a lifetime commitment, no matter where your career takes you! Attempt to stay current, or you can try to have your ASI removed. The choice is yours — think about it.

SGM JAMES S. SPURLING
Division Master Gunner

Author Seeks Information On Tank Qualification Patches

Dear Sir:

I am writing in the hope you may help me. I am seeking information on initial use of armor pocket qualification patches. I am trying to determine when early TCQC patches were worn, and hope some Armor Association members might be able to help me.

I am researching the history of qualification badges and awards so I might use the information in a book I am writing on these prizes. While most of the awards I am researching concern individual marksmanship badges and prizes from 1880 to the present, I would like to include some information above the TCQC and similar pocket patches. During World War II, the 10th Armored Division had a pocket patch to show tank crew proficiency, and in 1951, then Major General Bruce C. Clarke introduced a green and yellow TANKER diamond for wear on the HBT's in the 1st Armored Division. I have seen photos of 3d Armored Division members wearing green, black, and yellow pocket patches in about 1961. I know of no other awards for tank crew proficiency being worn on fatigue uniforms until these 3d Armored Division patches. I am seeking information on when, why, and how the pocket patches commonly worn in the 1960s and 1970s came into use. Any information you might provide me would be greatly appreciated.

I hasten to assure you that I am a serious writer and researcher. My book on the history of U.S. Army chevrons was published by the Smithsonian Institution Press in 1982, and my current book on U.S. Army branch insignia will be published by the University of Oklahoma Press in the spring of 1996. I have published over 60 articles on U.S. Army uniforms and insignia in various magazines over the past 25 years, and have been a Fellow in the Company of Military Historians since 1972.

Any assistance *ARMOR* readers might give me concerning the early wear of TCQC patches would be greatly appreciated. Thank you for your time.

WILLIAM K. EMERSON
LTC, Armor, Retired
124 Kensington Drive
Madison, Alabama 35758
PH: (205) 461-8782

Dashes and Slashes...

Dear Sir:

I was a bit disappointed that the back cover of the September-October 1995 issue contains the glaring error in 'military grammar' of listing our cavalry units as if they were companies in battalions or brigades in divisions instead of the proud squadrons of storied regiments as they should be. Separating the squadron from its parent regiment by a '-' vice the '/' is, of course, the correct way to designate units which are affiliated under the Combat Arms Regimental System, according to FM 101-5-1.

GREG GARDNER
LTC, GS
ACofS, G3
25 ID(L)

LTC Gardner is correct as far as non-regimental cavalry goes. However, a careful reading of the bottom paragraph on page 2-73 of FM 101-5-1 indicates that cavalry squadrons of a regiment are designated with the "/," e.g., 3/3 ACR indicates 3d Squadron, 3d Armored Cavalry Regiment. 1-4 Cav is the proper notation for the 1st Squadron, 4th Cavalry, which is a divisional cavalry unit, and 1-8 Cav is the proper designation for the 1st Battalion, 8th Cavalry, a tank battalion assigned to the 1st Cavalry Division. We regret the errors on the September/October 1995 back cover. - Ed.

Dutch Author Seeks Info on Marmon-Herrington Light Tanks

A Dutch author seeks to correspond with former U.S. Army personnel who had experience during World War II with Marmon-Herrington light tanks. The series included the CTLS-UTAY (T14) and UTAC (T16), CTMS, and MTLS, some of which were used by the Dutch. He's interested in former crewmen, testing and arsenal personnel, and shipping personnel.

Anyone wishing to share information may get in touch with Hans Heesakkers at Akkerstraat 2, NL-5061 DE Oisterwijk, The Netherlands.

BOOK ESSAY

Hard Lessons In the Schoolhouse of War

Closing with the Enemy, by Michael D. Doubler. University Press of Kansas, Lawrence. 1994. 354 pages. $40.00.

After a flood of new books last year on World War II, it's hard to imagine anything left unsaid, but this fine book is an exception. It is a history of the the U.S. Army in that war, but rather than retelling what our Army did in conventional narrative, Doubler focuses on how the Army learned and changed as the war progressed.

It should be an invaluable book for those entrusted with training, as it describes critical shortfalls and how the Army changed to meet these challenges. In each instance, covered in a chapter each, he describes gaps in preparedness — city combat, forest fighting, river crossings —and the measures taken to rectify weaknesses on the road to victory.

Incredible as it may seem, the brilliant planners who mounted the Overlord invasion of Normandy failed to anticipate the next step, the bitter fighting in the bocage hedgerows that stalled the drive eastward at a cost of thousands of casualties. One would think that in the careful invasion planning, with its emphasis on extensive aerial reconnaissance of coastal France, someone would have noticed that the battlefield ahead was a series of hundreds of compartmented, sunken farm fields, each separated from the rest and from neighboring roads by raised, wooded hedgerows — perfect terrain for an experienced German army on the defense.

Over the centuries, Norman farmers had encouraged this checkerboard of berms, heavily entangled with trees and bushes to moderate the winds off the Channel. Each wooded strip could conceal defenders and stymie the passage of tanks, but more important to an army on the attack, the berms separated each unit from others on its flanks, creating a series of isolated mini-battles where it was impossible to mass or maneuver.

Men attempting to cross the open fields would be mortared and machine-gunned by enemy units in the next hedgerow, and tanks attempting to go over these obstacles were vulnerable to antitank fire as the bellies of the tanks were exposed. Each field presented another identical challenge, creating new casualties and sapping the will of the men who, weeks earlier, had triumphed on the beaches. General Omar Bradley called the bocage "the damndest country I've seen."

Blundering into mortar attacks in pre-registered fields, kept down by machine gun fire grazing the tops of the berms, bedeviled by snipers, and still green in combat, the attackers were blooded by a seemingly endless series of 300-yard firefights, field by field. They hadn't been trained for this, nor were tank and infantry units comfortable enough with each other to fight the kind of seamless combined arms combat that became routine as the same army moved toward Berlin later in the war. Armor units, especially, were stymied by this kind of fight: pushing through the fields was impossible, and outflanking the enemy on the sparse road network made the tankers perfect targets for long-range antitank guns.

The author proceeds from this point to answer the question, "Well, how come they still prevailed?" This is the core of the book — how the American Army developed the tactics, techniques, and procedures that solved these problems in the heat of combat, discarding doctrine when necessary and adapting to overcome battle-hardened defenders.

Improving tank-infantry cooperation offered the beginning of a solution. If the tanks' cannon fire could be brought to bear on the defenders, the infantry had a better chance. Several ways were developed to "bust the bocage." Blade-equipped dozer tanks could plunge through smaller berms, but there were only four in each infantry division's tank battalions. While they waited for more, other solutions emerged. The 29th Infantry Division experimented with using explosives to blow gaps in the hedgerows, then perfected a technique to emplace the explosives using their tanks. Six-inch diameter pipes were welded to the front slopes and the tanks rammed the hedgerow, removing a plug of roots and earth so that explosive charges could be placed deep in the obstacle. The charges were packed into empty 105-mm artillery shells for easy transport and to maximize the explosive effect. Another approach was developed in the 2d AD's 102nd Cavalry Reconnaissance Squadron by Sgt. Curtis G. Culin, the sawtooth hedgerow cutters welded to the front of tanks. Pointing up the improvisational nature of the fix, the cutters were actually fabricated from steel salvaged from German beach defenses. The Culin devices had another advantage over explosives — they did not alert the enemy.

Ad hoc improvements in communication between tank crews and accompanying infantry also helped the synergy of combined arms attacks, specifically the back deck telephone. And aerial forward observers learned to spot and adjust fire on defenders from a vantage point the ground troops wished they had.

While technology and better communications were making a difference, units began to develop new tactics and procedures, formalizing lessons bitterly learned. The 29th ID, again, pioneered a tank-infantry-engineer approach that allowed units to maintain momentum and kept defenders from regaining their balance as they retreated. The 3rd AD developed another approach, attacking the two fields adjoining a third, then moving in behind the center field once the hedgerows were penetrated.

The overall result, according to the author, was that "Forces that crossed the Normandy beaches in June had evolved a great deal by July. The greatest changes took place in combat units, where tankers, infantrymen, engineers, and artillery FOs became close-knit partners in a coordinated effort...By the end of July, First Army used on a routine basis a large number of combat techniques and procedures unheard of in the preinvasion period."

Each subsequent chapter outlines a battle problem similar to the challenge of the Normandy terrain — the difficulty of river crossings, the attack on heavily forested terrain like the Huertgen Forest, the techniques developed to speed attacks in built-up areas, the coordination of the ground-air team, the attack on the fortresses in Eastern France, and the hurried adaptation to the defensive at the Bulge.

The theme in each diverse chapter is adaptation under combat conditions, and the author's judgment is that this is what won the war. Ironically, our advantage was that we were an army of individuals from a nation that prized individuality and questioned authority. So, when doctrine failed, the solutions came from the bottom up, not the top down.

The conclusion might make us question our reliance on teaching doctrine, rather than encouraging a flexible, open architecture that presumes we will never anticipate everything, but can adapt to anything.

This is a superb book about warfighting, and everyone in the business of training soldiers ought to read it.

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ARMOR Staff

BOOKS

The Great Battles of Antiquity: A Strategic and Tactical Guide to Great Battles That Shaped the Development of War by Richard A. Gabriel and Donald W. Boose, Jr., Greenwood Press, Westport, Conn., 714 pages, $95.00.

There is something romantic and exciting about the study of antiquity. Whether it is the study of the culture of ancient Egypt, the rise of the Grecian city-states, or the grandeur that was the Roman Empire, something always draws me to any book dealing with the ancient world. I am especially intrigued by any book or author that examines ancient military systems and the battles of antiquity. In our post-Cold War world, however, soldiers and the study of military history, especially ancient military history, seem relegated to the intellectual trash heap. In a direct challenge to this short-sighted view, Richard A. Gabriel and Donald W. Boose have co-authored *The Great Battles of Antiquity,* a well-written book grand in scope and design, and worthy of study by soldiers and statesmen alike.

The authors begin their study with the Battle of Megiddo in 1479 B.C. and end with the fall of Constantinople in 1453. Their goal is to distill "a number of strategic and tactical lessons that may aid in providing useful insights to the modern-day soldier and statesman." (p. xxv) Thirty-two battles and campaigns are analyzed around four categories. The first category, "Strategic Setting," covers the political and strategic context of the battle or campaign, while "The Antagonists" assesses the doctrine, organization, and leadership of the armies involved. A detailed account of the battle(s) is the third category, with the final category, "Lessons of War," providing guideposts for the modern-day soldier and statesman. Gabriel and Boose accomplish their purpose marvelously throughout the book.

The breadth and depth of this book is worthy of volumes, but the four-step methodology employed by the authors serves them well in limiting its scope. The physical construction of *The Great Battles of Antiquity* allows readers to "browse" through a single battle or campaign at their leisure. Each chapter concentrates on a single battle or group of battles (The Campaigns of Hannibal for example), without the need to read the book sequentially. Because each chapter is constructed identically within the context of the four categories of analysis, I was able to move smoothly from Alexander the Great to the Battle of Hastings.

The analysis in all four categories is superb. The authors are meticulous in their presentation of the impact of culture on warfare. For those who eschew the study of culture and its impact on military and political processes, this book serves as a primer on how to integrate culture into military history without diluting the importance of either in society. The authors are at their best when analyzing a series of battles or campaigns, such as those by Hannibal or Alexander the Great. They also do not suffer from the myopia of Eurocentrism, but incorporate the warfare practiced by the Chinese, Koreans, Mongols, and Japanese.

While the four-step analysis process serves Gabriel and Boose well throughout the book, they present the final section "Lessons of War," in the form of bullet comments that would be at home on any briefer's slide. For all of their effort in the preceding three sections, they could have closed each chapter more effectively had they tied their comments together in effective prose. As it is, many of their lessons take on the appearance of maxims, seemingly divorced from the context in which they were made. While a "bullet comment" approach works for the military reader, I feel it fails the civilian.

There is little doubt that warfare is a social institution among human beings. Regardless of the date of the battle or campaign, there is one constant — the human being. Although the weapons and tactics of warfare have changed and evolved considerably from the time of the Battle of Megiddo, the essential human element remains constant. Gabriel and Boose effectively examine the efforts of our ancestors, and bridge the centuries to show us the timeliness of the study of ancient military history. Perhaps instead of looking for the evanescent lessons from the Gulf War, we should turn to the timeless nature of the problems encountered by the Great Captains of the past.

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Panthers in the Shadows by Scott Hamilton. HPS Simulations, P.O. Box 3245, Santa Clara, CA 95055, $59.95. Internet 74774.771@Compuserve.com.

System Requirements: Minimum 386 CPU, VGA monitor, 2 MB RAM, DOS.

Panthers in the Shadows is, without a doubt, the most detailed and realistic tactical-level armor simulation currently on the computer market. *Panthers* allows computer owners to do something new: apply actual armor tactics to a computer game. Designer Scott Hamilton (an ex-Engineer officer) of HPS Simulations has done an incredible job of creating a program that is more simulation than game.

The strength of *Panthers* lies in the tactical scale and the rich variety of the weapons offered. The simulation has a scale of 100 meters per hex and one minute per turn, with units representing platoons or sections of vehicles, AT guns, mortars, artillery, or infantry platoons. Losses are taken by individual vehicle and individual infantryman. There are over 1,000 weapons systems in the database, along with over 1,500 types of ammunition. APC, APCBC, HEAT, HE, APCR, smoke, canister, illumination, and a slew of other ammunition types are available for use by the appropriate weapons. Battles may be fought at night, in rain or snow, or in a howling windstorm, as the program allows for a full range of climatic conditions. In addition, there are wire and obstacles, minefields, paratroops and gliders, naval gunfire support, engineers, flamethrowers, and airstrikes. Virtually every armored vehicle and weapon that fought in the Western theater during WWII is covered. As I've told my friends, "any simulation with 43 different types of Sherman tanks available is worth investigating!"

As an armor officer, the real attraction *Panthers* has for me is the ability to use real tactics and doctrine successfully. In *Panthers,* it pays to use your forces doctrinally, and to advance with elements in overwatch. The player who uses a combined arms approach and masses his forces will see definite results with this program. Using smoke, covered and concealed routes to the objective, and coordinating artillery missions (which have delay times) are reminiscent of miniatures gaming, except with computer-driven assistance. Miniatures enthusiasts will appreciate the fact that *Panthers* differentiates between front, side, front turret, side turret, and rear armor, and calculates penetration based on kinetic energy versus the armor thickness modified by the angle of incidence of the strike. Armor enthusiasts will appreciate a computer program that accurately depicts the feeling of armored combat at the tactical level.

The simulation has three levels of difficulty, can be played against an AI opponent or by e-mail against another person, and comes with nine canned scenarios and a scenario builder. The scenario builder can cover any battle in the Western and North African fronts during WWII from 1940 to 1945, and includes French, British, U.S., Italian, Dutch, Belgian, and German force structures. Factors such as morale, training level, ammunition dud rate, weather, counterbattery fire, air superiority, and visibility are fully adjustable.

There is really very little negative to say about the program, although the sound effects are rudimentary at best and usually get turned off quickly. This is in contrast to *Panzer General,* another currently popular computer program. But *Panzer General,* despite superb sound effects and graphics, is really nothing more than a computer game with a historical backdrop. *Panthers in the Shadows,* with average sound effects and graphics, is a superb computer simula-

tion of armored warfare, which can be used to illustrate the synchronization of forces so necessary to win. I highly recommend this program for all computer-literate armor officers.

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Tiger Ace: The Life Story of Panzer Commander Michael Wittmann by Gary L. Simpson, Schiffer Publishing Ltd., 1994. 394 pages. $35.00, hardcover.

The exploits of Michael Wittmann have taken on a legendary quality in the annals of military history. This book lends credence to the title military historians have given to Michael Wittmann — that of the greatest tank commander in World War II. *Tiger Ace* chronicles the life of a man who was personally responsible for destroying 138 armored fighting vehicles and another 132 antitank and artillery pieces during five years of fighting.

Author Gary Simpson begins the book with five pages that describe Wittmann's experiences growing up on the family farm. It was on the farm that Wittmann learned the values of diligence, caring, open-mindedness, and decisiveness that would serve him well as a military leader. More importantly according to Simpson, Michael Wittmann developed his love and respect for mechanical vehicles while working on the farm. Throughout the remainder of the book, Simpson repeatedly reminds the reader that Wittmann's actions on the battlefield are directly related to his experiences on the farm.

At the age of twenty, Wittmann volunteered for the German Reichs Arbeitdienst (German Voluntary Labor Service) and served for six months before enlisting in the German Wehrmacht as an infantryman in October 1934. After two years, Wittmann joined the Leibstandarte, Hitler's personal bodyguard regiment. Simpson is careful to point out that Wittmann joined the SS because he wanted to be one of the elite, and not because he shared the same political philosophy. Wittmann found the training to be harder and more realistic than in the regular army, with a greater emphasis placed on being aggressive on the battlefield. Wittmann served as an armored car commander during the Polish Campaign in 1939 and the German attacks in the West in 1940. Upon the fall of France, Wittmann was selected for training and commanding the new Sturmgeschutz III (StuG III — assault gun). He served as a StuG III commander during the Balkan Campaign and the first year of Operation Barbarossa, the invasion of the Soviet Union. In June 1942, Wittmann attended the SS officer cadet school. Wittmann's performance at the school and on the battlefield enabled him to become one of the first to command the new Panzerkampfwagen VI 'Tiger.'

Wittmann assumed command of a Tiger platoon and fought on the Russian Front beginning in January of 1943. He participated in all the major battles on the Russian front from March 1943 to March 1944, to include the recapture of Kharkov, the battle for Kursk, and the desperate fight to defend Kiev. Wittmann's Tiger platoon performed superbly in all these battles, accomplishing almost every mission assigned, but it was Wittmann and his crew's performance over this time period that earned them great distinction. During the Battle of Kursk, Wittmann's tank destroyed 30 T34/76 tanks and 29 AT guns in four days. Later, in November 1943, Wittmann's Tiger destroyed 16 tanks and 12 AT guns in one day. By January 14, 1944, Wittmann's Tiger totaled 88 enemy tanks destroyed, earning him and his gunner, Bobby Woll, each a Knight's Cross. That same day, after the awards were presented, Wittmann's Tiger destroyed 19 Russian tanks. As a result, on January 30, 1944, Wittmann received the Oak Leaves to his Knight's Cross and a promotion to the rank of Obersturmfuhrer (1st Lieutenant). Simpson's account of the battles on the Russian Front try to describe the constant and ferocious fighting, but it is beyond the author's limited writing abilities.

In February 1944, Wittmann assumed command of the 2nd Company, SS-Pzr Abt. 101, a Tiger company within Leiberstandarte's Tiger Detachment. The entire division moved to Belgium to reequip and reorganize after a year of heavy fighting in Russia. It was on the Western Front that the world would witness Wittmann's most spectacular feat and his controversial death. On June 13, 1944, Wittmann and his crew destroyed 25 armored fighting vehicles and stopped the advance of the British 22nd Armored Brigade at Villers Bocage in Normandy, France. Wittmann received the Swords to the Knight's Cross and a promotion to Hauptmann (Captain) for his efforts that day.

On August 8, 1944, Michael Wittmann died in battle near St. Aignan-de-Cramesnil. Author Gary Simpson's account of Michael Wittmann's death is very definite — a Sherman Firefly commanded by a British Lieutenant James. Simpson does not mention the current controversy as to how Wittmann died and who should receive claim. Whether this is a result of Simpson's research or ignorance is unknown due to his poor documentation.

The book contains numerous previously unpublished photographs of Michael Wittmann and his crew. The photographs lend credence to the author's statements of Wittmann as a young, vibrant, and caring leader. Unfortunately, the author does not include any maps to assist in his description of Wittmann's military operations, not even of the route that Wittmann used at Villars Bocage. Instead, the writer unsuccessfully attempts to paint a picture with his narrative of each operation.

When I first found *Tiger Ace,* I anticipated a hard-edged account of the life of Michael Wittmann as a small unit leader. I could not have been more disappointed. The book is poorly written and is full of clichés and redundancies. Even worse, the atrocious editing makes the book almost too hard to read. Simple grammar rules, like subject-verb agreements and avoiding sentence fragments, are not observed. The poor writing makes me question the scholarship of the author. Also, the book unintentionally makes Wittmann look like a tank commander and never a small unit leader. The author usually writes about the commands that Michael Wittmann used to fight his tank, but rarely mentions any of the tactics or fire commands that Wittmann used to fight his platoon and company.

The inside cover of the book claims that Gary Simpson conducted extensive research and travel in preparation for this book. Unfortunately, the majority of the research focused on the Battle of Villars Bocage, and not on Wittmann's exploits prior to Normandy. The author documents his interviews with Wittmann's widow, members of the 22nd Armored Brigade, and Oberstleutnant Jurgen Wessel (Wittmann's deputy commander in Normandy) in annexes in the back of the book, but fails to do so in the main text. Simpson also used recorded interviews with the propaganda ministry and personal material that Wittmann's widow presented to him. Since the majority of the author's research focused on the Battle of Villars Bocage, this is the most readable and interesting chapter in the book. Finally, although the publisher claims that this is the first comprehensive study of Michael Wittmann, this is not true. Dr. Gregory Jones wrote and published *Panzerheld: The Story of Hauptmann Michael Wittmann* in 1993 (reviewed in the March-April 1994 *ARMOR*).

Simpson's *Tiger Ace* is a book that falls far short of its great potential. Only the most die-hard military historians should read this book. Anyone interested in the life of Michael Wittmann and the tactics he used is better served by Dr. Jones' book on Michael Wittmann.

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Lucky War: Third Army in Desert Storm by Richard M. Swain (reviewed in our September-October 1995 issue) is available from the Combat Studies Institute, U.S. Army Command and General Staff College, Fort Leavenworth, KS 66027-6900.

It's Dangerous to Wear Synthetic Fiber Underwear Under a NOMEX Suit

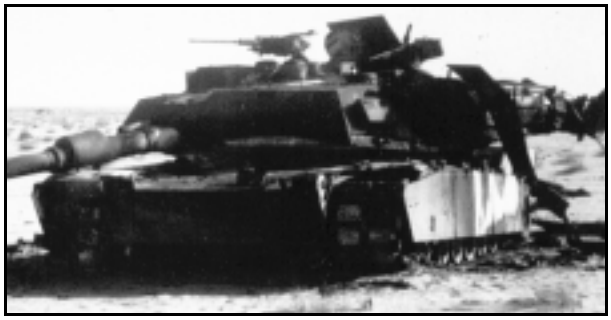
A question that surfaces frequently is: Is it safe for Combat Vehicle Crewmen (CVC) to wear underwear made with synthetic fibers under their NOMEX CVC coveralls?

The answer is, No.

Armor soldiers in the field need to be made aware that a potential safety hazard may exist if these type of synthetic underwear are worn under their NOMEX CVC coveralls in the event of a tank fire. Nylon and synthetics such as polyester and polypropylene melt at about 480 degrees fahrenheit and 300 degrees fahrenheit respectively. Heat transfer through your NOMEX (which is resistant to temperatures up to 700 degrees fahrenheit) could be high enough to melt these synthetic undergarments. It also should be noted that your NOMEX will burn if it's contaminated with flammable substances such as Petroleum, Oil, and Lubricants (POL) products or household starch. Dry cleaning or laundering after contact with these substances will restore your NOMEX's fire retardant state.

To restate the importance of wearing proper underwear underneath your NOMEX, I'll use a quote that CW3 Boyd Tackett III made in a recent flight FAX regarding the experience he had when his aircraft caught afire. "My chest, back, and buttocks were spared from any burns at all due to the cotton underwear that I had on. The burn literally went to where the underwear was and stopped. If I hadn't been wearing my NOMEX protective equipment and wearing it properly, there is no doubt in my mind, that I would very probably have either died in the fire or died as a result of the burns I would have received."

So for your protection, the underwear that you wear should be made of 50% cotton/50% wool or 100% cotton. These natural fibers won't melt under heat and will help keep the heat away from your body in a flash fire. If your underwear is fabricated of 50% cotton/50% polyester, it's unsafe to be worn when the possibility of flame hazard exists. If you have any additional question on this subject please give us a call (Mr. Larry Hasty) here at Directorate of Force Development, DSN 464-3662/2176.



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