ARMOR

Light/Heavy Integration at the Joint Readiness Training Center *Page10*

PB 17-98-4

July-August 1998

Several interesting pieces in this issue should strike your fancy, but for my money, the letters are once again the magazine's best part. That often seems to be the case, but have you ever wondered why the letters are often more engaging than the well-referenced and researched articles which appear later?

I think the answer is that guys with strong feelings about issues which affect all of us have laid their souls bare and given us the benefit of their insights. These insights then form the basis for our own thinking and further development of the ideas. This phenomenon occurs in issue after issue of this magazine. While the letters aren't always the most polished of presentations, they are nothing if not honest attempts to help us practice our craft better. What more could we all want from our magazine and our fellow readers? We have soldiers from sergeant to colonel willing to say what is on their minds. That is special. That is strength.

I find the letters especially rich, because even though most of them are pointing out faults somewhere (you have to have an issue to be moved to write), they indicate that there is much more going on than worried, paralysis-inducing, woe-is-us hand-wringing. Sure, lots of folks are concerned with where developments are taking our Army, our Armored Force, their unit, and so on. They should be, if they care about our profession. But let's face an unsettling condition of mid 1998: we all know guys who get one or two under their belt at the club, or who have their 32 ounces of java before 0800, or who have breathed too much diesel and turbine exhaust who are sounding Chicken Little, sky-is-falling alarms. That behavior is counterproductive and only spreads panic when panic is in no way warranted.

Not to panic? Correct. Here is one reason why not. Read this issue's "Commander's Hatch" to understand a little of the thought process that went into the new heavy division design. This solution, which many of us will have to employ in future conflicts, **is** good enough to win. It certainly was not crafted by mindless automatons who don't care about us in the turrets. Our chief of armor and cavalry, whose strong suit is muddy boots training, was in on the process, as were many other similarly "real" guys. Even if you aren't happy with some aspects of the new design — maybe you want to retain the six-tube mortar platoon, vice the four-tube platoon of the future – it is nearly time to salute smartly, say "Yes, sir!" move out, and draw fire. Our advocates, the branch chiefs, had a tough job, and they knew that they had to make compromises.

Not to panic? I'll give you another reason. Whether you think Colonel Swan (in the second letter this issue) is right or not, we have been at a critical juncture before in our branch history, and we have prevailed. I just re-read some of George S. Patton's thinking, published over the years in this magazine. Beginning when he was a lieutenant and continuing later during his career as a field grade officer, he too complained about things, but he didn't spread panic. Quite the contrary. He offered solutions to the conditions and issues of his era (some of which weren't all that good, frankly, given our 1990s hindsight). Some of those conditions ring amazingly true today. But read this quote from his article in this magazine in 1916, and you be the judge:

> *Another point which has already been mentioned in the press in accounting for the lack of news regarding the tactical use of cavalry from the war abroad, is that war correspondents have rarely had access to the distant and varied fields of cavalry combat; and perforce, they have written about the work of the guns, whose decisive effects on the battlefield, they can readily observe and appreciate. Yet their incessant chatter has made many, who should know better, think that wars can be decided by soulless machines, rather than by the blood and anguish of brave men."*
>
> — "A Defense of the Saber," *Journal of the U.S. Cavalry Association*, July, 1916, pp. 49-50.

So, when you hear gloom and doom from your wingman, do not succumb to it yourself. Instead, try to see the plus side of our force today and get the most out of your opportunities. Then maybe, just maybe, like the people in Arlo Guthrie's "Alice's Restaurant," others will start picking it up, humming it, and before you know it, we'll have a bona fide *movement* on our hands. That is the kind of infectious attitude that will see us, our soldiers, and our units carry on, with a spirit conducive to success, as we approach the millennium LD.

— TAB

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army

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Features

Departments

ON THE COVER:

Tankers and infantrymen learn to fight light/heavy at the Joint Readiness Training Center. See article on Page 10.

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Directory — Points of Contact

DSN - 464-XXXX
Commercial - (502) 624-XXXX

ARMOR Editorial Offices

Editor-in-Chief
LTC Terry A. Blakely 2249
E-Mail: blakelt2@ftknox2-emh3.army.mil

Managing Editor
Jon T. Clemens 2249
E-Mail: clemensj@ftknox2-emh3.army.mil

Editorial Assistant
Vivian Oertle 2610
E-mail: oertlev@ftknox2-emh3.army.mil

Production Assistant
Mary Hager 2610
E-Mail: hagerm@ftknox2-emh3.army.mil

Staff Illustrator
Mr. Jody Harmon 2610
E-Mail: harmonj@ftknox2-emh3.army.mil

U.S. Army Armor School

Director, Armor School (ATSB-DAS)
COL Richard P. Geier 1050
E-Mail: geier@ftknox-dtdd-emh5.army.mil

Armor School Sergeant Major (ATSB-CSM)
CSM J. D. Duncan 5405
E-Mail: duncanjd@ftknox-emh5.army.mil

NCO Academy (ATZK-NC)
CSM Kevin P. Garvey 5150
E-Mail: garveyk@ftknox-emh3.army.mil

16th Cavalry Regiment (ATSB-SBZ)
COL Michael D. Jones 7848
E-Mail: jones@ftknox16cav-emh12.army.mil

1st Armor Training Brigade (ATSB-BAZ)
COL Scott R. Feil 6843
E-Mail: feil@ftknox-emh3.army.mil

U.S. Army Armor Center

Commanding General (ATZK-CG)
MG George Harmeyer 2121
E-Mail: harmeyer@ftknox-emh7.army.mil

Deputy Commanding General (ATZK-DCG)
BG Robert Wilson 7555
E-Mail: wilson@ftknox-emh5.army.mil

Chief of Staff (ATZK-CS)
COL Frank J. Gehrki III 1101
E-Mail: gehrki@ftknox-emh7.army.mil

Command Sergeant Major (ATZK-CSM)
CSM David L. Lady 4952
E-Mail: ladyd@ftknox-emh7.army.mil

Directorate of Force Development (ATZK-FD)
COL John F. Kalb 5050
E-Mail: kalb@ftknoxdfd-emh13.army.mil

Directorate of Training and Doctrine Development (ATZK-TD)
COL William J. Blankmeyer 8247
E-Mail: blankmeyer@ftknox-dtdd-emh5.army.mil

TRADOC System Manager for Force XXI (ATZK-XXI)
COL Robert L. Westholm 4009
E-Mail: tsmfxxi@ftknox-xxi-emh1.army.mil

TRADOC System Manager for Abrams (ATZK-TS)
LTC(P) James H. Nunn 7955
E-Mail:

Mounted Maneuver Battlespace Battle Lab (ATZK-MW)
COL Karl J. Gunzelman 7809
E-Mail: gunzelman@ftknox-mbbl-lan.army.mil

Office, Chief of Armor (ATZK-AR)
COL Patrick F. Webb 1272
E-Mail: webbp@ftknoxdfd-emh13.army.mil
FAX 7585

Special Assistant to the CG (ARNG) (ATZK-SA)
LTC Randall Williams 1315
E-Mail: williamr@ftknox-emh7.army.mil

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LETTERS

Tank-Design Imperative: Prepare to Repel Boarders

Dear Sir:

I enjoyed CPT Meyer's article in the May-Jun 98 issue and thought it was well done. However, I have a couple of comments that may be of interest.

First, APS can be considered a subset of the close-in defense systems that have appeared since the beginning of World War II (e.g. the German Nahverteidigungswaffe, a roof-mounted 92mm mortar; Tiger Tank 'S' mine dispensers, and bent barrel Stug-44; the U.S. short-range flamethrowers for the Pacific; British AP munitions for their smoke dischargers; and Rhodesian/U.S. counter-ambush devices). These were all intended primarily to prevent or discourage antitank dismounted boarders. This remains a very valid requirement today, especially as we contemplate the increasing probability of urban combat and the restrictive rules of engagement that permit potential enemies to approach very close before they show 'hostile intent' (particularly since the M1's 120mm smoothbore currently has neither APERS nor HE rounds). It is interesting that only the French Galix and the Israeli POMALS systems specifically address this need. Second, I suspect that the emerging threats presented by wide area mines (top and possibly side attack types), precision-guided mortars (such as Merlin and Strix), and Fiber Optic Guided Missiles, all of which are also in development in Europe, fall outside the engagement parameters of the current defense systems (low velocity and high arc). However, I believe these could also be countered (or at least degraded) by these defense systems if the threats are considered in the development process and allowances made in the design. Actual hardware/software changes would not be required until these threats become reality.

MAJ WILLIAM SCHNECK
ADE, 29th ID (L)
Virginia Army National Guard
email: wschneck@nvl.army.mil

Computer Simulation Fallacy: Assuming Troops Are Well Trained

Dear Sir:

Major Eastman's and Mr. Helton's article, "Simulations and Training," in the March-April 1998 issue comes at a crucial time as our Army wrestles with balancing virtual, live, and constructive simulations in training the force. From what I read and what I see, our funding and development priorities seem to be weighed heavily toward the virtual and constructive simulations and away from live, FTX-based training. These computer-driven training simulations will dominate the so-called "second training revolution." In my opinion, we do not understand all the risks associated with such a prioritization.

Clearly, live simulation — as represented by the "dirt CTCs" and other FTX-based training — is very expensive, but it is also the only training appropriate for tactical units consisting of tank crews, rifle squads, attack helicopter companies, and artillery batteries. Even the best computer simulations we have today fall far short of replicating the friction of the battlefield and the determination of an uncooperative, even ruthless, enemy. In my estimation, instead of investing so heavily in computer simulations, especially the constructive ones like BBS, CBS, WARSIM 2000, etc., we need to find ways to adequately resource home station FTX training and fully resource CTC rotations. Let's use, or at most upgrade, existing computer simulation systems.

Of course, I am biased toward live simulation, but have used all types of simulations throughout my career. In my two years of total immersion in simulated combat operations at the NTC, the world's foremost "simcenter," I have discovered a couple of interesting things. First, every one of our constructive simulations aimed at training commanders and staffs at corps, division, and brigade levels are based on a single fundamental assumption — that the platoons, companies, battalions, and brigades represented by computer icons equate to well-trained soldiers and units. From what I have observed, that assumption, which underpins all of our simulations, may be flawed and makes the outcomes of our computer simulations suspect! I know that sounds like heresy to some, but I have rarely seen a rotational unit at the NTC that can perform its mission as well as a computer icon. And if we continue to divert resources away from training those units and the soldiers who will do the fighting and dying on the next battlefield, we will further skew the results of our simulated war games.

What evidence is there of this? First, the last four brigade commanders who trained at the NTC indicated that the computer simulations they used at home station (JANUS, BBS, and CBS during participation in BCTP Warfighter exercises) did not adequately prepare them or their staffs for what they experienced in simulated combat at the NTC! They referred to basic combat activities, like movement of units over real terrain, navigation, night operations, fire support operations, casualty evacuation, heavy logistics operations, and others as being highly doable in the simulation world, but were exceedingly hard to accomplish at the NTC due in part to the internal friction in their units as well as the actions of the OPFOR (which, incidentally, uses little or no constructive or virtual simulations in its own internal training — hmmm...). Secondly, the Chief of Staff of the Army has indicated that the entry level of units arriving for training at the CTCs is not as high as it was a few years ago — for many very good reasons, including lack of adequate home station training. Does this situation imply that the success that these units and their higher HQs experienced during exercises like a Warfighter should be called into question? The answer must be a qualified "yes," at least and until their units can perform at the CTCs as well as their icons can perform in the simcenters. In other words, live simulations address reality or "what is" while many of our other simulations address only "what ought to be" — clearly, a disconnect.

All of this runs counter to the argument posed by some that the "results" of engagements and battles at the dirt CTC are inaccurate or are out of sync with our experiences in the computer-driven simulation world. I contend, though, that it is the perceived success that units experience in the constructive world that must be taken with a grain of salt; because even the performance of units that do exceedingly well at the NTC in live simulation (the hardest to execute and the most difficult to resource) rarely matches what their icons are capable of. If any realignment is needed, it is in the opposite direction — have units perform their missions in constructive simulation based on historical performance at the CTCs — then we will get a truer picture of the combat capability of our brigades, divisions, and corps.

An extension to the argument above is for us to be cautious in making modernization and force structure decisions based on the outcomes of constructive simulation exercises. Take, for example, the proposed reduction of the tank battalion from 58 M1A1 tanks to 45 M1A2 tanks. Once again, the key assumption underpinning such a decision is that there will be well-trained crews and leaders operating these systems. Without that assumption being absolutely irrefutable, such decisions must be viewed as highly questionable. I wholeheartedly agree that the M1A2 is qualitatively better than the M1A1 (certainly it is in shooting, but in moving and communicating, too?) — but ask yourself which of the following is better? The M1A1 tank in the hands of a highly trained and experienced unit, or the M1A2 in the hands of an inexperienced or poorly trained outfit? Just saying that the M1A2 is better than the M1A1, no matter how the equipment performs, doesn't make it so (yet, it is so in a computer simulation). Unless we fund the live simulations that stress M1A2 crews and units in order to see that they are as well trained (or better trained), we cannot truly maximize a tank battalion with 13 fewer 120mm guns and 520 fewer rounds of main gun ammo. In sum, the acquisition of high quality weapon systems demands more, not less, live experience to meet their max potential! Training funds must be prioritized this way or all that we have put into systems like the M1A2 tank may never be fully realized in terms of enhanced combat capability — a fact that will further skew our battlefield expectations which are based on constructive computer simulations that assume that new technology automatically performs better.

As an aside, I'm not convinced that the young soldiers and leaders who join our Army today do so to perform their many go-to-war tasks in simulators. I think many join for the adventure of driving tanks, firing their weap-

ons, maneuvering their units, and feeling the excitement of a team effort securing an objective in the field. How many will stay if all they do is train in the relatively sterile world of virtual and constructive simulations? How many will have the true confidence in their battlefield abilities that only comes from getting their hands dirty?

Readers should not misunderstand where I am coming from. Virtual and constructive simulations will be vital to training the Force XXI Army of tomorrow. They are not, however, the panacea they seem to represent, nor should they dominate the so-called "second training revolution" as they are now planned to do. All this leads back to my fundamental premise. The performance of leaders, soldiers, and units in the field is what wins on the battlefield, not the performance of icons on a computer screen. We must build confident leaders and soldiers who know they can execute their METL tasks because they have done so under the most stressful battlefield conditions that can only be replicated in the field. If we are not careful, we run a serious risk of developing a wide gap in what commanders assume their units can do and what they can actually accomplish and will find ourselves continually questioning why we don't do it as well at the NTC as we did in the simcenter.

GUY C. SWAN III
COL, Armor
Cdr, 11th ACR
Ft. Irwin, Calif.

USAREUR Maneuver Training: Overcoming the Limitations

Dear Sir:

The long awaited moment of taking my first platoon passed quietly enough in February 1997. Being in a divisional cavalry squadron, I anxiously awaited the challenges ahead of me. I was placed into a scout platoon, passing the tank platoon that is normal progression of a lieutenant. Within the first month of taking the platoon, I began to realize the restrictions placed upon me due to Conventional Armed Forces in Europe treaty, German-mandated quiet hours, Status of Forces Agreement, budget restrictions, and environmental concerns that would hinder aggressive maneuver training. These restrictions presented the question of how to train my platoon with little or no maneuver area.

I was a platoon leader for nearly a year and had the opportunity to maneuver my six M3A2 Cavalry Fighting Vehicles only once. The maneuver was during BT XII at a gunnery rotation consisting of no flank units or platoons and an operational area of 2 kilometers by 2 kilometers. Bottom line, realistic maneuver training is scarce in USAREUR.

The restrictions are being felt at the base level, the platoon. Platoons are just not able to get their vehicles out of the motor pool and into the field to train on the most essential of maneuvers, battle drills. These drills are central to the success of crews, sections, and platoons and are deteriorating with each passing quarter. Without these skills, the higher echelons will be less effective in accomplishing their missions, putting soldiers lives on the line in the heat of battle as they learn their job instead of plying their trade.

To overcome the restrictions that govern USAREUR units, I propose increased utilization of HMMWVs. HMMWVs suffer from fewer restrictions on when and where they are permitted to operate. They provide excellent basic maneuver training for the section and platoon by providing a vehicle that is able to travel without having to be reported under the Conventional Armed Forces in Europe treaty, and are able to convoy during all hours of the day and are cheap to operate. The HMMWV is also host nation friendly, as it is doesn't tear up the highways and land as tracked vehicles do. All of this, combined with fewer logistical considerations, suggests that the use of HMMWVs would allow platoon and troop-sized elements to train maneuver more frequently.

The objective is to provide the platoon a viable means to train on battle tasks and give troops/companies the ability to train their METL tasks cheaply and more frequently. This could be accomplished through the use of HMMWV training companies attached to each brigade within the division. Each brigade would receive a company of 40 HMMWVs with a headquarters and maintenance slice to schedule the training and maintain the vehicles. The command element could consist of a commanding officer, executive officer, first sergeant, training NCO, and a motor sergeant. The training NCO would be assisted by one enlisted man and would be responsible for the scheduling of vehicle use and administrative affairs. The motor sergeant would be in charge of the maintenance section with 2 staff sergeants, 4 sergeants, and 12 enlisted personnel to ensure vehicle standards are maintained.

This would allow, for example, Troop B, 1-1 Cavalry to call and reserve 34 HMMWVs for a one-week exercise. They would then be able to sign for the vehicles, road march to Hohenfels, train the troop on their METL tasks and allow the platoon leaders the opportunity to maneuver their platoons. This not only affords the troop commander an opportunity to develop his platoon leaders, but also provides the soldiers the ability to train in their skill levels in a tactical environment. Battle drills and SOPs become solidified and units become lethal fighting forces. The final result, maneuver leaders and soldiers that are proficient at the basic tasks so essential for success on the battlefield.

Although maneuver is not the end-all solution to training in Europe, it is the essence of what we, as Armor, offer to the Army. Agility, maneuverability, and firepower able to move and react quickly to provide overwhelming firepower at the critical point at the critical time. Recent history has shown that the ability to move and control that movement is a requirement that cannot be ignored and must be trained. The addition of a HMMWV company would offer excellent opportunities to train battle command and battle drills so integral to the success of units. This maneuver training supplemented by a solid and well executed gunnery program, utilizing the UCOFT, chair drills, SIMNET, and PGSS/TWGSS provide the basis of knowledge for the capabilities and utilization of the weapons systems. Local training areas, although small, offer plenty of space to train new drivers and keep current drivers familiar with the capabilities of the vehicle, completing the training regimen.

The combination of local drivers training with home station gunnery programs and maneuver training with HMMWVs in the larger training areas, provide for a well rounded training program focused on building lethal, well-trained units from the bottom up.

TODD A. NAPIER
1LT, Armor

Today, Budget Cutbacks Dampen the Warrior Spirit

Dear Sir:

I read with great interest the two articles in the Jan-Feb issue of *ARMOR* dealing with the up-armored HMMWVs and their use in Bosnia. Being a member of the only cavalry squadron in the 25th Infantry Division (Light), I was particularly interested in reading about the pros and the cons of utilizing the HMMWV in peacekeeping operations. Both 1LT Byrom and LTC Prevou did a solid job of supporting their respective opinions, but it is a certain portion of LTC Prevou's article that most caught my eye.

LTC Prevou wrote that he was concerned with 1LT Byrom's excessive focus on "budgets, fuel efficiency, low wear and tear of roads, and protection of infrastructure." He asked if the Army is breeding a "generation of leaders more concerned with management functions than warfighting?" Unfortunately, these are issues that junior officers are forced to deal with on a daily level. With shrinking budgets and emphasis on doing more with less, today's leader is not always allowed to pursue the Warrior Spirit with as much vigor as in the past. Gone are the Team Spirits and other large scale maneuver operations where lieutenants and captains could work with their units without worrying a lot about getting reprimanded for collateral or environmental damage.

Instead, we have units conducting computer simulations because it is easier and cheaper. Unfortunately, this type of training deprives the junior leaders in the armor branch the opportunity to learn more about their vehicles, their men, and, most importantly, themselves in a field environment.

The U.S. Army of today is very different than the one of even seven years ago. Eight

fewer divisions and the "peace dividend" were supposed to make our army leaner, meaner, and better prepared for the future. This is not happening. Many junior officers are leaving our ranks due to frustration with the current situation. As a quick fix, the Army is promoting officers to 1LT and CPT six months earlier than in the past. This solution is only depriving those junior leaders of critical time with troops at the platoon level.

LTC Prevou's remark that a "cost-conscious, cautious, and careerist attitude" is perhaps infiltrating the Army is something to seriously think about. This is one of many reasons that many of my peers have decided to end their service to the country and pursue civilian careers. The Army is seeing too many highly qualified leaders leaving, and this is a sign that something is not right. I plan on staying in and seeing what happens in the next couple of years. Unless there is a change in how we do business, the junior officer's pursuit of the Warrior Spirit will continue to wane.

T.J. JOHNSON
1LT(P), Armor
Schofield Barracks, Hawaii

Take Pen in Hand, It's Your Journal

Dear Sir:

I am responding to your "Stand To" column, and the letter of LTC Stephen L. Melton in the March-April 1998 issue of *ARMOR.*

In civilian life, I have served as consulting editor of a refereed professional journal, guest editor of another professional journal, and editor of four other publications.

In none of my civilian experience have I found the free and open exchange of ideas I find in *ARMOR.* I know I will always read something in each issue that will start my mind racing with ideas. Part of this is due to the balance of articles the magazine contains, and using a thematic approach would not provide this kind of balance.

While LTC Melton is not interested in historical articles, such as those dealing with WWII, I find the historical articles on past battles very meaningful, because I think there is always something to be learned from the actions and decisions of those in combat.

I have no disagreement with LTC Melton's desiring more articles about what he sees as the future of Armor (he has in fact presented a very fascinating outline), and I would welcome these, too. However, as mentioned in this month's "Stand To" column, someone has to write the articles.

There are five staff members listed on the masthead of *ARMOR*, and none are identified as writers or correspondents. My experience tells me that there is simply not the time available for the staff to write regularly as well as edit and publish. The correspondents for the magazine are the professionals in the field.

It takes a tremendous amount of work to put together an issue of a journal like *ARMOR* every two months. Many civilian journals are quarterly, do not have photos, and thus the bi-monthly schedule of *ARMOR* is even more demanding. It is also more effective because it maintains continuity between issues that adds a freshness to *ARMOR* that other professional journals do not have.

Since LTC Melton is obviously clear-thinking and articulate, he would be a fine candidate to write the kind of articles he wants to see. The outline he presents in his letter would serve as the basis for at least several articles, but if he cannot write them, then perhaps he can urge a colleague with similar views to do so. I hope he does.

PAUL S. MEYER
Cincinnati, Ohio
Former USAARMS Information
Officer and Armor School Historian

The Force May Get Lighter, But Tanks Still Have a Place

Dear Sir:

I refer to LTC Stephen Melton's letter published in the March-April 1998 issue of *ARMOR.* I can agree with him that the "Home of Armor" does not move at the speed of the "Thunderbolt" that is its symbol. I am sure you do know, however, that studies and analysis go on continuously as to how the Armored Force might contribute in the future. Since the days of mechanized cavalry, there has always been a light and heavy school of thought in the employment of armored troops. For decades, an armored cavalry officer and a tank officer had a different MOS and wore different collar insignia. I can only guess that the force will get lighter as the threat gets smaller and more diversified. However, it takes time and money to evolve the force structure and, for years to come, I believe the "tanker" and his 120mm gun will remain at the forefront of ground warfare.

I would like to comment on his remarks about *ARMOR Magazine*. As a retired Armor officer and a former editor of this publication, I can say *ARMOR Magazine (Cavalry Journal)* has had, and still has, articles that are far-reaching and thought-provoking. This journal is one of the most respected and emulated professional military publications in the world today, and has been since 1888. It is a historical masterpiece of original thinking and brilliant ideas, even if many of these ideas get lost in the constant battle for dollars and disagreements over roles and missions.

Now as to strategic mobility, light Armor concepts, and scout vehicles, I suggest to you a few articles published in *ARMOR* and written by this author over the years:

"Showdown at Echo Junction," May-June 1967 (This article came from my CGSC Monograph on Strategic Mobility.)

"An Approach to the Scout Vehicle Dilemma," September-October 1970

"The Case for an Armored Dune-Buggy," May-June 1971

"The Scout Mount 10-1," January-February 1973

"XR 311 - A Star Waits in the Wings," September-October 1977 (This would have been the best scout vehicle we ever had.)

"Fast Troops," September-October 1980

"Ground Mobility in Perspective (Wheel Versus Track)," January-February 1982

"A Missing Link in Support of Light and Heavy Forces (Mortars)," March-April 1989

Letter to the Editor: "We Must Learn From the Past," January-February 1994

Certain armor units are going to get wheeled armored vehicles. There is jest in this thought because, since World War II, every armor R & D officer has known genetically from father to son, there were to be no wheeled armored vehicles accepted into the Army inventory for U.S. armor units. There is more truth in this than fiction. I know!

Finally, one area of development that bothers me and others is the evolution and proliferation of the hand-held shoulder fired anti-armor systems. They have become very accurate, with increased range and a more lethal warhead, especially against light armored vehicles. If we are to go into an Area of Operation where such weapons may be expected, our light armor people must develop doctrine. This must be in conjunction with other combat arms which insure our ability to both carry out the mission and survive.

BURTON S. BOUDINOT
LTC, Armor (Ret.)
31st Editor-in-Chief
ARMOR Magazine

Don't Lighten Up The Combat Arm of Decision

Dear Sir:

Huzzah to MAJ Edgren! (Mar-Apr '98) We need to stop worrying about being something we're not (amphibious or light armor) and concentrate on being what we are: the combat arm of decision.

The point was made by MAJ Edgren that our purpose is to close with and destroy the enemy, utilizing shock, mobility, and firepower. That is what we are, period. We should be utilized when decisiveness is critical on the battlefield, not when a group of bandits need to be maintained behind a line that has been painted either by our government or the United Nations. Don't get me wrong, I'm not saying that purely dismounted infantry should handle these missions, or that infantry assigned to peacekeeping missions should not have armor support. What I am saying is that we should not be wasting precious dollars on trying to develop a light armored vehicle, when they could be more efficiently utilized by

training the soldiers that are already assigned to the Armor branch.

LTC Stephen Melton, in the same issue, says that he felt "slap(ped) in the face" by the Military Police branch, because they have developed the Armored Security Vehicle. No disrespect meant to LTC Melton, but an Armored Security Vehicle was developed because it meets the mission of the Military Police. That does not mean that it should be adapted to the mission of Armor (or that the mission of Armor should be adapted to the capabilities of the ASV). LTC Melton listed the characteristics of the advantages of a light wheeled vehicle versus a tracked vehicle. These were mobility, armor protection, firepower, shock, "ground reconnaissance over large areas with great speed" and high powered, mobile radios, capable of calling in fire support. The M3 version of the Bradley fits that bill and then some.

LTC Melton also accuses *ARMOR* magazine of being "dilatory and backward-looking." I think that LTC Melton may be referring to *ARMOR* printing articles about previous battles, some from WWII. If LTC Melton reads the back of his membership card, he'll see that the Constitution of the Armor Association states that they are "to preserve and foster the spirit, the traditions and the solidarity of Armor..."

What better way to preserve and foster than to inform today's soldiers of the sacrifices that were made by our predecessors, and what better way to "promote the professional improvement of its members" than to show members things done right and things that could have been improved in previous battles.

Too many people are proposing the LAV as a solution. The LAV may be a viable solution to the 82d Airborne's lack of armor support, and I will go on record to say that option should be researched, but it should not be used to replace the M3 Bradley.

There have been many arguments that there are no modern enemies for heavy forces, but I disagree. As long as there is an enemy that might take the field against us, we should be prepared to utilize our greatest power against them. Nothing would be more demoralizing to a "poorly armed opponent" then a company team of M1s and M2/M3s screaming across a battlefield, hurling high explosives many times further than their small arms could even hope to achieve. Once again, Huzzah MAJ Edgren!

GARY F. BONANNO
CPT, Armor
CA ARNG

**Continue the Mission,
Then Be Sure to Fix the Problem**

Dear Sir:

I was very pleased with CPT John Basso's article, "M1A2: One Year Later," January-February 1998 issue; however, there is a statement in the article which needs to be clarified. The article discusses the crew's use of the Prime Power Interrupt (PPI) or power-cycling to work around a suspected software or hardware fault allowing the tank to continue its mission. CPT Basso discusses the capability of the tank, through the use of redundant systems, to find a way around the fault when restarted.

One could infer from the article that due to the redundant features of the M1A2, a piece of faulty hardware could go undetected only to be discovered at a later date. This is not the case.

The M1A2 tank is a complex system, and similar to a desktop computer, problems in the software, hardware, or user's interface to the system can occasionally occur which require the crew to cycle power or use the Prime Power Interrupt (PPI) on the tank. The analogy to the desktop computer is the Control-Alt-Delete function we have all utilized to clear an apparent system lockup. This feature is used to reboot the tank's electronics systems and alleviate or work around a "lockup" or unusual condition; however, rebooting the tank will not result in a hidden hardware defect. Beginning at power-up and throughout operation, the tank's self-test feature is functioning in the background, invisible to the crew, and will report cautions and warnings to the crew. In many cases, the crew can continue operating the tank after resetting the caution, but the caution will remain active and will be added to the caution/warning summary page on the commander's display. In some cases, where there is an intermittent failure, a caution can appear which will be erased if the problem does not reoccur. The crew should provide the defects listed on the caution/warning summary page to unit maintenance in order to troubleshoot.

The primary redundant feature in the tank is provided by the Turret Electronics Unit (TEU) and the Hull Electronics Unit (HEU). These two line replaceable units (LRU) control the data bus traffic and the power management of all the tank LRUs. When one of these units, either the TEU or the HEU, break down, the other unit will take over the control of operations for the entire tank (data bus and power management control).

When this occurs, the crew will receive a caution advisory via a display unit that the TEU or HEU has developed a critical fault. The tank remains operational; however, the crew is advised to report the fault to unit maintenance in order to properly diagnose and repair the defect. At the maintenance unit, the crew can utilize the tank's Built-In Test and Fault Isolation Test capabilities to troubleshoot and correct the problem.

CHRISTOPHER V. CARDINE
COL, U.S. Army
Project Manager, Abrams Tank System

**Maneuver Warfare Supporters
Begin with Faulty Premises**

Dear Sir:

I will begin with an apology and an explanation. I am writing in response to MAJ Vandergriff's article, "Without Proper Culture: Why Our Army Cannot Practice Maneuver Warfare." I apologize for the late date, however, I did not receive that issue until the end of March.

I should first state that MAJ Vandergriff raises some legitimate concerns, and in regards to his assertion that our personnel management system often does promote unworthy officers and NCOs, I agree with him. However, MAJ Vandergriff makes some rather large assumptions, and uses either poorly understood terms, or prejudicial ones. This is aside from the fact that he never proves his main point.

In my Intro. to Anthropology class, *culture* was defined as the totality of a given people's material and spiritual effects. The half-stated assumption in the article is that maneuver warfare is superior to the style practiced now. The German army was able to practice maneuver warfare: ergo, the German culture, at least in regards to its ability to wage war, is superior to our own. The reason, stated but not proven, is that the Wehrmacht's soldiers showed more initiative than ours did or do now. I urge all my fellow soldiers to carefully consider whether or not this is the case. I would argue that MAJ Vandergriff, and the maneuver warfare doctrinaires, have started from a faulty assumption, and continued their arguments from that point. The discussion, in my mind at least, should be whether or not the proposed system is better, where it differs from our own, and how we can best blend the two together.

Once again, I am saying MAJ Vandergriff does have an argument, and several very good points. For example, how many of us have never spent hours of night time copying intricate graphics that bore very little relation to the battle as it unfolded. In the unit I now serve with, it is not unusual to get bad photocopies of the graphics superimposed upon a black and white map, and both are totally unreadable. I throw them away, and do the mission — an example, in my mind, of fine initiative shown. MAJ Vandergriff is quite correct in stating that this sort of thing is the result of a 'zero defects mentality.' Whether or not this is the result of our culture is another matter.

Finally, and most importantly, MAJ Vandergriff consigns us to defeat and dishonor. To quote: "These negative practices will result in defeat on tomorrow's battlefield." This is a sweeping statement, and I was aghast at it

Continued on Page 53

The New Heavy Division

It's more deployable and just as deadly

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

Developing and reorganizing an Army division into a new design is historically a difficult task. We have just completed an effort encompassing several years and involving literally hundreds of people — the redesign of the heavy division. This task was undertaken methodically and deliberately. It was supported by constructive, virtual, and live analysis, as well as the reasoned military judgment of each branch proponent in the Army. As Chief of Armor, I was personally involved throughout the process, as was my predecessor. On balance, the redesigned division is the best of the several alternatives examined. As you are no doubt aware, we have become a power projection Army with global demands and responsibilities. This redesign embodies that change and postures the Army, and the Armored Force, to move forward into the next century. We will now focus our energies on fielding, training and testing the new division. This "Commander's Hatch" will review some of the reasons for the new design and discuss several of the more significant aspects of the new Force XXI heavy division.

First, the requirement to deploy a heavy division faster was a central piece of the new design. The ability to deploy has historically competed with the tactical capability of the unit. That is, if a force is easily deployed, then it generally lacks tactical mobility, survivability, and lethality. This has been at the heart of the enduring debate concerning the capabilities of heavy and light forces. Our task in redesigning the division was to retain as much capability as possible, but in a smaller package. The obvious comparison that tends to be drawn is in relative combat capability to the Army of Excellence division. One of the great truisms has been that "more is better." But we have reached the point in our mission set where more is not necessarily better it is just more, and strains our available resources. "Better is better," therefore the objective we pursued was to provide a more readily deployable force with the combat power needed to successfully execute the mission, while sustaining minimum losses. Our research shows we have accomplished this. The Force XXI heavy division will retain its capability and be 10% more deployable by air and 14% more deployable by sea than our current Army of Excellence Division. For the foreseeable future, there is no expectation that we will fight massed armored forces to the extent anticipated during the Cold War. Therefore, the combat power of the division is sized to successfully defeat projected threat opponents both in war and in peace support operations.

Second, we are now in a class all unto ourselves in terms of capability. No other army in the world can approach the degree of battlefield awareness we are achieving through digitization. This capability enables us to reduce uncertainty about enemy and friendly forces, the terrain, and the battlefield in general to the point where knowledge becomes a substantial force multiplier. This means that each tank present on the battlefield is postured to make a contribution to the mission, and fewer assets are wasted or underutilized by being in the wrong place at the wrong time. This capability enables the Force XXI heavy division to dominate the battlespace, control the tempo of the battlefield, and operate with unmatched agility. Coupled with new systems like the M1A2 SEP tank, M2A3 Bradley, Comanche, and Crusader makes this smaller force equal to, or perhaps greater, in terms of lethality and survivability.

Third, we needed to make the division smaller because it no longer fit with the projected strategic environment. Since the end of the Cold War, the Army has eliminated six active divisions as part of the overall drawdown of the Department of Defense. At the same time, the number of missions assigned and regions where our Army is deployed have increased. The Army is strained in meeting all of these requirements. Many units, as recently pointed out in a General Accounting Office report, are manned at a marginal level. The choice was clear — reduce the size of the division or reduce the number

Force XXI Division

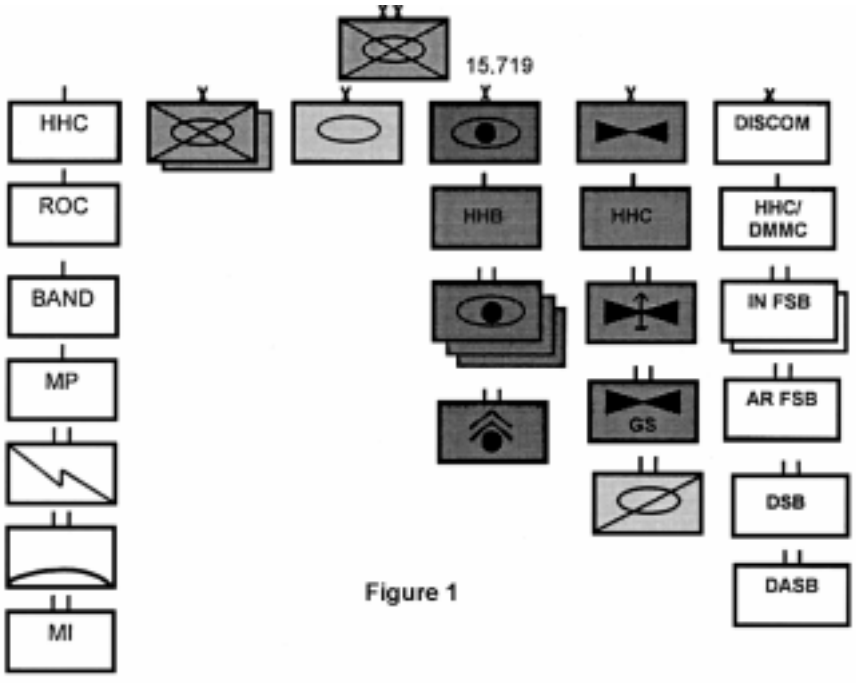

Figure 1

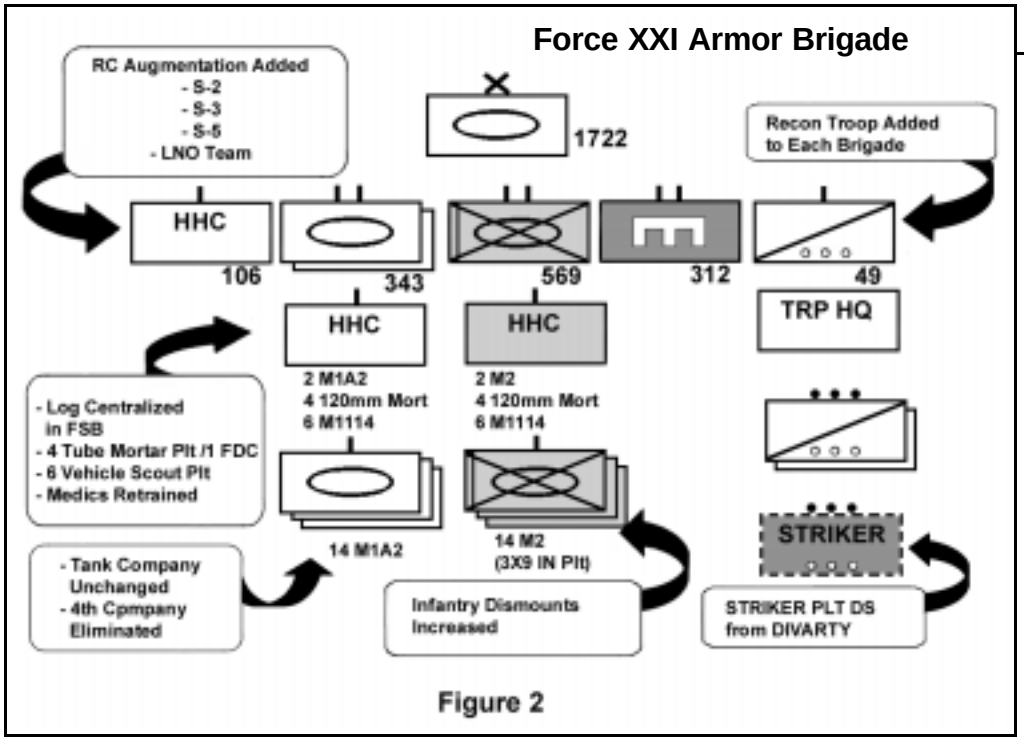

Figure 2

of divisions fielded. Attempting to maintain the size of a division built to oppose a Soviet-type threat was an untenable position for the Army.

With this as a backdrop, let me now briefly describe the changes in the heavy division. I will focus on those which directly impact Armor units, but will also outline some which are of significant interest.

Figure 1 shows the major commands within the division. Most of the brigade-size organizations found in the Army of Excellence Division are still present. A notable exception is the absence of the engineer brigade. Since the engineer battalions normally function under control of the maneuver brigade, they are now attached. The engineer brigade headquarters is thus eliminated and the division engineer staff increased to handle division-level engineer planning. The division chemical company also is gone. The NBC reconnaissance platoon is retained, but relocated to the division cavalry squadron. Area smoke and decontamination functions are moved to corps. The division cavalry squadron remains under the aviation brigade. A new addition to the division is the rear operations company. This unit provides an organic capability to plan and coordinate operations in the division rear area. Other notable changes resulted in increasing the MLRS battery to a full battalion, and adding a second and third lift company in the aviation brigade that will be formed in the reserve component. Overall TOE strength of the mechanized infantry division is reduced from 18,069 to 15,719, of which 417 is structured in the reserve component. This reduction also encompasses eliminating some Compo 4 (unresourced) units, such as the second attack helicopter battalion and the antiarmor company in the mech infantry battalion, which were required but not resourced.

Figure 2 shows the new armored brigade at a strength of 1,722; the mech infantry brigade comes in at 1,948. Besides the engineer battalion, a reconnaissance troop has been added to each brigade. Changes in the brigade staff include the addition of an S-5 and a brigade surgeon, two retrans teams, additional liaison teams, and staff augmentation in the S-2 and S-3 sections. These enhancements will be formed in the reserve component. This organization provides a more capable, flexible brigade headquarters for continuous and dispersed operations. The reconnaissance troop adds a key capability to the brigade that has been lacking for some time. The brigade commander now has a dedicated reconnaissance asset to satisfy his requirements for battlefield intelligence that will aid him in his fight for information dominance. The troop is composed of two 6-vehicle platoons, plus a troop headquarters section. A dedicated HMMWV is provided for troop operations. The ability of the recon troop to significantly contribute to the brigade fight was demonstrated clearly during the brigade and division advanced warfighting experiments, as well as in TRADOC Analysis Center (TRAC) evaluation.

The tank battalion, shown in Figure 3, has a strength of 343. This decrease in required strength is achieved through sev-

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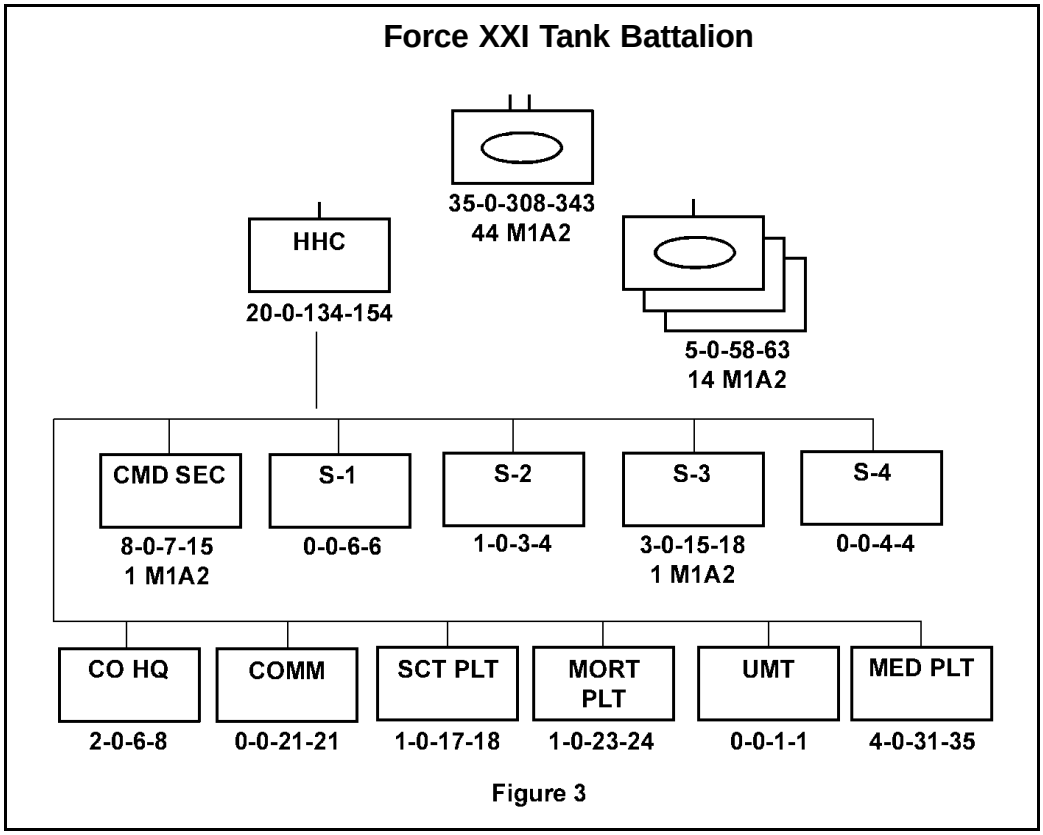


Figure 3

Cavalry Focus Week:

Training Capstone Also Sustains Cadre's Critical Skills

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

Drill sergeants and instructors, leaders in 1ATB and 16th Cavalry, serve at the home of Armor for at least four years performing a critical mission: they create the tankers, scouts, and armored leaders of the future. This is a necessary part of their self-development, and will be noted by centralized promotion boards, but there are too few resources devoted to sustaining their critical warfighting skills. Innovative leaders are now creating methods for sustaining these skills while training new soldiers and leaders. Our best-developed initiative is Cavalry Focus Week in 5th Squadron, 16th Cavalry, which conducts 19D OSUT.

LTC Gary Whitehead and CSM Bill Brooks have instructed their staff and subordinate commanders to accomplish three missions during each training cycle: conduct gunnery and maneuver training with focus on 19D SL10 tasks; provide a "Rite of Passage" event for graduating cavalry scouts; and sustain the critical combat skills of the 19D30/40 NCOs who serve as CFV/HMMWV crew instructors and as drill sergeants.

Cavalry Focus Week is the end-of-cycle training event for a 19D OSUT troop. It provides the scenario to train individual skills in a collective skills environment. Collective training is layered onto the individual training tasks, also enabling 19D30 and 40-level skills practice. The focus of the training must be the initial entry private, but the drill sergeants and instructors serve as platoon sergeants and section sergeants.

The "week" lasts eight days, and is based on a squadron operations order. This order provides a screening mission against an enemy MRR, followed by security missions which protect other friendly ground forces preparing for a counterattack. This provides the basis for each range or STX-lane order. The four STX lanes are: CFV, HMMWV, dismounted patrol, and security/base operations. Each lane prepares an order to be given to the privates as part of their lane training. The order is briefed by the cadre-platoon sergeant and follows the five-paragraph format, scaled down to the level of the privates. The process reinforces the importance of a correct OPORD to these soldiers.

The exercise begins with four days of gunnery, with the focus on CFV firing techniques with the 25mm and M240. The culmination of the range training is a modified Bradley Table VI A/B. The squadron OPORD drives the engagement scenario, a screening mission. The target array reflects the targets that a CFV section should engage while performing a screen. The CFVs are positioned to reflect a scout section, and they fire by section. In the tower, the troop master gunner or the troop 1SG acts as the platoon leader and gives the section a tactical prompt to begin the engagement. The section leader will issue the section fire command upon target presentation. Targets are set on "bob." M2 machine gun firing is done from a HMMWV.

As HMMWV scout sections would rarely engage as sections, .50 cal gunnery is familiarization fire. There are no section fire commands, but cadre conducts the individual engagement as a tactical engagement. An AAR of section fire commands and reporting procedures is conducted for each section leader, but away from the privates.

On transition day, a tactical road march of CFVs and HMMWVs moves to occupy a TOC/troop assembly area. From this day, continuous operations begin, and over the next four days, each platoon rotates through four STX lanes. Again, prior to each lane, the PSG and section sergeants give an operation order based on the troop OPORD. Warning Orders and FRAGOS are issued throughout the lanes, as part of change-of-mission. Each platoon is led by the PSG, assisted by the section sergeants. The company commander, XO, or 1SG observe and control each lane. Emphasis is on critical individual tasks for the privates, and on critical tactical and leadership tasks for the cadre.

The CFV lane begins with tactical driving instruction. It transitions into a zone recon mission. Situations along the zone recon include: clear a restricted area, recon an obstacle, react to indirect fire, actions on contact. The next phase is a night screen. The soldiers man their OPs and detect the OPFOR moving into zone. The OPFOR is from the dismounted patrol lane.

During the HMMWV lane, the privates and cadre exercise the TTP for conducting a route recon as a HMMWV-equipped scout platoon. Situations along the route recon include obstacle/restriction recon, actions on contact, call for and adjust indirect fire, and cross danger area. Night training brings two options: night screen or night route recon. Night screen sees the soldiers manning OPs and detecting OPFOR. Night route recon simulates reconning and marking the

Continued on Page 20

Light/Heavy Integration At the Joint Readiness Training Center

by Sergeant First Class Paul E. Thompson Jr.

PHOTO: Fort Polk PAO

"I see a whole lot of Albanias in the future; a whole lot of Haitis and Mogadishus. That's because of this globalization of information, globalization of population, birth and migration, a certain amount of expectation and fascination."[1]

Yes, we still have to be ready for our Desert Storm-type scenario, but in the next decade we are expecting more Haitis, Panamas, Somalias, and Bosnias than we are problems with Saddam. It is this type of contingency mission that armor soldiers must accomplish along with the Desert Storms.

The Joint Readiness Training Center (JRTC) specializes in low- to mid-intensity conflict of the type today's armored force will encounter during many deployments. JRTC's mission is to provide an advanced level of joint training for Army, Navy, Air Force, and Marine Corps contingency forces under tough, realistic conditions of low- to mid-intensity combat. It is also the premier light infantry training center in the world. This claim is proven by the number of countries who send observers to JRTC in order to set up their own training centers replicating the battlefield realism and effective observer controller coverage demonstrated at JRTC. However, many people, Armor soldiers included, don't know that there is a heavy team attached to the light brigade task force executing a JRTC rotation. The heavy team usually consists of a balanced company/team of two M1 platoons and two Bradley platoons led by either a tank or a mechanized infantry company commander. Occasionally, there is a heavy cavalry troop with a standard mix of tanks and Bradleys, maintenance support, logistical support, and 120mm mortars.

At JRTC, rotations include a light brigade task force consisting of two light, airborne, or air assault infantry battalions, one CPX battalion, a field artillery battalion, aviation task force, one forward support battalion, and one heavy team. The OPFOR is from the 1/509th Airborne Infantry Battalion, which includes three infantry companies and a cavalry troop augmented by the 2nd Armored Cavalry Regiment.

The OPFOR is a 24-hour-a-day, 360-degree type of enemy that gives no break to the BLUEFOR once they are "in the box." They are there in the morning, during the day, in the evening, and they are there all night. They are truly a worthy foe. There are also 11 MOUT villages and cities in the "box," along with three flight landing strips. Some of the MOUT sites are fully instrumented and provide the heavy team with full-scale, realistic training in urban combat. MOUT operations includes sites fitted with MILES on the outside of buildings and equipped for both live fire and force-on-force operations. Many buildings are equipped with cameras to provide film footage to integrate into the after-action reviews.

Battlefield realism is pervasive at JRTC. Actual Soviet Bloc helicopters are used. There is a Hind-D, a Hip, a Helix, and a Hoplite. Also present are UH-1Hs replicating those found in military forces throughout the world. An actual Soviet AN-2 Colt is used to insert enemy parachutists or to resupply enemy forces. Visually modified M551 Sheridans replicate T-62 tanks, VISMODs on HMMWVs replicate BRDMs and on M113s replicating BMPs. Fire markers place all indirect fire missions for both BLUEFOR and OPFOR. They also pro-

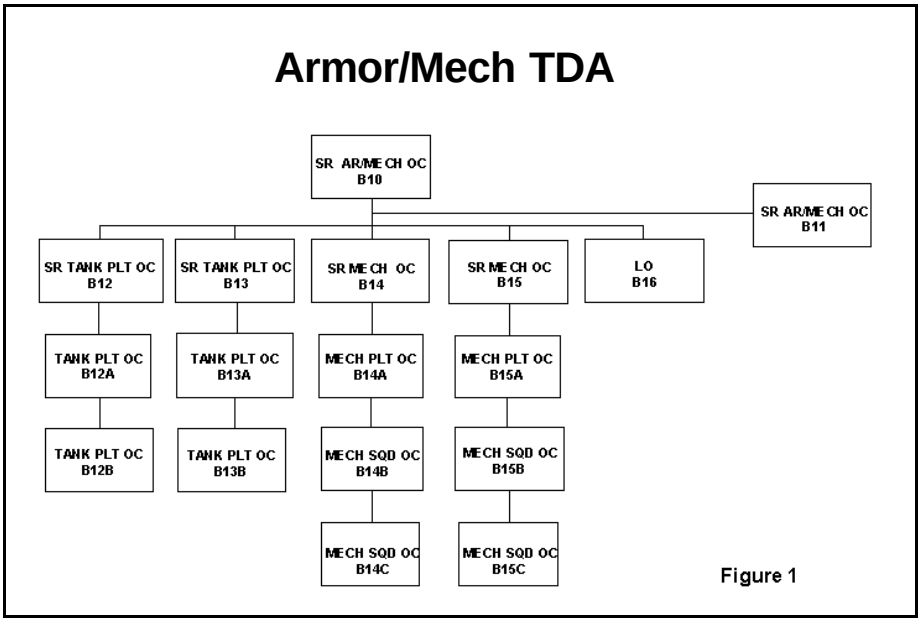


Figure 1

vide effects for minefields if a vehicle or soldier wanders into one. Secondary burns are set up to simulate vehicles or equipment burning. Terrorist bombs or rucksack bombs are a favorite tactic for the OPFOR. Simulated casualties must be evacuated through the CSS system, all the way to the deployed corps area support hospital if the injury requires that level of treatment. Civilians on the battlefield add their presence with village and city mayors, non-governmental organizations, host nation police, and host nation armed forces. Add battlefield clutter, civilian vehicles destroyed in minefields, and uncontrolled refugee traffic, and the result is a battlefield closely resembling the conditions the armor force will likely encounter in today's environment just about anywhere.

In order to be effective in such an environment, tanks and infantry must mesh. Unfortunately, our Army must re-learn this on a conflict-to-conflict basis. At JRTC, the armor/mech team package of observer controllers focuses on armor operations supporting light infantry operations in restrictive terrain. (A copy of the armor/mech team TDA is included in Figure 1.) It is readily apparent during rotations that tankers are not used to working with light infantry. The reverse is even more apparent, but we must learn to do so again, as we have in the past. Since the first British tanks crossed no-man's land at the Battle of the Somme in 1916, we've known that tanks without infantry support in restrictive terrain can lead to a disastrous situation. The reverse can also lead to disaster, as we found out the hard way in Somalia.

The following are some observations I offer to my fellow armor soldiers based on my tour as an observer controller:

Light/Heavy Integration Observations

Heavy force commander involvement in the planning process. A major or branch-qualified captain must accompany the company/team as a liaison officer/special staff officer to interface between the brigade commander and the company/team. The LNO and the commander are the brigade commander's "subject matter experts" on armor employment, capabilities, and limitations of the force. Many light infantry commanders and staffs possess only limited knowledge of the capabilities and limitations of armored forces. The LNO and the commander are there to answer those critical questions which are vital to a light brigade since the heavy team represents roughly a third of the brigade's combat power.

Insufficient time provided to the heavy force commander for rehearsals. As we are so often taught in the heavy community, the last of the troop-leading procedures is perhaps the most important. That is supervise, refine, and rehearse. Light infantry troops can conduct rehearsals and go. In tanks, we like to do as a minimum a walk-through, and also a mounted rehearsal, if possible, to work out any bugs. In the fluid and quick world of the light infantry, you may not have time for the mounted rehearsal. In fact, all you may have time for is a FRAGO over the radio.

Heavy teams not adapting well to restrictive terrain and the enemy dismounted threat. At Fort Polk, there are dense forests, low, marshy ground, and generally poor visibility. Not a perfect place for tanks, but we may have to deploy to a similar place in the future. Think about it. In WWII, the tankers that went before us fought in such imperfect places as Saipan, Okinawa, and the Philippines. Neither Korea nor Vietnam are ideal "tank country," either. Today's tankers are used to dealing with tanks as a threat and troops as a secondary target. How would it be to have to deal with troops as a primary target for the better part of a CTC rotation? Easy? Think again. It is not as easy as you might think, especially when the troops are laying mines, sniping at you, and basically taking every chance they can to disrupt your every routine. Local security without Bradley dismounts can be a real problem if you come here tank-pure.

An effective technique here is to hit the trees during the day so you will not be exposed to OPFOR air, dismounted observation, or the summer sun. At night, occupy an open area where it is easier to spot OPFOR dismounts with night vision devices and you have a better kill zone. Make full use of trip flares, OPs, and the TIS for early warning. The important thing is to move around and not get too comfortable in an AA where you can be targeted by OPFOR mortars or infiltration. Adjust your TIS by sending a dismount out in the woods during the day, adjusting it for brightness, contrast, and sensitivity, and marking those settings. Do the same at night and remember to place the TIS on the daylight settings for the day and the night settings at night. You can make adjustments to compensate for light levels, but just be aware there is a difference and the adjustments give you a starting point to observe enemy dismounts during day or night operations.

Teams not establishing OP/LPs. OP/LPs can earn big money for local security and early warning against a dismounted attack. This is where task organization with light infantry soldiers can be a big plus. If tankers spend all day and all night on their night vision, their performance will degrade in a few days to the point they will be just about useless. If you have infantry dismounts in an assembly area, put three men in a fighting position outside of the perimeter and put them at 33%. You can then go to 25% or 50% on the tanks and Brads, depending on the enemy situation. Use one fighting position during the day, then after dark, set up trip flares around that position and pull your OP/LPs closer to the perimeter. If your dismounts are discovered during the day, the OPFOR will have a surprise waiting for them at night. Just before daylight the next day, move back to your day hole, disarm the trip flares, and take up residence again if you are going to stay at the same place.

Deconfliction of SOPs prior to linkup. It is always nice to work off the same sheet of music. Many times armor and mech platoons deploy to JRTC never having worked together. The company team commander must determine the brigade's SOPs, (especially reports and reporting procedures) prior to linkup with the brigade and establish a common SOP for the company team. This should include reporting procedures as it seems that no two units in the U.S. Army have the same reports or reporting procedures. Of course, I am being facetious, but the statement is not so far from the truth that we can't all wryly smile at it.

Overtasking the heavy force because of its mobility. The heavy force can usually get anyplace on the battlefield in a very timely manner. Throw in a few minefields, snipers, and convoy escorts combined with a quick reaction force mission in support of a light infantry unit, and the heavy team is overwhelmed in a few days of continuous operations. The LNO and the commander must closely monitor the company/team and allocate time for rest and maintenance.

Tired soldiers can accomplish a mission, but exhausted soldiers become a menace to themselves and others. The heavy team can only handle so much.

Underestimating the amount of logistical support required to sustain the heavy force. Many light brigades have never worked with a heavy team and have little idea of the size of the logistic demands it can place on their supply system. The support platoon leader of the heavy team must provide accurate logistics estimates to the brigade. The entire light brigade will probably not use as much fuel in an entire rotation as the heavy team does in three days.

Battalion/brigade commanders and staff do not understand how to employ the heavy team in the attack or defense. Many times the heavy force is piecemealed into the attack or the defense. There are times when individual tanks are split from their platoons to do missions when OPCON to a light battalion or company. Tanks should NEVER be split down past section level. The tanks need each other for mutual support and security. Two tanks or Brads together should be the minimum slice traveling the battlefield. Mass is still critical to success; however, sometimes mass can be defined as a tank or Bradley section when facing dismounts.

Poor adjacent unit coordination. There is a real problem with adjacent unit coordination at JRTC. Light infantry units are always moving on the battlefield. We believe that there is a need for the heavy team to have a TOC for battletracking. They should get continuous updates from the brigade on unit movements, contacts, mine strikes, and upcoming operations. This way, when a platoon leader gets a mission, he can step into the TOC and get an updated situation from the TOC officer or NCO. This can help to reduce fratricide and continually running into minefields that have been re-seeded by the OPFOR.

LNOs not able to maintain 24-hour operations. A typical LNO team that comes to JRTC is an officer and his driver. We recommend a more robust LNO team that can execute 24-hour operations. This should include two officers (at least one field grade and one company grade), two NCOs, and one driver. An LNO from the FSB could be put to good use also, relieving the brigade LNO from chasing down parts and fuel. This is the minimum package needed for continuous operations. At least one M113 and one HMMWV should be included in the package. A good LNO team can iron out many details before they become problems. They participate in wargaming and targeting meetings. They can also assign the correct task and purpose by translating "Infantryese" into an armor mission. It is also helpful to have a field grade officer from the home battalion around to visit the crewman in the field.

Fratricide, inflicting and receiving. As tankers, we are used to engaging targets at long range and having some sort of a sense of lines on a battlefield. At JRTC, you cannot take this for granted. Correct target ID is important for vehicles and for dismounts. Armor forces have inflicted fratricide and been on the receiving end. Situational awareness and adjacent unit coordination are two main causes, but poor target ID is also a factor.

Inability to coordinate direct fires within a MOUT environment. On many occasions when M1s and Bradleys enter a MOUT environment they have an "unleash the hounds" mentality. This "shoot anything that moves" mindset may have been OK in the past, but many groups take a dim view of it today. Soldiers need to get used to working with tactical rules of engagement and, on the JRTC battlefield, they will be held accountable for willful collateral damage. There are civilians, churches, and schools in the MOUT environments here, and soldiers have to be careful with the shots they take and the type of ammunition that they use. As tankers, we are not used to treading lightly, but in a case involving innocent civilians we must tread a bit lighter in this environment. Fire discipline is critical. If you train at a training center to level a city, chances are you will do it in an actual situation.

Inability to execute combined arms breaching in restrictive terrain. Combined arms breaching is one of the critical tasks that will make or break a company/team. Using the mineroller to detect the leading edge of a minefield, the roller tank strikes or sights a possible minefield. He then backs off and provides overwatch with the rest of his section. The infantry goes out to the flanks under cover and the engineers go forward to breach. SOSR is that very important but little practiced set of breach fundamentals that stands for suppress, obscure, secure, and reduce the obstacle minefield. We are responsible for the first three in combined arms breaching, and the engineers take care of the last one. Unfortunately, at JRTC a lot of engineers are "killed" because we do not execute the first three properly.

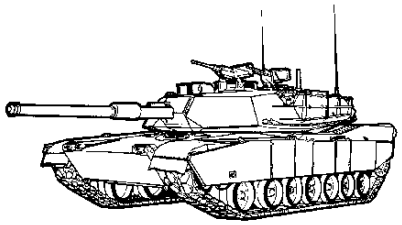
In the last 81 years, warriors in the armor and cavalry field have derived many good ideas. Unfortunately, as the lessons from Panama, Desert Storm, and Somalia get farther away in time many of the lessons from them fade into the history of the totally forgotten lessons from earlier wars. These are the very same lessons we continually learn and re-learn at the CTCs as shown below:

- When a minefield is cleared there is a good chance that there has been, or is, enemy activity in the area, and a better than even chance that the minefield will be re-seeded. After you've searched the area for mine caches, consider an ambush position around the old minefield to prevent the reseeding. Remote sensors can tell you if there is someone up to old tricks. If allowed by the rules of engagement, targeting the area with artillery or mortars might bag you a couple of bad guys.

- When traveling tank-pure in restrictive terrain, it is a good idea for wingmen to occasionally check each other out for enemy dismounts who try to at-

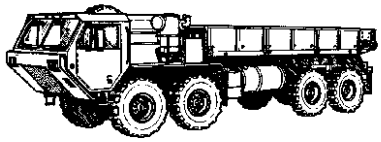
Proposed Unit Equipment Density

COMBAT VEHICLES:
M1A1: 10 each
M2A2: 8 each



SUPPORT VEHICLES:
M113A2 (ENG) 4 each
M2 BSFV: 2 each
MICLIC: 2 each
FISTV
CME: 2-Rollers/2-Plows

LOGISTICS VEHICLES:
M88A2 Recovery Vehicle: 2 each
M113A2 (MAINT): 2 each
M977 (Cargo): 4 each
M978 (Fueler): 4 each
HEMTT Wrecker: 1 each
M925A2 (5 ton) (DS)
M925A2 (5 ton) (Supply,
Tool, PLL, Mess, (EN) 6 each
M113A2 (Medic): 2 each



Proposed Unit Personnel Density

Heavy Team		
Company HQ	15	15
Mechanized Infantry Plt (x2)	64	64
Armor Platoon (x2)	32	32
Company FIST	0	8
Transportation Sec (-)	0	5
Tank Co III/V Squad	0	10
Food Service Section (-)	0	5
Maintenance Supply Section (-)	0	1
Recovery Section (-)	0	3
Maintenance/Service Section	0	6
Ambulance Squad	0	4
BFV Co Maintenance Tm	0	6
Tank Co Maintenance Tm (-)	0	6
FSB (DS) Maintenance Slice	0	10
FSB Transportation Support	0	12
ADA Section	0	13
MAX: 3xBSFV w/PL and 2 Stinger Tms		
LNO to Brigade TOC w/driver	0	6
LNO to BSA w/driver	0	6
Engineer Plt w/Equipment Sec	0	46
MAX: 2xACE; 2xAVLMs; 1xVOLCANO		
Heavy Team Total	**111**	**258**

Figure 3

tach themselves to the back decks and turrets in an attempt to destroy the tank with satchel charges or Molotov cocktails.

Your wingman will understand if you let him know over the radio that you are going to "scratch his back" with your coax.

This will take care of those pesky "growths," and your wingman will be no worse for the wear.

- Keep plenty of fragmentation grenades in your basic load for local protection. Tanks in Vietnam used this technique very effectively. Another similar technique was strapping Claymore mines to the outside armor of the tank with the clackers marked as to position inside the driver's compartment.

- Canister ammunition was very effective in all theaters of WWII, Korea, and Vietnam. With the amount of missions that have taken place in Third World countries in the last few years and the significant amount of dismount threat associated with them, it is good to hear there is a 120mm canister round in the works. HE also has a serious antipersonnel effect but it is nowhere near as effective as canister. Until the introduction of the new round, the Bradley 25 MM HEI-T is also very effective, with a killing burst radius of five meters.

- In Vietnam, we modified the M113, eventually giving birth to the Armored Cavalry Vehicle (ACAV). At first it came out with a .50 cal. machine gun. Later an armored shroud was added around the .50 cal. Later, two M60 7.62 MGs with armor plating on the mount were added as wing guns. A variation of the ACAV was used by the Vietnamese, and turned out to be very useful. Between 11 June and 30 September, 1962, which was soon after the Vietnamese fielded the M113, the original two companies killed 502 Viet Cong and took 184 prisoners at a cost to themselves of 4 dead and 9 wounded.[2]. With the loss of the Sheridan, there are rumblings across the armor community that the ACAV may be resurrected for use in the 82nd Airborne Division. Currently, M113s are equipped without armor shielding around the .50 cal. We learned it once. We should not have to learn it again.

- At Tarawa Atoll during WWII, only two out of six M4A2 tanks landed actually picked their way across a coral reef to shore.[3] Those two tanks played a major part in turning the tide of the battle on the western tip of the island. If armor vehicles will help save lives in any situation, then we should not hesitate to use them when we have to deploy our troops.

- When tanks were used during Vietnam as relief platoons (known currently as a quick reaction force (QRF)), the QRF force was used to relieve units under attack or who had been ambushed. It was a common practice for the relief platoons themselves to be ambushed by

the Viet Cong. Plan on it, because someone in the future will find the guts to try it. Air/ground coordination is useful in this situation, and many others, to scout the route and warn the QRF of any surprises. Air/ground coordination can be used for many situations in light/heavy integration. Most cavalry units we have seen are very good at it, and it is not a bad idea for all units.

- Fascines are devices that have been used to cross ditches since the time of the Roman legions. Most recently, they were employed in Operation Desert Storm by the British. They used huge bundles of PVC piping to fill in ditches for armored vehicles to cross. No, we currently have no way to move fascines, but if there are trees around you have the ability to build one by cutting them down and throwing them into the ditch until it is filled enough to cross. I have seen it used only once at JRTC, and the idea came from a corporal. Yes sir, NCOs can think also! (By the way, for the ecologically minded, the unit used already dead logs and limbs to fill in the ditch and did not cut down any live trees. It is against the EXROE to cut or knock down trees bigger than three inches.)

- When in a static position use chain link fence around an area to protect vehicles from RPG rounds. These RPG screens will pre-detonate the rounds before they reach the vehicle. There is still the danger of fragmentation, so other appropriate measures are also in order

- Use sandbags on top of vehicles to protect from top-attack weapons and attack air. Also use it in the floors and cab roofs of lightly skinned vehicles for mine protection and additional ballistic protection.

- In a fight against dismounted forces, one tank with an infantry platoon can be considered mass. However, splitting the armor below section level should be resisted at all costs. The armor platoon is designed to fight as a platoon. Section level should be the lowest level that tanks are employed. In Vietnam, it was not uncommon to have an armor company headquarters in one place with one platoon undergoing maintenance services. The other two platoons could be 50-100 miles away, supporting operations with the infantry or providing strongpoint defense on bridges or other such critical locations. In this situation, the headquarters supply sergeant always had slings prepared with a platoon basic load so that they could be quickly resupplied by air if they came into contact and depleted their basic load. Regular supplies had to either be sent from that base camp or begged from the infantry.

- In Vietnam the air cavalry units found the enemy, dismounted troops to fix the enemy, and then the armor was called in to finish them. Sounds like a good way to conduct search and attack.

- When going into an area with a heavy dismounted threat, load up on MG ammunition. If you have to go into the trees, machine guns can be useful for reconnaissance by fire, not to mention the snipers you may end up taking out. This should only be used if there is a known threat in the area, but it is better to waste ammunition than one of your men's lives.

- In Vietnam, armor and mech forces would circle the wagons at night and dig in to prepare for enemy attacks. By this time, in 1968, the enemy had learned to bypass armor forces. American forces countered this enemy tactic by blanketing an area with four-man ambush patrols. Since M113s had patrol routes they had to cover every night anyway, the ambush patrols were loaded on the M113s and, immediately after dark, would drop off the ambush patrols without stopping. This made it very difficult for the enemy to pinpoint ambush positions because the vehicles never stopped moving during their reconnaissance. If one of the patrols bit off a little too much for them to chew, the ACAVs and tanks could get there quickly as a reaction force. It made the enemy think twice about their infiltration and minelaying efforts.

- In the past, all soldiers learned to be infantrymen in basic training, and then went on to AIT to learn their individual job. Then in PNCOC or PLC, infantry skills were again stressed so that small unit leaders could hold their own if they had to pick up that rifle and use it. Today, basic training and PLDC do not teach enough of those skills. We need more of an emphasis on those basic skills. As evidenced in Bosnia and Macedonia, tankers may not always have their armored beasts around them. They need to be able to succeed on foot also. Yes, we have had tankers on foot patrols and in HMMWVs running around Bosnia. These are but a few lessons learned. There are plenty of old tankers and cavalrymen out there that could undoubtedly teach us more. If you have any comments, please forward them to:

Operations Group-Bde C2
Attn: Armor/Mech Team
7154 Alabama Ave.
Fort Polk, LA 71459-5313

E-mail at chevaljh@polk-emh2.army.mil

Light/heavy integration has been around for a long time, although not always called such. There is a light/heavy handbook coming out as a pocket help for commanders to do planning. Perhaps an FM may be in the offing to help us permanently establish doctrine that will carry us into the missions we will face in the next 10 years or so. Tankers, get ready for light/heavy integration, because it is not only coming, it is here. "No tank is to be surrendered or abandoned to the enemy. If you are left alone in the midst of the enemy, keep shooting. If your gun is disabled, use your pistols and squash the enemy with your tracks... in any case, remember that you are the first American tanks. You must establish the fact that American tanks do not surrender...." orders to the first American tankers from then Major George Patton as quoted in *Tank Aces*, by Ralph Zumbro (an old tanker whom I admire). With a combination of American tankers and American light infantrymen, you will have an unbeatable team.

A proposed unit equipment density is in Figure 2. In Figures 3, there is a list of possible company/team missions that may be encountered during a JRTC rotation.

Notes

[1]GEN John J. Sheehan,USMC.

[2]CMH Pub 90-17 Vietnam Studies: Mounted Combat in Vietnam, 1978.

[3]*Tank Aces,* Ralph Zumbro, January, 1997.

SFC Paul E. Thompson Jr. enlisted in the Army in 1976 as an Indirect Fire Infantryman. His assignments include 2-325 AIR, 82nd Airborne Division; 4-333 FA, 428th FA Brigade; 2-64 Armor, 3rd Infantry Division; Cincinnati Recruiting Battalion, Recruiting Command; and 4-67 Armor, 1st Armored Division. He is currently assigned as an Armor Platoon Observer Controller at the Joint Readiness Training Center at Fort Polk, Louisiana.

An All-Wheeled Scout Option?

Marines Mix LAVs with Mountain Bikes

by Captain Kelly P. Alexander

- Author photos

Using bicycles in military operations is nothing new. The French used them in WWI, the Japanese in WWII, and the Vietnamese along the Ho Chi Minh Trail. But in conjunction with armored operations, the choice has traditionally been the motorcycle and/or sidecar, the classic example being the German 7th Panzer Division's employment of motorcycles for reconnaissance in the invasion of France in 1940. Motorcycle-mounted troops seized key terrain, bridges, and intersections, and then armor moved forward to occupy the positions before the French could react. This two-wheeled option enabled German forces to add great mobility and flexibility to their operations.

While several recent experiments using mountain bikes were successful, those experiments failed to gain much attention. In April of 1997, Charlie Company, 1st LAR embarked on a self-generated experiment to test the viability of mounting mountain bikes on the LAV and employing them with scouts during light armored reconnaissance (LAR) operations. In December 1997, the company received the support of the Marine Corps Warfighting Lab and Marine Corps Systems Command to conduct a Limited Technical Assessment (in the form of ten mountain bikes) for continued research and development.

Concept Development

The LAV is fast. It can project power and presence forward quickly and efficiently. It can project in depth and be sustained, as demonstrated during Operation Deep Strike in August of 1997. In the company form, LAR can bring to bear firepower rivaling an entire light infantry battalion. That is not to say LAVs are the panacea for every tactical situation, because they are not. However, Light Armored Reconnaissance, in conjunction with scouts, deployed in pairs on mountain bikes, offer several advantages.

In April of 1997, we began to experiment with mountain bikes and scout employment. At first, we used two bikes donated by marines within the company, and compared their performance to that of our foot-mobile scouts. We did little more than paint these antiquated bikes flat black, rig the bikes to the left side of our LAV-25s, using existing brackets and bungee cords, and move out. The bikes proved to be quick and quiet, and their light weight offered encouraging results. We tripled our efficiency in conducting route and zone reconnaissance missions when compared to the foot-mobile scouts. On several major exercises (Kernel Blitz, Operation Deep Strike, and JTFEX), the mountain bikes projected forward with such speed and security that LAR was able to arrive and seize key points literally hours before "scheduled" Red Cell elements were in position.

The advantage was faster reporting and an abbreviated OODA loop process. While the bikes in no way eliminated the need for ground mounted reconnaissance, they did — when the situation permitted (i.e., the threat was moderate to low) — allow LAR to cover terrain quickly and securely. Perhaps the biggest advantage the mountain bikes offer is the increased situational awareness and the heightened probability that commanders would receive reports faster, enabling the leader to make his decision before the enemy reacted. In summary, the mountain bike option contributed to a more rapid decision-making process for commanders at all levels. The LAV commander determines, based on METT-TS&L, whether or not the situation is appropriate for mountain bike employment. Based on nearly ten months of experimentation, we have determined that mountain bikes, in conjunction with Light Armored Reconnaissance operations, are a viable consideration both on the modern battlefield and in Stability and Support Operations.

Tactics, Techniques and Procedures. Reconnaissance and security operations are extremely time-consuming, often slowing the main force. If the higher commander becomes frustrated, the reconnaissance may be conducted hastily, thus sacrificing speed for security. Mountain bikes offer more timely reconnaissance while maintaining an acceptable degree of security.

Organization. Currently we employ twelve mountain bikes, six bikes per line platoon (LAV-25). The bikes are mounted on the left side of the vehicle, on existing mounts and bike mounts constructed by our company welder. The bikes are secured with bungee cords, the handle bars turned flush with the side of the vehicle. Hanging the bikes outside seems to cause very few problems — even when the LAVs are traveling on LCACs. The bikes do not extend beyond the buffer of packs or cammie netting which adorn the outside of a combat-loaded LAV. With the exception of one bike damaged when grazed by a tree in close terrain, transport on the side of the LAV has worked quite well. We are continuing to experiment with different

mounting options and apparatus. Currently, the scouts can dismount the vehicle, detach their bikes, and deploy in about seventy seconds. Remounting requires about two minutes.

Route Reconnaissance. Employed forward of the LAVs, a bike section consisting of two scouts on two bikes deploys to conduct the traditional tasks of observing and reporting. The scouts carry load-bearing vest, T/O weapon, and one PRC-119 radio per section. We have experimented with a variety of weapons such as the 9mm pistol (too little firepower) and the MP-5, which slung nicely across the chest of the rider but was still questionable due to its limited maximum effective range. We believe the answer may lie in the new M-4 short-barreled rifle, which will be more manageable yet maintain needed firepower capabilities. For communications, we carry the PRC-119, which is heavy and cumbersome, but we are in the process of acquiring Motorola radios. A new "adapter" allows the Motorola to be attached directly to a BA5590 battery, thus increasing the life span of the Motorola from seven hours to seven days (no more rechargers!). This "adapter" is currently being used by 2nd Reconnaissance Battalion and was the source of our information.

Depending on the threat, the scouts will travel on or off-road. Supported and overwatched by their own LAV-25s, they ride forward to observe and report. Prior to their departure, they receive the standard "Ranger" five-point contingency plan from their vehicle commander so that, in the event that enemy contact does occur, a future link-up can occur at a predetermined rally point. The remaining two scouts stay with the vehicle, providing security. If the threat is high or contact expected, the bikes may not be a consideration and the four members of the scout team deploy forward on foot. If the threat is moderate or low, the scouts may detach their bikes, proceeding forward by bounds, terrain masking and conducting mounted or dismounted crest drills along the way. A crest drill is nothing more than concealing or caching the bike on the reverse slope and crawling forward to observe, presenting a minimal silhouette.

In a matter of a few minutes, reports are flowing back to the platoon commander, the company commander, the battalion commander/BLT, and finally the division or MEU commander. What previously took hours to achieve, we now conduct in minutes, quickly and securely. The bikes at 3000m and less (the max. effective range of the LAV-25) begin to report the situation ahead. If the route is clear of obstacles, the key terrain unoccupied, or the bridge unguarded, the scout radios the vehicle to move forward, and in minutes the position is owned by an LAV.

If the route requires obstacle reduction, the scouts on bikes are able to give advanced warning as to obstacle location and composition without having a vehicle in proximity to be engaged by direct or indirect fires. Engineers are brought forward, if beyond the scouts capabilities, and the bikes continue forward on the flanks to provide an added buffer during the breach or obstacle reduction. While a myriad of tactical scenarios are applicable, the bottom line is this: the bikes provide a means to push farther forward in a timely fashion, allowing LAR to have that crucial "reaction time" that is critical in all mechanized operations. The rate of reconnaissance has tripled when using our mountain bikes. A route recon also includes the investigation of areas adjacent to the route which may influence it, to include defiles and lateral routes. The mountain bikes allow us to observe and report on these areas without committing an LAV, thus enabling us to focus our firepower forward, rather than dispersing it laterally.

Zone Reconnaissance. Perhaps the most difficult and challenging type of reconnaissance, zone recon, also requires the most time. Here, the bikes are invaluable as they scour the area, moving forward, laterally, and sometimes backwards to investigate. Although not as detailed as a reconnaissance conducted on foot, the decision to deploy the bikes is based on two things — terrain and enemy threat. Perhaps one of the greatest assets the bikes provide is a quick, quiet, and easy insertion and extraction into the immediate AO. Whereas previously the LAV would easily compromise both the vehicle and the scouts because of its noise, the mountain bikes enable the scouts to disembark at distances over a mile away. This, in addition to our new "silver series engines," permits LAR scouts to conduct their reconnaissance quickly and quietly.

Security Operations (specifically screening operations). The mountain bikes are used to conduct mobile patrols on the screen line, confirm grids using a "plugger" for engagement areas, and mark target reference points (i.e., chemlites, air panels, etc.), conduct time/distance analysis between trigger lines and break lines, all in a mobile fashion. To the rear of the screen line, the bike-mounted scout is able to confirm routes back to subsequent battle positions, conduct time/distance analysis, recon and mark battle positions, as well as "plugger" future "on-call" targets for use during anticipated defend or delay missions.

The bikes can be incorporated into convoy operations as well as rear area security missions using scouts to provide mobile patrols and early warning from this mobile platform.

Observation Posts. Before, LAR scouts were limited to the distance of the scout/vehicle tether. With the bikes, we are able to extend the length of the tether greatly and push them farther forward, allowing them to observe, report, and in some cases initiate engagements with indirect fires and CAS; then egress back to the vehicles under cover of the LAV-25s and LAV-ATs. It enables us to emplace hasty obstacles and overwatch them at greater distances, thus allowing us to better shape the engagement area towards our decisive point. In a defensive posture, the bikes are useful in emplacing AT mines or providing mobility for monitor/survey teams as they investigate the extent of an NBC attack.

Raid. The bikes are used to recon the route to the objective rally point (ORP), recon the ORP, and, if needed, they can be cached so the scouts can continue on foot to the objective. Either way, the bikes again offer a new dimension to tactical mobility and security.

Operations Other Than War. Perhaps the bikes' greatest usefulness lies in their utility during MOOTW situations. Outwardly, the bikes offer a non-threatening posture. In reality, a 25mm Chain Gun lurks in the shadows up to two miles away, ready to respond at a moment's notice.

Scout management. This is the term for the scheduled introduction of scouts onto the battlefield at specific intervals, in order to preserve scout endurance, proficiency, and survivability. By employing the bikes in pairs, we are able to retain two scouts with/near the vehicle, keeping them fresh to rotate in on the bikes, as the commander may direct. Before, we would deploy the entire four-man scout team on foot. Even for the fittest, a 25-mile route reconnaissance during extended operations proved to be impractical. With the bikes, riding is potentially taxing, but offers more efficiency and yields consistent, reliable reports and results.

At left, scout dismounts his bike from mounting points on the LAV hull and prepares to move forward. As patrol progresses, the LAV crew, right, overwatches and remains ready to suppress. With lighter radios and shorter, M4 versions of the personal weapon, bike scouts would be even more effective, author notes.

Night Operations. Because the bikes are fast and quiet, they often proceed unnoticed. They are difficult to detect, identify or track, as they give off such a small thermal signature, and cover large areas in a short period of time. Scouts with NVGs are able to observe and report from several different locations in a matter of minutes, thus giving us better security and improving situational awareness. Between the scouts on mountain bikes and the LAV thermal sights, we are able to move quickly, securely, and strike accurately on extended frontages and depths. Especially at night, the mountain bikes offer not only depth to the battlefield but a new dimension.

RESEARCH and DEVELOPMENT

During Exercise Kernel Blitz, the mountain bikes revealed several tactical benefits. Attached to the outside of the LAV, the bikes weathered safely an 0300 flight on LCACs. Once ashore, in darkness, the bikes were pushed forward to recon key terrain. In 20 minutes, the bikes had seized and reported two key pieces of terrain dominating the beach area — a job that normally, on foot, would have taken 1-2 hours. Additionally, the bikes identified two enemy HMMWVs, which were then destroyed by quickly moving the LAV-25s into action under the guidance of the bike scouts. During the amphibious landing of Regimental Landing Team 1, the bikes provided key mobility as they achieved a crucial link-up with B Co. 1/4, alerting them to a potential ambush just inside a nearby canyon. Most notably, the bikes conducted a night movement to seize key terrain that the company prepared to occupy the next morning. Over ground that would have taken ground-mounted scouts 6-8 hours to recon, the bike scouts were able to advance quickly and quietly, at night, and in two hours reported the entire three-mile area "all clear." At this point, I was able to make the decision to occupy the ground immediately (2300, vice NLT 0900). As the sun rose the next morning, the entire company lay poised at an engagement area. The OPFOR entered the area just before 0700 and was destroyed.

OPERATION DEEP STRIKE. During Operation Deep Strike, the bikes were employed in a desert environment. While the bikes did not prove useful on soft sand, they did provide some key benefits on hard desert crust and harder packed roads. During a battalion-sized attack in the Lead Mountain area of 29 Palms, the bikes moved forward in the high ground to establish an OP overwatching the objective. The bikes were able to traverse the foothills and lava rock in a timely fashion and occupy the OPs to enable the company to further occupy a nearby attack position and then overwatch as the company moved into its support-by-fire positions. The scouts on bikes were also employed with MP5 submachine guns to offer firepower but reduce the awkwardness of carrying both an M-16 and a PRC-119. This experiment proved fruitful for the scouts as it allowed them to sling the weapon in front, resting against their chest, instead of slinging the awkward M-16 across the back. A point of interest: the LAV scout as well as the LAV crewmen should be outfitted with the new M4 5.56mm carbine versions of the M16. This weapon, with collapsible stock and short barrel, would maintain current firepower and make it easier to get on and off an LAV.

Transitioning to Operations Other Than War (OOTW), the bikes were employed in conjunction with vehicle checkpoint operations on the Colorado River. The scouts on bikes moved forward into the city of Blythe, Calif., and in conjunction with local law enforcement authorities, conducted "house calls" to notify local residents of the U.S. Marine training checkpoint being conducted in the area. While the scouts conducted liaison forward, on mountain bikes, the remainder of the platoon, with its LAV-25s, established the checkpoint itself and positioned the vehicles. The checkpoint was successful; and with the mobility of the mountain bikes, this "flying" checkpoint was established within 10 minutes of arrival. The checkpoint processed 25 vehicles of various types in a 2-hour period.

MINI-CAX. Charlie Company conducted a "mini-CAX" (combined arms exercise) at 29 Palms with BLT 1/4. For the first time, we coordinated the employment of mountain bikes and live-fire operations. We conducted a raid in which a platoon conducted reconnaissance of the route, the objective rally point, and the objective itself using the mountain bike scouts under cover of darkness. This provided for a rapid and secure deployment of the raid force into the objective area while receiving real-time intelligence from the bikes on the objective.

In a separate and live fire evolution, during a company defense, we occupied a battle position in the vicinity of America Mine. Scouts on mountain bikes deployed to man observation posts 3600m forward of the battle position. Upon positive identification of the advancing enemy, the scouts initiated live-fire preplanned and registered targets, our 81mm mortar variants delivering HE designed to suppress and mark the oncoming mechanized formation. We began to canalize the enemy into the outer edges of our engagement area. Once on target, the scouts remounted their bikes under the suppression of the 81mm mortars and moved back toward friendly lines in darkness. The bikes transited the desert floor (3500-3700m) in about 12 minutes,

and upon reentering friendly lines, we launched our first TOW missiles, separating the tanks from the armored personnel carriers. The LAV- 25s conducted their direct fire engagements, and the 81mm mortar variants concluded with coordinated illumination and an FPF. While the focus of 29 Palms was to conduct live-fire and maneuver, our research continued to provide valid methods for the employment of mountain bikes in conjunction with the LAR missions.

MISSION: HAO. We used the bike scouts to establish initial "eyes on" on the refugee camp located at Warner Springs, Calif. The ambient temperature was about 50°F and raining. The scouts provided early reports as to the numbers, activities, etc. The bikes allowed us to close quickly and securely while keeping the vehicles at a distance of about 3000m — out of sight and out of mind of the unpredictable refugees. The bikes were used at night with NVGs to conduct mobile patrols in the vicinity of the camp; they were ideal because the bikes did not present the ominous presence of an armored vehicle, but offered an unseen buffer of security for both the company and the refugees. LAVs provided the catalyst to drop off foodstuffs.

With bike-scouts in overwatch, the "chow vehicles" (LAVs) moved forward, dropped off the MREs (from a secure and mobile platform), and bounded back. The mountain bikes departed the scene as the vehicles completed their offload, linked up with the vehicles at a predetermined rally point, and reembarked the vehicles — mission complete. When the crowd became unruly, the scouts in overwatch had the mobility to withdraw from the area quickly and safely under the cover of their vehicles.

We were able, in this environment, to experiment with bounding overwatch using bikes and LAVs. We held the refugees with the bikes and brought in the vehicles only when the situation deteriorated, thus complying with the ROE to present a "non-threatening presence" at the site.

The bikes operated at night in 30°F temperatures, rain, mud, fog, and some hail. They performed admirably with no maintenance problems.

MISSION: PERMISSIVE NONCOMBATANT EVACUATION OPERATION (NEO). Since the MSSG was delayed as a result of the weather; for four hours Charlie LAR conducted initial screening and in the form of a mini-Evacuation Control Center. Due to overcommitments of assets and scouts needed for security and the manning of stations, we were unable to employ our bikes. In the future, we plan to employ them (in a permissive NEO) as mobile patrols on the fringes of the NEO ECC. They will provide mobile early warning, check out lateral routes, and occupy the key intersections, bridges, and waterways influencing the NEO site. Obviously, these positions would and could be reinforced by the vehicles in one simple radio transmission.

MISSION: SCREENING/SECURITY OF THE BLT/MEU. Mountain bike scouts were used to conduct nighttime route recon of two canyons which were on our BLT axis of advance. In both cases, the bikes followed rotary-wing close air support armed recce missions. Armed recce missions confirmed that the defiles were, in fact, clear. The bikes were silent and secure, providing quick real-time intelligence for the MEU. Since the MEU was not yet ashore, the bike scouts established overwatches on the canyons, emplacing hasty obstacles and AT mines after bringing the vehicles forward. This caught the OPFOR by surprise, as they did not expect us to have moved into the canyon, cleared their obstacles, and emplaced our own within a few hours. As a result, the bike scouts with AT-4s were able to ambush an enemy spoiling attack at one of the obstacles. The scouts were able to approach the reverse slope of a hill, hump their bikes to the military crest, then crawl up to observe and report. Upon completion, they simply rode down and returned to their vehicles in record time. While not in use, the bikes were camouflaged and placed in a hide site away from the observation post.

One lesson learned was the overextension of scouts who were placed over six kilometers away in an OP. These scouts were compromised, and at the time they were operating on foot. They were hunted down and killed by OPFOR infantry. This reinforced two things; the scouts out forward must be within supporting range of their LAV-25, and the mountain bike option in this case (the platoon commander chose not to use them in this instance) may have allowed the team to break contact and escape with their lives and information.

The employment of mountain bikes and LAVs during JTFEX (SOCEX1-98) was very successful. The bikes performed well under various conditions in special and conventional roles.

The Bike

The specific components of the 1998 Gary Fisher "Big Sur" were found to be most durable over the last nine months of testing.

- Aluminum frame - reduces salt water corrosion while at sea.
- Avid Brakes - fewer working parts and better than cantilever brakes
- Mono shock or "Rock shock" - needed for rough terrain impacts, now standard on most bikes.
- "Rapid fire shifters" - easier maintenance and user friendly, versus the "grip shift" shifter.
- Kevlar Beaded Tires - extremely durable, tough, and survives well on the exterior of the vehicle.
- Shimano LX components - recommended for survivability, dependability, and sustainability.

A Class IX parts block also accompanies the bikes, in order to sustain them while on deployment. Each bike will be treated as a vehicle and receive scheduled maintenance that will be tracked through a discrepancy folder. Repair and replacement will be tracked and recorded using EROs in order to document the history of each bike using an "in-house" maintenance management program. Two of our older mountain bikes will remain in the rear for additional and continued R&D by 1st LAR Battalion. We have noted that the chromium-magnesium shocks are subject to extensive corrosion and we are replacing them with all-aluminum front shocks for the deployment. Four of our marines have been trained as mechanics and received a six-day training package, courtesy of the vendor, a mountain bike dealer in San Diego.

This R&D period will extend for our entire deployment with the 11th MEU.

In the end, we hope to prove the mountain bike and the LAV, in tandem, provide an "all-wheeled" option which allows commanders to observe-orient-decide-act in an informed, accelerated fashion. The employment of mountain bikes with LAR operations is not the answer to every tactical scenario; it simply addresses an old concept with new technology.

CPT Kelly P. Alexander, USMC, commands a Marine Light Armored Reconnaissance Company (Troop). He is a graduate of AOAC, the Cavalry Leaders Course, the Army Ranger Course, and Basic Airborne Course.

Mobile Pre-Positioning

A simple but effective CSS technique
For a battalion task force

by Captain Scott Maxwell

While Army doctrine is well defined in the areas of tactics and operations, many gaps exist when it comes to doctrine for CSS planning and execution. Our FMs and ARTEPs offer little to guide the CSS executor in the "how" of getting the beans and bullets to the troops in the tanks.

Perhaps the best reference available is *FM 71-123.* This FM gives some excellent techniques available to the battalion's CSS players in terms of planning resupply operations and executing LOGPACs. But what can the battalion do when planning isn't enough and regular LOGPACs aren't flexible enough to meet the battalion commander's battlefield requirements? In an environment such as the National Training Center, the need to address CSS operations out of the ordinary is not only important, it is necessary.

While *FM 71-123* mentions a few alternate resupply methods, it offers little detail on any of them. One of these methods, however, mobile pre-positioning (MPP), turned out to be one of the most effective techniques our battalion found for addressing our dynamic CSS requirements and fluid battlefield demands during our recent NTC rotation. MPP is just what its name implies: locating loaded resupply vehicles forward on the battlefield. Employment of MPP not only gives a task force much more flexibility in the responsiveness of mission-generated demands, but the decreased lead time for resupply operations greatly enhances the commander's ability to rearm and refit before the enemy can.

Organization. We organized our MPP similar to a LOGPAC, led by the support platoon leader and using his haul assets. As with a LOGPAC, he briefed drivers on their loads and identified which companies they would resupply before the MPP rolled out. We sent the support platoon sergeant out with the MPP as well, ensuring additional FM communications capability while the MPP was on the move.

Configuration. Normally, our MPP consisted of Classes III(B), III(P), and V packages loaded on the support platoon trucks, as for normal LOGPAC. Ideally, the MPP would be a push of unit basic load, from which combat elements would take what they required to return them to a "GREEN" UBL status. We also placed any special III or V requirements for follow-on missions in the MPP load. Such special requirements were normally identified through detailed CSS planning during the battalion orders process.

Depending upon the CSS situation when the MPP moved out from the field trains, other classes of supply could be pushed forward as well. For example, Class I MRE cycles, Class II and IV items needed for follow-on missions, or medium-priority Class IX parts could be prepositioned to arrive as early as possible.

MPP execution. Because the MPP wasn't always necessary, we only used it when the S4 determined that scheduled LOGPACs would not be sufficient to meet timely or unanticipated logistical needs — usually on battle days. If we decided an MPP would be used, it departed the field trains shortly before daybreak to a concealed position well outside the BSA, as well as outside enemy cannon artillery range. Choosing such a location increased the survivability of critical CSS assets in the MPP by taking them out of the enemy's deep operations target areas.

During the offense, the MPP continued to follow the battle by moving from one concealed position to another, while staying out of enemy cannon range and away from templated air avenues of approach. In the defense, the MPP made periodic survivability moves. Sometimes, these moves would place the MPP further from the task force than the BSA. However, due to the responsiveness of the pre-configured and pre-loaded MPP, the time/distance tradeoff still worked to our favor. In both the offense and defense, it is best, as with all CSS actions, for the MPP's repositioning to be linked directly with OPFOR or friendly events. For example, in the offense, the MPP may key off of the reserve company executing phase lines, or destruction of particular enemy echelons in the defense.

As soon as a lull in the battle occurred, or the brigade gave the battalion a change of mission order, the MPP rolled into action. A hasty LRP site was selected by the S4 from existing CSS graphics, and Class III/V resupply occurred as would a normal LOGPAC — company team first sergeants met their "breaks" at the LRP site, resupplied their companies, and returned the breaks to the LRP by a predesignated time. Since the MPP could be on the road within ten minutes of being called, companies had little wait time for their critical resupply. If the S4 is able to anticipate the battlefield lulls before they occur, rolls the MPP early, and selects an LRP closer to the resupplied units, the wait time for an MPP resupply can be even less. This may be critical, for example, when the company teams run lower than anticipated on Class V fighting the OPFOR AGMB, and the battalion commander still has yet to meet the first echelon MRB. If the battalion commander has to wait for the supplies to get loaded and then moved forward from the field trains, he may have to wait too long to win the overall fight.

What about CTCP emergency resupply? MPP is not intended to replace CTCP emergency resupply. A CTCP prepo is used to give individual vehicles or specific units enough Class III and V to sustain immediate combat — it is unpredicted opportunity resupply. MPP is used to resupply the entire task force to bring them up to a full UBL — it is a planned resupply at an unplanned time and place.

What about LOGPAC? When the MPP is used by the battalion for quick resupply, the trucks still have to return to the

field trains to top off. Depending upon how the brigade operates, it is quite likely that they will not be able to receive essential supply classes until the BSA is prepared to issue them — which may be well after the normal LOGPAC time. In this case, the MPP must take the place of the UBL resupply of the scheduled LOGPAC. The LOGPAC itself, or what remains of it, must still continue as scheduled to push forward replacements, difficult to move or timely items, and non-critical supplies to the units, such as hot Class I, personnel replacements, low-priority repair parts, and so on.

Quite often, however, the MPP will not be used for resupply, or will have only issued a small portion of what it carries. When this happens, the MPP must link up with the remaining LOGPAC elements from the field trains for the scheduled battalion LOGPAC LRP. Depending upon time requirements, the MPP may either return to the field trains altogether, or the supply sergeants may move forward to the MPP hide location under the direction of the HHC first sergeant or XO.

Advantages and disadvantages. Using an MPP afforded us several benefits to our battalion's operations:

- By being positioned outside of the BSA, the MPP increased survivability of critical CSS assets. This was especially true when the MPP locations were carefully selected to avoid enemy ground and air avenues of approach and downwind chemical hazards.
- As the MPP can roll in just a few minutes, the battalion maximized CSS response time, while minimizing the crises that CSS executors had to react to in order to meet unexpected CSS demands and timelines.
- The battalion commander increased the flexibility of his combat elements, allowing them to resupply, reposition, and return to the fight without having to wait for them to rearm and refuel in the midst of the direct fire battle.
- The MPP also supported continuous operations better than a scheduled LOGPAC by ensuring continual resupply of forward combat elements. No company was left without ammo or fuel. In 24-hour operations, the FSB should be more flexible in topping off battalion elements, making continual resupply by MPP practicable.

Of course, the MPP has its potential drawbacks as well:

- Drivers may get less sleep.
- The support platoon leader and platoon sergeant may not be present to assist LOGPAC elements in the field trains prepare and execute. This drawback may be overcome by ensuring other CSS players are capable of supervising LOGPAC operations in the field trains. We used our HHC supply sergeant to conduct pre-combat checks and ensure the remaining LOGPAC elements were prepared to depart the field trains on time. Our support platoon leader normally was able to return to the field trains in time to lead the LOGPAC forward to the scheduled LRP. Depending on how your unit utilizes the HHC XO, he may be available to bring the LOGPAC forward when the support platoon leader cannot.
- The support platoon leader and platoon sergeant may also not be present to assist in advising the HHC commander on changing CSS demands projected by the S4. The impact of this may be lessened, however, by detailed asset tracking within the field trains CP. If the FTCP can identify on-hand supply quantities at the field trains, on the MPP, and positioned forward at the combat trains, and can quickly assess the support platoon's maintenance status, then the HHC commander can reasonably estimate his CSS capabilities and relay them to battalion.

We found MPP to be an exceptionally flexible and beneficial technique for executing battlefield resupply. For MPP to be successful, however, CSS leaders must be capable of independent action and careful anticipation of CSS demands during the fight.

CPT Scott Maxwell enlisted in the USAR as a 19D cavalry scout (M113) in 1988. He was commissioned in Armor in 1993 from USMA. He has served as a tank and scout platoon leader in 1-4 Cavalry and as LNO, S3/Air, and HHC XO in 2-34 Armor. He is currently stationed at Fort Knox for AOAC, CAS3, and CLC. His next assignment is at Fort Polk.

DRIVER'S SEAT *Continued from Page 9*

route for a tank battalion's tactical road-march into a tactical AA.

The dismounted lane will consist of a day and a night patrol. The night patrol moves to an NAI behind the CFV screen line. After completion of the night patrol, soldiers return to the TOC/troop AA and conduct security, tactical sleeping, and stand-to on a portion of the defensive perimeter securing the TOC.

If there are four platoons, the support lane will include tasks that support the security of the troop AA/TOC: TOC operations, NBC skills, and prepare defensive positions. Security tasks include stand-to, TOC security, and roving patrols of the AA. OPFOR will attempt to penetrate the TOC perimeter. At the end of the eight exercise days, a day is spent preparing for the end-of-course test (Cavalry Stakes), and the unit conducts a dismounted road march into the cantonment area. The next day is Cav Stakes, followed by the rite of passage ceremony.

As I said, this is our best cadre sustainment program. The NCOs sustain such tasks as: direct engagements from the BFV commander's position, control scout platoon fires, perform pre-combat checks, establish LP/OP, plan a zone recon, conduct a screening mission, conduct a PCI, plan/conduct dismounted patrol, perform a passage of lines, and reconnoiter an obstacle. They are more confident as they return to TOE units.

The Armor Center is responsible for allocating resources for more robust cadre sustainment training and for conducting such courses as the Tank Commander Certification Course, which "reblues" officers and NCOs as they depart the Center (We need a Scout Commanders Certification Course!). Each Armor Center unit must be innovative when using existing resources to set their sergeants up for success as they depart Fort Knox.

Each of our sergeants is responsible for taking the best advantage of the opportunities for self-development on Fort Knox. They will return to the force, and they must be competent and confident.

"SERGEANT, TAKE THE LEAD"

T-72...T-64...T-80??

Why Three Tanks?

Why the Soviets eventually produced three different tanks to what appeared to be the same requirements.

by CW2 (Ret.) Stephen "Cookie" Sewell

Since the first of the Soviet Third Generation tanks appeared racing across the steppes in fuzzy, windblown photographs in 1967, a great deal of effort has gone into trying to determine why the Soviets eventually produced three different tanks to what appeared to be the same requirements.[1]

Many military analysts searched long and hard to find reasons, especially when they looked at the forces opposing NATO in Europe during the late 1970s and early 1980s. In Germany, NORTHAG faced T-64-equipped units in the north of Germany (the 2nd Guards Tank, 20th Guards, and 3rd Shock Armies) and T-80 units in the south (1st Guards Tank and 8th Guards Armies). In Czechoslovakia, the units had T-72s, and in Hungary, T-64s. Fleets of each kind of tank awaited in the "second echelon front" armies in the western Soviet Union, and even more lurked behind the Urals. By 1991, they formed the backbone of a fleet which may have reached as many as 77,000 tanks.[2] But why ***three*** different tanks?

The Soviets did face a wide variety of tank threats from Europe and on their other borders. The U.S. fielded first M60s and then M1 Abrams tanks; the British, the Centurion and then the Chieftain; the Germans, the M48, Leopard 1 and 2; France, AMX-30; and the rest, a variety of U.S., British, and German tank designs. In the east, the Soviets only faced Chinese copies and variants of their own late second-generation tank designs (T-54, T-55, and T-62). But these tanks could be countered with a single superior main battle tank type, not three.

The answer, in a single word, was the power of the "*Oboronka.*" This term was the Russian slang for the Military Industrial Complex, which dominated nearly 50 percent of the Soviet economy for many, many years. With the incestuous relationship among Party leaders, factory heads, designers, and military commanders, this society within a society ran the country. It also made and broke people at will, especially when political influence was turned all the way up. Few men in the USSR survived being broken by the members of the *Oboronka*, and few ever made their way back into its exalted ranks once expunged.

But in the end, the *Oboronka* was men, and it was men who made the machinery which kept the *Oboronka* in power, and the *Oboronka* kept the Party in power. This was not just the comic opera "KGB knock-at-the-door" threat of power, but wealth, position, and an enormous military force in being, which gave the trappings of power to those who fed it and worked with it. The reason that there were three main battle tanks in simultaneous production was because some men played the *Oboronka* game better than most, and were rewarded for their loyalties and achievements. But in order to see how this worked, our story begins in the 1930s.

The Rise of the Design Bureaus

The Soviet tank industry itself dates back to 1920, when the Soviets made their first direct copies of the Renault FT light tank. Throughout the 1920s, theorists like Marshal Tukhachevskiy saw the need to create armored forces to provide the backbone to the Workers' and Peasants' Red Army (RKKA). But it was not until 1930, when the Soviets purchased the British Vickers Six Ton Tank, and the U.S. M1931 Christie wheel-and-track tank chassis in 1931, that their industry and their tank corps begin to grow.

During that period, the Soviets built tanks in one of two places. They either built them at the Kharkov Steam "Komintern" Locomotive Factory in Kharkov, Ukraine, or they built them at one of three factories in Leningrad. Each factory had a design bureau in charge of the tank design process, headed by a chief designer. The factory leadership was composed of the factory chief, the chief designers of various bureaus in these factories, the chief engineers, the head of the Party political committee at the factory, and the lead workers in charge of mechanical assembly. But of all of these, the most powerful people were the factory chief and the chief of the design bureau.

Mikhail Koshkin organized the project that became the famous T-34 of WWII as chief designer at the Kharkov tank plant.

The factory chief and design bureau chief were trusted men, and both had to be Party members. The factory chief was usually an engineer with some design experience, but his main function was to ensure that production took place and goals were met on time. The chief of the design bureau was the head of the product design team, and his function was to get the product ready for production, keep it current, and ensure that problems were solved as quickly as possible. While others figured prominently in the day to day affairs of the plants, nothing could take place without the approval of these two men.

By 1938, the Soviet Union had essentially two production centers. Both had experienced a major turnover in staff the previous year. The "*Komintern*" Kharkov Locomotive Works, or less dramatically, Factory No. 183, received a new director and a new chief of the design bureau to replace two individuals who had been purged and shot. The new factory director was Yu.Ye Maksarev, who was a busy man and key to making the tanks roll; but the real driver of Kharkov's production was Mikhail I. Koshkin, the chief designer.

In Leningrad, the three factories were truncated and reorganized during the

mid-1930s, and by 1937 had boiled down to one controlling design bureau which oversaw the activities of the three factories. Of the three factories — *K.Ye, Voroshilov* Factory No. 174; *Bol'shevik* Factory No. 100, or the Prototype Design for Special Machinery; and the Leningrad *Kirov* Factory No. 185 — the Kirov factory was the true power, and its new chief was Izaak M. Zal'tsman. The chief designer of all three plants was Zhosif Ya. Kotin.

The T-34 Model 1941, seen here at the Ordnance Museum, came as a total shock to German intelligence. Its balanced design combined a relatively large cannon, sloped armor, and a diesel engine on a maneuverable, rugged chassis well adapted to Russian terrain.

-Author photos

Koshkin: Clear Vision and Concepts

Mikhail Koshkin (1898-1940) was one of a rising group of star engineers. A Party member since 1919, he had performed well and impressed influential Party members on his way up. He studied at the Sverdlov Communist University and graduated from the Leningrad Polytechnic Institute in 1934. While there, he met and worked with Sergei M. Kirov, one of the major driving forces in the Leningrad Communist Party. At the Institute, he was also befriended by and came under the wing of a patron, Sergo Ordzhonikidze, one of the major early figures in the Communist Party. This ensured his getting a prime position at the best of the Leningrad factories. Thus, upon graduation he went to Factory No. 185 to work as a designer. In January 1937, he was assigned as acting chief designer of the tank bureau at the KhPZ, replacing A.O. Firsov, who had been denounced. But his joy at receiving the new position was diminished when Sergo died in February 1937, essentially leaving him without support in the higher levels of the Party.

At the KhPZ, Koshkin immediately impressed his contemporaries, and showed a firm grasp of engineering details and what was expected of him. However, the KhPZ was considered only a secondary tank plant, and the jewels in the *Oboronka* crown were all in Leningrad. Koshkin was told that his main mission was simply to make a better BT tank, as the series of fast tanks were the only major military product of the KhPZ. But there was one other ace in the deck; the KhPZ was also home to the diesel engine design bureau, and after six years of work and testing, it was ready to produce the BD-2 high speed diesel engine.

Koshkin saw the value of this at once, and even though the arrest of the engine's designer in December 1937 set things back, the project went forward for test in April 1938. Combined with other projects going on in the factory, such as the BT-IS tank with improved running gear and the BT-SV series tanks with sloped armor protection, Koshkin began to see the need for a better tank design. There was only one minor glitch: a graduate engineering student named Dik managed to solve the problems with the drive train in the BT-IS tank, which would have placed it in production in 1938. This was a warmed-over BT with the same complex and troublesome wheel-and-track driveline which discredited the tanks used in Spain, but that was popular with old line cavalry commanders of the day. After discrediting and overworking Dik, Koshkin began easing his way around the tight restrictions placed on him by the Party and the *Oboronka* leadership to move towards a new concept.

Koshkin had a simple, but unauthorized, plan in mind. Dump the troublesome wheel-and-track drive for a pure tracked drive, build a hull from sloped armor plates, stuff the BD-2 diesel engine in the new tank, and get the largest tank cannon possible to ensure sufficient firepower. Since he couldn't advance his design directly, Koshkin sidled up to it with several interim models: the A-20, which appeared to be an improved BT-SV-2, and the pure tracked A-32, both of which were passed on to the *Oboronka* overseers as simply "improved" BT tanks.

Kotin: Contacts, Contacts, Contacts

Zhosif Kotin (1908-79), on the other hand, was not the gifted designer and latent genius of Mikhail Koshkin. Kotin had simply attended the right schools with the right people at the right times. Kotin attended the Dzerzhinskiy Military Automotive Technology Institute in Leningrad, where he came under the eyes of Party luminaries such as Kirov, Voroshilov, Blyukher, and Tukhachevskiy, eventually even marrying Kliment Voroshilov's daughter. While it appears that Kotin was a competent, if not spectacular, engineer, his forte was political wrangling, and with the approval of the powerful, he advanced rapidly.

Zhosif Kotin, chief designer at the Leningrad Kirov Factory that produced the KV heavy tank. Kotin named the tank after his father-in-law, the powerful Klimenti Voroshilov.

On 7 May 1937, Ivanov, the chief of the SKB-2 design bureau at the Leningrad Kirov Factory, was denounced as a "Trotskyite" and taken out and shot. On 23 May, Zhosif Kotin took over the factory design bureau, and Isaak Zal'tsman took over as the factory director. For most of their working lives, Zal'tsman

Kotin's KV-1 heavy tank was pressed into production on the basis of very limited employment during the 1939 war with Finland. Unreliable, too heavy, and with no better cannon than the T-34, the KV-1 was an obsolete design.

and Kotin appear to have gotten on well, and worked well as a team. At this point in time, the Kirov works were in turmoil, and the task before them was to design a heavy tank to replace the huge but uninspired T-35 heavy tank, as well as the T-26 infantry escort tank.

Kotin, as the chief designer of three tank factories, placed SKB-1 (the design team at the Voroshilov factory) in competition with SKB-2 at the Kirov works. Both teams produced similar designs; SKB-1 came up with a three-turreted tank called the T-100, and SKB-2 produced a very similar design they named after the factory — SMK, for Sergei M. Kirov, who had been assassinated in 1934.

The designs were only slightly less clumsy than the T-35. When shown two models of the T-100 and SMK, Stalin joked that they were "department store tanks, with a gun for every occasion." Kotin claimed later he really wanted a single-turreted tank – but most observers claim that it was really Stalin who was responsible for ordering the change. Stalin is reputed by most others to have told Kotin the designers should concentrate on a single-turreted design, and he broke a turret off of one of the two models to show which direction to take.

The Competition for the Single Main Tank of the USSR

In August 1938, Koshkin showed his new designs to Moscow. Koshkin dutifully brought along the modified BT tank concepts, as well as the factory's own A-20 and A-32 design concepts. Koshkin stood up in front of the major "players" in the *Oboronka* and denigrated the wheel-and-track concept used with the BT, which was beloved of many on the General Staff. He recommended a new concept — a lighter, faster, better armed and better armored full tracked vehicle. Many of the "old guard" were aghast, and since Voroshilov was one of the committee voting, the sleek new A-32 was nearly rejected out of hand as he "felt" the Leningrad team would produce a better tank. Stalin, however, interceded and asked Koshkin to develop both the A-20 and the A-32; however, Stalin himself did not seem to find great favor with the pure tracked tank, and resorted to his legendary tactic of hammering Koshkin at every opportunity on why he was so convinced of its superiority.

One fortuitous event happened on 5 February 1939 while the rivals were building their designs. Vlyacheslav A. Malyshev (1902-1957) was named as the Peoples' Commissar for Medium Machinery Production, which included all tanks. Malyshev was perceptive and intelligent, and a very tactful individual in a society which prized stealth and craftiness. Of all the *apparatchiki* who could have held this position, Stalin had picked one who actually was perfect for the job.

Things came to a head in September 1939. At a meeting in Moscow, the Kirov works showed their three new tank prototypes — the T-100, the SMK, and the single turreted tank model which Stalin appears to have suggested. The third tank was Kotin's push to gain the orders for the only tank he felt was needed — the one which responded to Stalin's advice, and in order to ensure its selection, he named it after his father in law, Kliment Voroshilov, as the KV tank. This tank was clearly superior to the two obsolete designs, and it showed the most promise of the three.

But in all of the official hoopla over the KV tank, the three tanks from Kharkov — the BT-7M, the A-20, and the A-32, now called T-32 — came as a major shock to the Leningraders. All three had one thing the Leningrad tanks did not — the BD-2 engine, now known by its service designator as the V-2. The T-32 stunned all present as it was clearly on another plane of achievement when compared with the clumsy efforts from Leningrad. Koshkin's T-32 was very impressive. Even Voroshilov himself could not deny its potential, but in a very wily move, gave Koshkin permission to develop the T-32 tank into the T-34.

The Finnish War and the War for Existence

In November 1939, problems with Finland came to a head, and the USSR declared war on its hapless neighbor. But hapless does not mean powerless, and the Finns soon began to show the Soviets that it was going to be a very expensive campaign in both men and materiel. When the conventional tanks of the time, the T-26 light infantry escort tank and the BT fast tanks, were easily knocked out by the Finns and found to be incapable of destroying Finnish positions on the Mannerheim line, the Leningrad Kirov Factory volunteered to send in their three new tanks (T-100, SMK, and KV).

While the first two did poorly — the SMK hit a mine and was knocked out, eventually being abandoned until the Soviets could recover it the following spring — the KV was committed to combat on 17 December 1939. While it apparently did perform reasonably well, the reports from the factory-oriented representatives indicated it could single-handedly win the war. Two days later, the KV was accepted for service, based on this one incident and without extensive testing first.[3]

The T-34 was also nominally accepted for production on 19 December 1939, but Voroshilov had pulled a fast one on the KhPZ. He had approved the *T-32* for production, but since the *T-34* was a "new machine," it had to go back and start all over in the acceptance cycle. Their first obstacle was having to build 11 tanks for factory and service testing before full permission was granted for production. In the meantime, Kotin's de-

sign bureau at Factory No. 174 had produced a new infantry escort tank, the T-126SP, which was accepted for production as the T-50. Kotin, via Voroshilov, now argued that the T-50 and the KV would handle all tank chores and the T-34 was now unnecessary.

The matter came to a head in March 1940. While they were to have 11 tanks finished by 1 April 1940, in the meantime Koshkin's work was interfered with as much as possible. He was finally ordered to show why the T-34 should go into production, and a comparative test was scheduled for Moscow in March 1940.

In one of the truly heroic demonstrations of confidence of all time, Koshkin and a select crew from the Kharkov factory drove from Kharkov to Moscow in twelve days. The two T-34 tanks suffered no major breakdowns, this was in the dead of a very nasty winter, and Mikhail Koshkin arrived in Moscow with the beginnings of pneumonia. The tanks went to Tsarevoi Kokol Square, where representatives from the Defense Council and Stalin awaited them. Also present was one of the KV tank prototypes.

The competition between the two tanks was never in doubt. The nimble T-34 far exceeded any tank in the collective memory of the people there, and impressed Stalin the most. The KV was shown to be clumsy and old-fashioned, and the Kirov factory people were stunned. There would be no denying the T-34 from production. While Voroshilov politely examined the tank from the outside, Malyshev checked both the outside and inside, and was delighted with the new tank. Koshkin was wracked with coughing as he explained the features to Stalin, and Stalin was a bit annoyed with the distraction. Koshkin and his crews then drove back to Kharkov, again with few problems. On 31 March, a resolution was passed ordering the T-34 into full series production.

The Voroshilov faction still dogged the T-34. After the Soviet-Finnish war was over, the prototypes were sent to the Karelian Isthmus to see how they could handle Finnish antitank obstacles; they passed with ease. But like famed British aircraft designer Reginald Mitchell, Koshkin would not live to see his creation prove its true worth. Mikhail Koshkin died on 26 September 1940 from complications brought on by the case of pneumonia he contracted during the ride through the snow. He would later receive a posthumous award of the State Prize for the T-34 design. In his place, Aleksandr A. Morozov, head of the design bureau transmission team and Koshkin's assistant, was named as the new chief designer at Kharkov.

Like many other men, Morozov was a good engineer, but one sadly possessed of a great deal of jealousy towards Koshkin and the T-34 project. Morozov had been involved in many earlier projects, most of which were swept away by Koshkin when he decided to go for the T-34 tank design.

But at the moment, Morozov had other problems. In September 1940, the chief of the Main Armored Vehicle Directorate — GBTU — was replaced with another former BT tanker and critic of the T-34, D.G. Pavlov. Pavlov was pro-T-50 and anti-T-34, and was among those who "requested" the Kharkov design bureau begin work on an "improved" T-34 which looked more like the T-50 than anything else. Problems with early T-34s did not help their cause, and the demand grew for the new tank, the T-34M. While factory director Maksarev and the head of the Kharkov Communist Party showed what had been done to improve the new tank, a new directive dated 5 May 1941 concentrated its efforts on forcing them to focus on the T-34M. The beginning of Operation Barbarossa by the Germans on 22 June 1941 stopped the plans cold.

The Great Patriotic War and Its Aftermath

When the Germans struck on 22 June 1941, both the LKZ and KhPZ were building their new tank designs as the KV-1 Model 1941 and T-34 Model 1941 respectively. While together less than 2,000 had been completed, early results from the front indicated that they were both a shock to the Germans and more than a match for any German tank. However, Leningrad was one of the German immediate objectives, and as a result on 24 June Stalin met with Zal'tsman and Malyshev to discuss moving the Leningrad plant and its workers to Chelyabinsk in the Urals. This movement began on 23 July 1941. Some 15,000 workers and family members would eventually be moved to that city. As the German drive progressed, Kharkov was warned to prepare to move as well on 15 September 1941. While Morozov and his workers began to move to the Urals on 19 October 1941, settling in Nizhniy Tagil, the Leningraders completed their move on 10 December.

The Leningrad Kirov Factory was co-located with the Chelyabinsk Tractor Factory, which was now ordered to cease production of tractors, switch to tanks, and complete production line expansion. On 6 October 1941, the factory had been renamed the Chelyabinsk Kirov Factory to show its new function. The Kharkov plant did the same, collocating with the Ural Railway Carriage Factory or "*Vagonka*," which was located in Nizhniy Tagil. While the Chelyabinsk plant would call itself "Tankograd" — literally "Tank City" — the *Vagonka* would go on to become the largest tank factory in the world.

Kotin was still trying to eliminate the pesky T-34 from production, but it did not take long before the grandiose overestimation of the KV-1 began to catch up with it. While numerous reports of KV-1s dying bravely as insurmountable pillboxes were received, the real problem was the poor overall design of the tank, its low mechanical reliability, and its use of obsolete concepts. A KV-1 Model 1941 sent to the US in 1942 for evaluation was found to be using a 20-year-old American Holt (Caterpillar) transmission design. This transmission was the main stumbling block of the KV-1, and there was some truth to rumors of Soviet drivers having to shift gears with a hand sledge.

Interviews with commanders in the field were even more damning. Kotin was now a major general of technical services (based on his position, not achievement) and when a fact-finding tour visited the front, only senior commanders and certified heroes (who were too valuable as propaganda material) were totally honest on what a dog the KV-1 really was. It was too heavy, too unreliable, and carried no better firepower than the T-34. The reports on the T-34 were ecstatic, and Kotin's ears burned to hear them heap praise on the hated rival tank. However, Malyshev was there too, and he was the one who would orchestrate production of the T-34.

While the KV was only produced — slowly — at Chelyabinsk, the T-34 was in production at Kharkov (later Nizhniy Tagil) and Stalingrad, and then plants were quickly added in Gor'kiy ("Krasnoye Sormovo"), and later in Omsk. What must have really stung Kotin was that even Chelyabinsk switched part of its production to the T-34 design in 1942-43. Eventually 61,000 T-34s would be built; KV production of all models was around 4,500.

In early 1942, the Chelyabinsk and Vagonka plants were given permission to develop new designs which would bring in a new generation of tanks. The new designs, called KV-13 and T-43 respectively, were quite different. The KV-13 was Kotin's fourth attempt to kill the T-34 (the push for the KV over the T-32, the T-50, the T-34M project, and lastly, the KV-13) as the major Soviet tank. It was an effort to produce a heavy tank using the parameters of a medium; it was a compact KV which would be able to best the T-34 and replace it as a "universal" tank. The T-43 was a departure from the past, with a new layout and concept. Dropping the Christie suspension, Morozov's team used torsion bar suspension and a transverse engine mount with a new transmission and final drive arrangement. Both tanks were tested by a state commission, and both were rejected. The KV-13 was found to offer no material advantage over the T-34, and the T-43 was also declined for the same reason. Kotin was crushed, and would often go to the factory warehouse and gaze longingly at the sole preserved KV-13 prototype.

The T-34-85, with its 85mm cannon, went into production in 1944. The strength of the T-34 design allowed a weight increase of 23 percent without reduced effectiveness.

Both factories continued to modify their products, albeit with diminishing returns from the KV-1. Finally, a new team, led by Nikolai Shashmurin, a truly talented designer working for Kotin, began to work on the problem. First, Shashmurin redesigned much of the KV-1 and produced the lighter and more functional KV-1s variant. He then designed a heavy tank with the most powerful gun installed in a production tank during the entire war — the IS. First offered with an 85mm weapon in 1943, when the T-34 upgraded to the 85mm gun as the T-34-85, the IS changed to the 122mm D-25T tank gun. While Kotin's team finally had produced a competent heavy tank, he took little joy in it, as it was only an afterthought compared to the sleek T-34. Early models of the IS-2 used the extra cast bow sections from the KV-13 which Kotin had ordered up in anticipation of production, so it is probable that the IS-2 only reminded him of what he could not do.

Morozov did not waste time either, and while the excellent T-34-85 went into large-scale production in February 1944, he began to work on a new tank based on the T-34. This tank was a refined version of its predecessor, using a modified design from the T-34-85 turret and a new flat hull less than a meter thick. This tank, the T-44, emerged from development in late 1944, but was not reliable enough to enter production until the war was over. A more refined version, the T-54, began planning at the same time and was scheduled to begin prototype testing on 1 January 1945.

At the same time, the Chelyabinsk plant began planning two new heavy tanks, the IS-3 and IS-7. While preliminary planning began, with the lifting of the siege of Leningrad and the recapture of Kharkov, both the original factories began to move back to their previous locations. Kotin immediately returned to Leningrad, but Zal'tsman stayed in Chelyabinsk, with Nikolai Dukhov remaining as the new chief designer at the Chelyabinsk plant. His deputy was M.F. Balzhi.

The IS-3M, with a 122mm cannon, saw some use late in WWII. The appearance of 52 of them in the Berlin victory parade in 1945 greatly impressed the Western Allies.

Four Plants and Four Wills

Thus, when the war ended in 1945, there were four main tank plants in the USSR: Leningrad Kirov works, Chelyabinsk, Nizhniy Tagil, and Kharkov. A fifth plant in Omsk was returned to the Leningrad group as an affiliate plant. This was staffed by personnel from Leningrad who had not been moved to Chelyabinsk, but this plant became controlled by Kotin's bureau and had no basic offerings of its own until the late 1990s.

The first fireworks came between Leningrad and Chelyabinsk before the war was even over, and the fight was over the IS-3 tank design. Tank designs were given factory designators early in the war, based on their working drawing sets, and referred to by the Soviets as "Objects" and a three digit number. The T-34 was "Object 135," the T-44 "Object 136," and the IS-2 was "Object 240." Each factory had a different index number system. Nizhniy Tagil got 1XX numbers, Leningrad Kirov 2XX, Kharkov 4XX, and Chelyabinsk 7XX. Both Leningrad and Chelyabinsk produced designs for the IS-3. The Leningrad design, Object 244, called the IS-3, was a very flat design with a "chopped" IS-2 turret and three steeply angled plates in the bow. It had a notched lower hull to allow more weight to be placed up high as thicker armor protection. The Chelyabinsk tank, Object 703 or the *Pobeda* (Victory) tank, was a very smooth redesign of the IS-2; it used the lower chassis pan of the proven IS design but with a smoothly flowing cast upper hull and a "frying pan" turret with no shot traps whatsoever.

Fights broke out between the design teams, and finally Malyshev "pulled rank" and sorted the problem out. The new tank would use the Chelyabinsk turret and the Leningrad hull; it would be called the IS-3, but the factory index would be Object 703. The IS-3 went into limited production in 1945, with 52 of the new tanks presented at the Berlin Allied Victory Parade in September 1945 and stunning Western observers.

But a tank designed by a committee is just that, and the IS-3 was a dog. The crews hated it for being too cramped, and while the Chelyabinsk turret was ballistically excellent, if a tight squeeze, the Leningrad hull design was flimsy and prone to breaking welds and engine mounts. At one point, tanks were taken straight off the production line in Chelyabinsk and

shipped to Leningrad for a complete depot rebuilding. It took at least three known rebuilding programs until the IS-3 was deemed satisfactory in 1959, but by that time it was obsolete.

Kotin did what he could to cripple the Chelyabinsk design team, moving key personnel and preventing them from acquiring others with good experience in tank design. Still, Chelyabinsk designed and produced the 60 metric ton IS-4 tank on its own in 1948-49, while the IS-5, IS-6, and IS-7 tank designs from Leningrad went nowhere. Admittedly the IS-4 only had a run of around 250 tanks, but it was better than the handful of prototypes coming out of Leningrad, and it did go into production.

The breaking point came in the late 1940s. The State published a requirement for a new heavy tank, and both Leningrad and Chelyabinsk moved to answer the requirement. The only limit was that the new tank could not weigh more than 50 metric tons. Leningrad proposed its model, apparently called Object 262 or IS-8, which was little more than a warmed-over IS-3 design. Chelyabinsk proposed Object 730, which was based on a Chelyabinsk design similar to their original Object 703 proposal. Zal'tsman was not impressed with either concept, as the State order was apparently for the next step beyond the IS-3, and this was little better. Kotin wanted the Leningrad design put forward, and Zal'tsman appeared to be dragging his feet.

Like the unfortunate Ivanov in 1937, suddenly the Party reared its head. In the midst of all this, Zal'tsman was conveniently denounced in 1950 for bribery and the "cult of personality." This was manifested by sending expensive gifts to minor party officials — Zal'tsman's friends — and not sending a present to Stalin on his 70th birthday in December 1949 which was deemed worthy of his stature. Zal'tsman was hauled to Moscow to defend himself — which he did with some success — but he wound up stripped of his position and sent to take over a tiny factory in the hinterlands producing track links for tanks. Kotin's design was later accepted for production as the IS-10, but by that time, it was late 1953 and Stalin was dead. The new tank was built as the more politically astute T-10.

Morozov and the rest of the old Kharkov team split up soon after the end of the war, when many of them returned to Kharkov to set up shop as Factory No. 75. The remainder stayed in Nizhniy Tagil, with Morozov himself staying until the late 1940s before returning home.

In December 1949, another talented designer arrived at the *Vagonka*. Leontiy Kartsev was soon promoted, and when the Kharkov design team completed its return to that city in 1953, Kartsev was named the Chief Designer of the UVZ tank design bureau. Kartsev, a pragmatic, thoughtful, and blunt man, was a good choice for running the team. However, Kartsev was often running into problems with the Party, and it was only due to his skill and talent that he managed to avoid joining many talented Soviet designers over the years in either the GULAG or at the wall.

The T-54 was Aleksandr Morozov's last product at the Nizhniy Tagil tank plant. Its revolutionary features included a tranverse engine mounting, a powerful 100mm gun, torsion bar suspension, and hemispherical turret. Morozov, at right, carried on a life-long rivalry with Koshkin, the T-34's designer.

1953-1958: The Doldrums

Between Stalin's death in 1953 and the ascension of Nikita S. Khrushchev in 1958, very little real activity occurred in what were now four separate tank design bureaus. Most work in that time frame appears to have been of the "full employment" variety, to keep plants busy while contemplating their next steps. However, while Chelyabinsk remained feisty as long as they produced tanks, Chelyabinsk chief designer Dukhov knew better than to cross Zhosif Kotin, so in essence there were really only three bureaus.

The major changes in Soviet tanks in those years had been not new designs, but technological upgrades and improvements. They introduced their first single-axis stabilizers in 1956 and then two-axis stabilizers in 1957. At the same time, night fighting began to rise in priority, and new sights with IR capabilities and IR searchlights were fitted to the tanks.

Morozov's last product in Nizhniy Tagil was the T-54, which was a clean break from the past. Entering major series production in 1951, this tank used a transverse engine (worked on since the days of the T-34M), torsion bar suspension, and a powerful 100mm gun in a low-slung hull with a hemispherical turret, far superior to the rehashed IS-3 which was the T-10. But he was still haunted by the fact that Koshkin, not Morozov, was the architect of victory with the T-34, and wanted to make a tank so unique no one would question its superiority. He turned over his chores at the *Vagonka* to Kartsev.

Like all other designers before him, Kartsev was not pleased with another's designs, and he did not like the T-54. One of the first projects he did was Object 140. This, called T-54M around the factory, used a new six road wheel arrangement with torsion bar suspension and three return rollers, all running on a new rubber bushed single-pin "live" track, which was a major departure from the past Soviet tank designs. However, while the tank was promising, it offered nothing but higher cost over the incumbent T-54 designs then in production at Nizhniy Tagil.

Kartsev then looked at all the incremental changes which were offered for the T-54 series tanks, and decided rather than piecemeal them into the tanks — the T-54, T-54A and T-54B were all current models, and he could see a T-54V, T-54G, T-54D and others coming, which caused unnecessary headaches in the maintenance and rear services units.

The innovative T-64 was powered by a 5-cylinder flat, opposed-piston engine, used an autoloader in lieu of a fourth crewman, and mounted a 125mm gun that was the largest tank cannon in common use at the time. Reliability suffered with all these innovations.

Kartsev called his designers together, asked them to merge all the good ideas and changes in one tank, and produce what was essentially a new tank which combined all incremental advances. The result, Object 155, was a refined tank and much better than its parent. On 1 January 1958, it entered full production under the service designator T-55. Its one glaring oversight — corrected twelve years later — was that it did not retain the antiaircraft machine gun for the loader which was found on the T-54.

The LKZ spent most of those years arguing among itself and with Chelyabinsk over the less than impressive T-10 family. While a T-10A with single axis stabilizer went into production in 1956 and the T-10B with two-axis stabilizer and IR equipment in 1957, the next model, the T-10M, found itself in the unhappy position of being produced under two designators in two places at the same time, and with incompatible parts. The Kirov works produced the tank as Object 272, and the Chelyabinsk plant produced it as Object 734. The Kirov design was not finally accepted as "the" T-10M until 1962.

The T-64

In 1955, Aleksandr Morozov was still eaten at by the fact that he had not been the sole creator of the T-34. He had managed to use his influence to get the names of Koshkin and Kucherenko (the other name officially credited with creating the T-34) removed from all of the histories and documents relating to the tank outside of the classified state archives, but still knew it was not his tank. While good, the T-54 was not a world beater like the T-34, and the fact that Kartsev had turned it into the more successful T-55 design was also not a boost to his ego. Therefore, Morozov gathered his designers around him, and told them he intended to produce a radical new tank which would be superior to anything on the battlefield.

The choice of gun was initially a hypervelocity 100mm gun; later, in the early 1960s, they changed to the new 115mm gun which was undergoing testing. Nizhniy Tagil later used these weapons in their prototypes Object 165 (100mm) and Object 166 (115mm) respectively. The latter was an incremental development of the T-55 which eventually entered production in 1962 as the T-62 tank. But what Morozov wanted was a more thorough departure than the *Vagonka* designs, which were only based on modified T-55 chassis.

The new tank was a very compact machine, with only a three-man crew and a full-up weight of 36 metric tons. The reason for the three-man crew was the use of an autoloader for the main gun. The hull was very small and very flat — the glacis was sloped at a 68 degree angle on top and 52 degrees below — and the tank used a new design of engine. The engine, a five-cylinder flat engine using an opposed piston design (effectively a flat 10), was called the 5TD and was similar in many ways to a Fairbanks Morse diesel used in railroad engines provided under Lend Lease. It was light and powerful. The tank used lightweight, internally bushed steel wheels with a lightweight steel alloy double-pin "live" track.

The first test model, called Object 430, appeared about 1960. It mounted the 100mm hypervelocity gun. However, due to some problems, and the fact that the British introduced the famous 105mm L7 gun in that time frame, the design was sent back to be redesigned around the 115mm D-68 gun.

The D-68 was similar to the U-5TS in Object 166, now adopted for service in a panic as the T-62, but used combustible case separate loading ammunition which fit in its autoloader. This tank was given a short test period, and Khrushchev ordered it accepted for service as the T-64 in 1962. However, like the T-34 before it, while Morozov essentially had a world-beating tank, it had a plethora of problems. First off was an adamant opposition by senior officers, including the Chief of Tank Troops, Marshal Poluboyarov.

Low volume series production began in 1963. The T-64 suffered from too many innovations adopted too fast. The 5TD engine was notoriously unreliable, and nearly impossible to start in cold weather. The tank was very cramped inside, and the crews did not like the absence of a fourth crew member when maintaining the tank. Lastly, the D-68 gun was highly unreliable, with the exposed autoloader gaining a bad reputation for grabbing the uniforms of the hapless gunner and commander and stuffing them into the breech. Only a limited number of these tanks were built, and they appear to have been sent to the Far East for long term testing. In December 1967, Morozov retired, and was replaced by N.A. Sholin. Kartsev had been offered the job — no hard feelings — but refused; he liked running things in Nizhniy Tagil, and also had a sickly daughter he did not wish to move.

A vastly improved model, Object 434, appeared in 1969. This used an improved 5TDF engine that was somewhat better than the 5TD, but most crews yearned for the simpler V-2 based engines. The biggest change in the tank was the replacement of the D-68 gun with the 125mm D-81 gun firing separate loading combustible case ammunition. At the time of its introduction, this was the most powerful tank gun in the world, and would remain so for twelve years. The changes were minor and the T-64A tanks weighed between 37 and 38 metric tons, depending upon production lot. It also introduced a laser rangefinder, the TPD-2-49.

These tanks almost did not get into production at all. After the Cuban Missile Crisis of 1962, Khrushchev was determined to change the face of world power and American nuclear domination once and for all. He ordered the *Oboronka* to concentrate on missiles and missile-firing weapons, and was of a mind to eliminate all tanks from the production inventory. The three major tank design bureaus had been given a warning about this in the late 1950s when he requested they examine missile-firing tanks. In 1960, Khrushchev was shown their first efforts:

Kartsev's Object 150, a missile-firing design which used what would become the T-62 chassis and a flat turret, and which eventually was accepted as the IT-1 tank destroyer; and Kotin's last new heavy tank design, Object 277, which caused Khrushchev to terminate all heavy tank design work.

This continued to bubble for two years, and at the height of the Cuban problem (22 October 1962) Khrushchev got to see another example of work by the three bureaus. Here Morozov showed Object 430, which he was told to convert into a missile-firing tank. Kartsev showed Object 167, which carried three 9M14 *Malyutka* (AT-3 SAGGER) missiles on a rack at the back of its turret; and Kotin showed Object 282, which was a T-10 with a pop-up missile launcher. Khrushchev roundly criticized all three, but only Kartsev stood up to him and argued back that the army still needed tanks. Morozov went back and worked on two antitank missile-armed versions of Object 430, Kartsev did some more on Object 150, but Kotin was told in no uncertain terms that the production of any more heavy tanks would not be tolerated. That the T-10 remained in production until 1966 is a mark of Kotin's ability to circumvent even the Premier as well as his lack of acumen when it came to future vision.

All was essentially reversed when Khrushchev fell from power in 1964, but the grounds had been laid for developing tanks which could also fire missiles through their main guns.

The T-72

In 1967, the U.S. Army was actively engaged in Vietnam, the Middle East was smarting from the results of the Six-Day War, India and Pakistan were only two years past their last major clash of arms, and the Soviet Red Army had only a handful of new tanks to face what they deemed Third Generation NATO tanks — the Leopard 1, AMX-30, M60A1, and Chieftain. As a result, GABTU sent a team with a T-64A prototype to Nizhniy Tagil and presented Kartsev with the task of finding a way to build a cheaper, simpler, and more reliable T-64.

Kartsev accepted the task, but did not like any of the major innovations of the T-64 design. While Morozov had been developing the T-64, Nizhniy Tagil had been working on a successor tank to the T-62. This tank, called Object 167, used the Object 140 running gear on a T-62 chassis and in its developed version, a V-26 engine, which was a 700 HP version of the reliable V-2 design. Later, it added a launcher for three 9M14 missiles to increase its direct engagement range from 1,700 meters to over 3,000. A final variant used two 350 SHP helicopter turbines linked together to test the feasibility of turbine power in a tank. None of the designs were accepted for production.

Another design saw an upgrade to the T-62. This tank used the 125mm D-81 gun with a totally new model of autoloader. Whereas the Kharkov design used a fork which selected the correct munition by index, placed both projectile and charge in a line, and then loaded them, the *Vagonka* design was more elegant, simple, and safer. Kartsev's team used a cassette and a chain hoist and rammer, in which the charge was located in the top slot of the two-section cassette and the projectile in the bottom. The hoist pulled up the selected cassette, loaded the projectile, dropped, loaded the charge, and then dropped the cassette back into the floor carousel. The only drawback was that, unlike the T-64's recovery of the "puck" from the expended round, the UVZ design had a port and ejected the "puck" out of the back of the turret. This compromised its NBC protection, but was simple and reliable.

Kartsev decided to simply borrow the best ideas from the T-64A and the best ideas which had not gone into production from Object 167 and the T-62/D-81 project. The result, which was still called a modified T-64A, had the Object 140/Object 167 suspension on a hull which used the sharply angled glacis and driver's position from the T-64A and little else. The complete T-62/D-81 turret and autoloader were used. The new tank also used a V-45 engine, another V-2 offshoot, producing 780 HP. This tank was readied on 10 January 1968, and received the interim index number Object 172.

When GABTU found out what Kartsev had done, they were furious and severely reprimanded him five days later for not following instructions. Still, this design showed promise, as it used proven technology and did seem that it would be cheaper and easier to produce and operate than the T-64. Kartsev was given permission to proceed with his design. However, in the meantime, I.V. Okunyev, the factory director of the *Vagonka*, retired and was replaced by one of Kotin's cronies, I.F. Krutyakov. Krutyakov immediately tried to quash the design, calling it a "strategic mistake," as he wanted to make the UVZ subservient to Leningrad and Kotin. Kartsev, who by now had a lot of political clout and was well respected by the Party hierarchy, blistered his ears with a stinging rebuke and forced Krutyakov into insignificance.

However, Kartsev's daughter was getting worse, and he retired in August 1969. V.I. Venediktov, his assistant and lead designer of Object 172, took over as chief designer. After a total of five years of tests, nearly all of which Object 172 passed with flying colors, it was accepted for service as the T-72.

The T-80

By 1974, GABTU was stuck with a problem. They had the T-64A in production, but it was still a handful and somewhat unreliable. The T-72 was going strong, and export models, dubbed T-72M, were being readied for sale and production abroad. But new Fourth Generation U.S. and German tank designs, the XM-1 and Leopard 2, were now undergoing preliminary testing, and the Soviet Union did not have a corresponding tank design. The T-64 was seen as too idiosyncratic, and the T-72 too conventional and old-fashioned. Thus, they turned to the Leningrad Kirov Factory and asked them to produce an advanced version of the T-72.

The design bureau in Leningrad had also seen Kotin retire from the design bureau and the reins handed over to Nikolai S. Popov in 1968. Kotin still held a great deal of influence, and could pull strings when he needed to "adjust" things. Popov had some experience with turbine engines, and he felt that a turbine, as was being tested in the Chrysler version of the XM-1, was the way of the future.

Turbines had been tested nearly twelve years earlier by the LKZ. The *Vagonka* had built a turbine-powered version of Object 167, called Object 167T, and reported the results of their test to Khrushchev in April 1964. The assessment had been that, even using relatively economical helicopter turbine engines, the problems with cold weather starting and fuel expenditure were not worth the reduced weight and increased power the turbine offered.

Still, Popov and his team felt they could do better than both Kharkov and Nizhniy Tagil, and like Kartsev and Object 172, after testing a turbine in a T-72 chassis under the index number Object 219, they designed another tank chassis, using the best elements of the T-72 (hull layout and suspension system) and replacing all the rest. The new tank, called Object 219RD, used a modified turret design based on the T-64A and its autoloader. This tank was used to develop

Tank Production: Factory Utilization 1939 – 1993

Year	Factory No. 75*	Factory No. 183**	Factory No. 174***	Factory No.185****
1939	V-2 engines	T-34 Model 1940	T-26	KV-1 Model 1940
1940	V-2 engines	T-34 Model 1940	T-50	KV-1 Model 1940
1941	V-2 engines	T-34 Model 1941	T-50	KV-1 Model 1941
1942		T-34 Model 1942		KV-1 Model 1942
1943		T-34 Model 1943		KV-1 Model 1943, KV-1s, T-34 Model 1943
1944		T-34 Model 1943, T-34-85 Model 1945		IS-2
1945		T-34-85 Model 1945	ISU-152	IS-2m, IS-3
1946		T-34-85 Model 1945, T-44	ISU-152	IS-3
1947		T-44, T-54 Model 1947	IS-3	IS-3, IS-4
1948		T-54 Model 1947	IS-3	IS-3
1949		T-54 Model 1949		
1950		T-54 Model 1949		
1951		T-54 Model 1951		
1952		T-54 Model 1951		
1953		T-54 Model 1951	T-10	T-10
1954		T-54 Model 1951	T-10	T-10
1955	Object 430	T-54A	T-10	T-10
1956	Object 430	T-54A	T-10A	T-10A
1957	Object 430	T-54B	T-10B	T-10B
1958	Object 430	T-54B,T-55	T-10M	T-10M
1959	Object 430	T-54B, T-55	T-10M	T-10M
1960	Object 432	T-55	T-10M	T-10M
1961	Object 432	T-55	T-10M	T-10M
1962	Object 432	T-55, T-62	T-10M	T-10M
1963	T-64	T-55A, T-62	T-10M	
1964	T-64	T-55A, T-62	T-10M	
1965	T-64	T-55A, T-62	T-10M	
1966	T-64	T-55A, T-62	T-10M	
1967	T-64	T-55A, T-62		
1968	T-64	T-55A, T-62		
1969	T-64A	T-55A, T-62, Object 172		
1970	T-64A	T-55A, T-62, Object 172		
1971	T-64A	T-55A, T-62, Object 172		
1972	T-64A	T-55A, T-72		
1973	T-64A	T-55A, T-72	Object 219***	Object 219****
1974	T-64A	T-55A, T-72	Object 219	Object 219
1975	T-64A	T-55A, T-72	Object 219	Object 219
1976	T-64B	T-55A, T-72	T-80	T-80
1977	T-64B	T-55A, T-72	T-80	T-80
1978	T-64B	T-55A, T-72	T-80B	T-80B
1979	T-64B	T-55A, T-72A	T-80B	T-80B
1980	T-64B	T-72A	T-80B	T-80B
1981	T-64B	T-72A	T-80B	T-80B
1982	T-64B	T-72A	T-80B	T-80B
1983	T-64BV	T-72A	T-80BV	T-80BV
1984	T-64BV	T-72A	T-80BV	T-80BV
1985	T-64BV	T-72A	T-80U	T-80U
1986		T-72B	T-80U	T-80U
1987	T-80UD	T-72B	T-80U	T-80U
1988	T-80UD	T-72BM	T-80U	T-80U
1989	T-80UD	T-72BM	T-80U	T-80U
1990		T-72BM	T-80U	T-80U
1991		T-90	T-80U	T-80U
1992		T-90	T-80U	T-80U
1993	T-84	T-90	T-80UM	T-80UM

The tanks listed are the main production items at those factories in those years. In the years which are blank, the factories did upgrades and depot level rebuilding of earlier production items.

Notes on the factories

* This plant produced engines until it moved out of Kharkov; on its return, was reformed and given a tank production mission; renamed the "Malyshev" plant on his death in 1957
** This factory was moved to Nizhniy Tagil in 1941 and kept the same designator when it stayed after the war
*** This factory was in Chkalov and used as the core of the reformed Leningrad tank industry in 1945; lost its production tasks in the late 1980s and all current production is performed in Omsk
**** Originally in Leningrad, moved to Chelyabinsk in 1941 and moved to Omsk after 1962

Object 219-2, which was accepted for service in 1976 as the T-80.

But the T-80 had problems, and a T-80B model appeared two years later. Early models had an extremely unreliable and thirsty GTD-1000 turbine engine, which to the dismay of troop commanders, showed itself incapable of moving the tank more than 285 kilometers on highways, even with auxiliary fuel tanks. Any other Soviet tank of the day, like its two competitors, could go from 500 to 700 kilometers on a single fueling. As a result, the very early T-80B tanks came with mounts for three 200 liter auxiliary fuel tanks (two over the rear track flaps and one on the top center of the engine deck).

The Brezhnev Doctrine and Further Developments

After 1979, things began to go downhill for the USSR. Leonid Brezhnev, in a classic example of what the Soviets constantly derided as "adventurism," began direct, overt intervention into Afghanistan, heightening tensions with the West. NATO deployed more tanks to Europe, and new ones to boot — the M1, followed by the M1 IP and M1A1; the Leopard 1A4 and Leopard 2 series; and the late model Chieftain with Stillbrew package and Challenger.

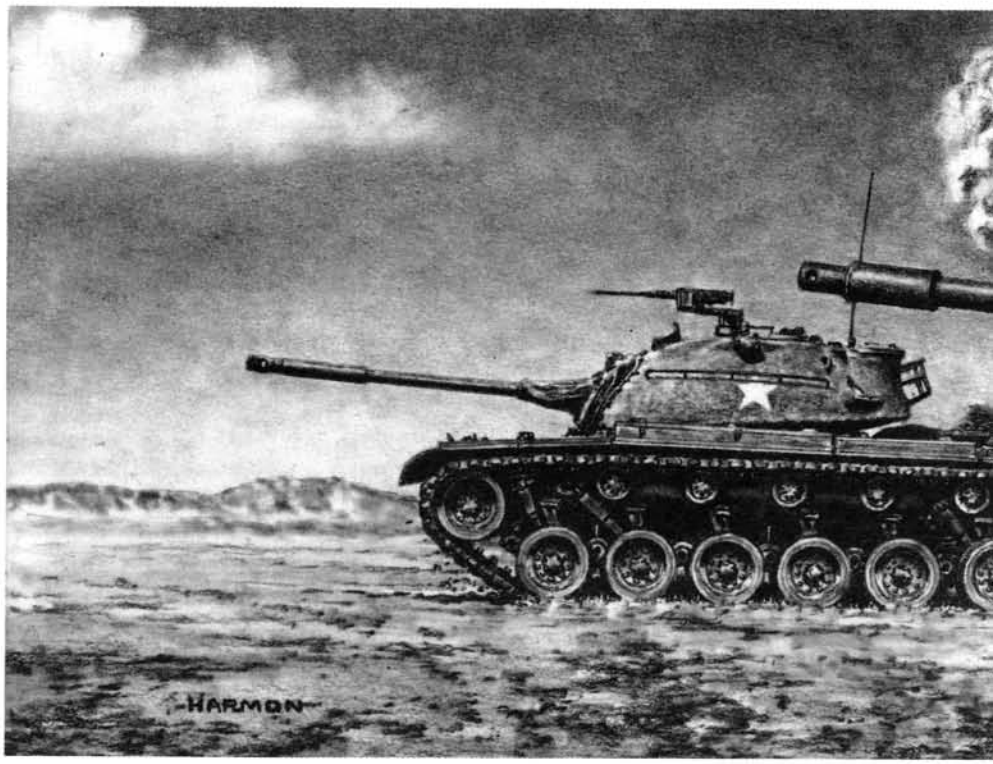
The Soviets became trapped by their own politics. The three factories, all with powerful friends in the Politburo and thousands of workers that had to be kept busy and continued unchecked. New models, aimed not so much at improving the tank park as "one-upsmanship" over the other two rivals, appeared at regular intervals. The T-64B, now with the 9M112 *Kobra* (AT-8 SONGSTER) through-the-bore launched ATGM, appeared in 1979; due to shared parts and components, the T-80B picked this feature up shortly afterward. In 1983, the T-64B, T-72A, and T-80B all began to receive reactive armor suites. This came about after the fortuitous 1982 Syrian capture of an Israeli M48 with "Blazer" proved its viability. In 1985, the T-72B and T-80U appeared. Both of them now mounted the 9M119 (AT-11 SNIPER) ATGM system, which used a laser beam riding system rather than the radio command guidance of the 9M112. The T-64, which had run its course, ceased production.

Continued on Page 45

American Tank Development

Maintaining the Edge Or Just Getting By?

by Dr. Robert Cameron



The first in this series of three articles, published in the September-October 1997 issue of ARMOR, addressed American tank development during the World Wars. This article focuses upon the Cold War era prior to the development of the M1 Abrams, illustrating the influence of the Soviet military threat. The desire to field a technologically superior tank that would more than offset Soviet numerical superiority made this period one of significant pioneering efforts in American tank technology. Despite problems in fielding reliable and effective designs, the efforts to build an ideal tank made possible the later development of the successful Abrams tank.

"We know exactly what we want. We want a fast, highly mobile, fully armored, lightweight vehicle. It must be able to swim, cross any terrain, and climb 30 degree hills. It must be air-transportable. It must have a simple but powerful engine, requiring little or no maintenance. The operating range should be several hundred miles. We would also like it to be invisible."

- General Bruce C. Clarke[1]

The close of World War II left the U.S. Army with three principal tanks in its inventory: the M24 light tank for cavalry missions, the M4 Sherman medium tank that constituted the bulk of the Army's tank strength and equipped the armored divisions, and the M26 heavy tank originally designed as a counter to the German Tiger and Panther tanks. None of these vehicles were considered ideal. The M24 proved popular and superior to the M5 light tank that it replaced, but it remained under-armed. Its low-velocity 75-mm gun, originally developed for aircraft use, possessed little antitank capability.[2] The various versions of the M4 medium tank proved mobile and reliable, but it lacked sufficient firepower and protection. The M26 heavy tank increased firepower and armor at the expense of mobility. It suffered from being under-powered. Its replacement, the M46, featured a new engine, cross-drive transmission, a bore evacuator, and fire control and suspension improvements, modifications that resulted in better overall performance, but it was still not an ideal heavy tank.[3]

In May 1946, the War Department Equipment Board completed its report on Army materiel needs. It acknowledged the need for a light, medium, and heavy tank, and recommended that a new tank be developed for each class.[4] Worsening relations with the Soviet Union encouraged implementation of the Board's proposals and development began upon the T37 light tank, the T42 medium tank, and the T43 heavy tank. In the immediate postwar years, however, this development occurred slowly amid Army demobilization and downsizing.

The Cold War's onset in the late 1940s triggered fears that the Soviet Union possessed far more tanks of superior quality.[5] The Army considered its own armored divisions as the principal defense against the Soviet military threat, but it did not believe it possessed enough tanks of the right type to sustain a ground conflict. Therefore the Army Field Forces Advisory Panel on Armor recommended accelerating development of new tank designs and focusing research and development efforts upon tank guns and ammunition.

It also requested immediate and sustained fiscal support of tank development and production to bridge the gap between American and Soviet tank numbers and capabilities.[6]

The outbreak of the Korean War in 1950 added urgency to the Advisory Panel's recommendations. Not only did the war catch the Army unprepared, the fear that it might become a global conflict highlighted the U.S. tank fleet's weaknesses, both in numbers and quality. The first tanks rushed to Korea came from infantry divisions stationed in Japan. On paper, each formation included one battalion of M4 medium tanks, but

During the Cold War

in fact each division possessed only a company of M24 light tanks, which proved no match for the North Korean T34/85s. Not until the arrival of M4 and M26 tanks in August 1950 did American forces possess a comparable armor ability to the North Koreans.[7]

In the United States, tank development and production entered a period of frenzied activity similar to that experienced in 1940 and 1941. Testing and development cycles occurred simultaneously with production to ensure the speedy fielding of new tanks. Such rapid production guaranteed teething troubles, but the importance attached to rapidly equipping combat units with the new tanks precluded detailed testing and evaluation prior to quantity production.

Of the triad of new tanks under development, the T37 light tank reached completion first. Design work began in 1947 to build a vehicle to perform cavalry roles and support airborne operations. To overcome the M24's weakness in firepower, the T37 design featured a long-barreled 76-mm with a stereoscopic rangefinder. This device provided the gunner with a separate target image for each eye. Range determination occurred by alignment of the two images into one, but its accuracy depended upon focusing abilities that not all people possessed. Although this device enhanced target acquisition at long ranges, its complexity led to its removal from the design. Thus altered, the vehicle became the T41. The first production vehicle was built in 1951, and the series became standardized as the M41.[8]

No M41s saw combat in Korea, but the tank remained in service throughout the 1950s, and 5,500 were built. Principal modifications included a fuel-injected engine and a hydraulic turret traverse that provided exceptionally fast turret movement.[9] The M41 saw extensive service with other nations. In foreign hands, primary modifications included replacement of the gasoline engine with a diesel, an upgrade in armament to 105mm, and new ammunition.

Later retrofit packages focused upon improved fire control systems, provision of an NBC system, laser rangefinder, and thermal sights.[10] The M41 proved popular, and its 500-horsepower engine permitted rapid cross-country movement. However, at 25 tons, it was considered too heavy for efficient air transport to support airborne operations. As a recon vehicle, the M41 suffered from excessive noise and poor fuel efficiency, managing only 75 miles before refueling. It was seen as having minimal combat potential against the Soviet T54 or JSIII, and its survival even against the older T34/85 depended upon scoring a first-round hit.[11]

Progress in developing a new medium tank occurred slowly until the Korean War. The T42's turret design carried an improved 90mm gun and possessed better protection in comparison with the M46. It also featured a stereoscopic rangefinder. The main armament could be operated by either the tank commander or gunner. However, its engine remained unsatisfactory.

The M47 resulted from mounting the T42 turret on an M46 hull. After a short trial and test period, the tank entered quantity production in 1952, but a series of teething troubles prevented it from en-

tering active service until after the Korean War. The principal source of these problems lay with the rangefinder that proved unusually complex and fragile for operation on a battlefield environment. Its turret control system too often malfunctioned. Its air-cooled, gasoline engine and cross-drive transmission permitted a top speed of 37 miles per hour and good cross-country mobility, but it possessed a range of only 85 miles. Symbolic of its evolutionary background, the M47 retained the standard five-man crew and hull machine gun of the WWII generation of tanks. Production of the M47 reached 9,100 by November 1953 of which 8,500 were exported, many going to NATO countries.[12]

The Army intended the M47 only as a stopgap until a superior medium tank design could be developed. Work on this successor vehicle began in October 1950 before the first deliveries of the M47. The new tank that became the M48 underwent testing in 1952. It featured a one-piece cast turret in a dome shape that offered improved ballistic protection. Most contemporary turrets narrowed at their base, creating a shot trap between the lower turret and hull that increased vulnerability. The M48 design eliminated this weakness, since the turret base overhung the tracks. The turret's shape derived from the Soviet JSIII, considered the nemesis of American tanks in the late 1940s and early 1950s because of its superior armor, armament, and range. Other principal features of the M48 included wider tracks, a 90mm gun mounting that permitted 15-minute gun tube changes, and for the first time in an American medium tank, a four-man crew. The design incorporated a cross-drive transmission and the same 810 horsepower, 12-cylinder gasoline engine intended for the T43 heavy tank to ensure sufficient mobility.[13]

The Army's emphasis upon long range accuracy led to the incorporation of a fire control system in the M48. This system included a stereoscopic rangefinder, ballistic computer, ballistic drive, and gunner's periscope. Collectively, these mechanical devices resembled in miniature the fire control systems used by naval vessels. Only after WWII did such systems become small enough for use in combat vehicles. They permitted tanks to engage effectively at much longer ranges than in WWII — a critical consideration for an army expecting to enter the battlefield outnumbered. Instead of a gunner's sight slaved to the gun tube, the ballistic computer and drive computed the range and elevated the gun. The gunner's primary responsibility lay in keeping the sight on the target. The mechanical ballistic computer made a more accurate computation of range possible by mathematically accounting for such factors as vehicle cant and ammunition type.[14]

The Army planned to produce over 9,000 M48s within three years of development. Such rapid, mass production would redress the imbalance between Soviet and American tank forces. Meeting this goal, however, required production simultaneous with operational testing and development. Chrysler Corporation became the principal producer of the tank. In a manner reminiscent of the M3 medium tank in WWII, Chrysler began building a new plant in Newark, New Jersey, to build the M48 while it continued to evolve the design. Expected production and teething troubles led to the creation of integrating committees to coordinate tank and component development. These committees included military and industrial representatives who provided early warning of defects and recommended remedies.[15]

Between April 1952 and December 1954, nearly 7,000 M48s were produced, with an additional 2,500 to be built through 1956. Combat units immediately received 2,120, but correction of defects discovered after production delayed the fielding of the remaining tanks. The first production vehicles suffered from excessive oil consumption and engine failures after only 1,000 miles. The gasoline engine managed only .33 miles per gallon, limiting range to 75 miles. The M48's width proved too wide for many European tunnels, complicating rail transport.[16] Operational readiness rates of M48-equipped units tended to be low. The tanks suffered from engine, transmission, track, and suspension problems, and the fire control system's complexity made it difficult to operate.[17] However, the M48 was considered an even match for its Soviet counterpart, the T54. The Army expected difficulties in engagements with the JSIII, since the M48's 90mm gun could not consistently penetrate the JSIII's frontal armor, even with special armor-piercing or HEAT ammunition.[18]

Correction of mechanical deficiencies resulted in a series of product improvements throughout the 1950s. The suspension, engine, and transmission underwent modifications that resulted in the M48A2. External fuel tanks boosted the tank's range but increased vulnerability, making them unpopular. Poor range remained a problem until the Army lifted its prohibition on the use of diesel fuel by large combat vehicles in 1955. Shortly thereafter the M48A3 emerged with a more fuel-efficient diesel engine that doubled the effective operating range.[19] Not until the emergence of the M48A5 in 1975, however, did the vehicle receive an 105mm gun to keep it competitive with more modern designs. The large turret and unusually large gun mounting of the orginal M48 design made it possible to increase the main armament with minimal modifications. Combat experience in Vietnam also generated several field modifications intended to provide better protection against shaped charge weapons, including covering the turret with sandbags and carrying chain-link fencing. When the tank moved into a position, the fencing was set up in front of the vehicle to detonate projectiles before they hit the tank. The cramped interior of the commander's cupola also led to the .50 caliber machine gun being remounted on a pedestal mount above the cupola for easier operation. The Israelis received the M48 in the mid-1960s. They immediately upgraded the tank with a diesel engine, 105mm gun, and lower silhouette cupola. In American service, these changes were not implemented until the M48A5.[20]

The various models of the M48 represented technologically advanced weapon systems. They fulfilled their intended role by providing the Army with a tank able to hold its own against all but the heaviest of contemporary Soviet tanks. It emerged during the crisis atmosphere of the Korean War, when America seemed to lag behind the Soviet Union in terms of tank quality and quantity. In 1960, the Controller General reported to Congress the findings of a General Accounting Office study of the M48 program. The report criticized the Army for placing a vehicle with known defects into mass production before correction, resulting in costly modifications only partially effective. It further accused the Army of issuing a defective tank to combat units. This report ignored the impact of the Korean War upon its development and the general satisfaction of crews issued the tank. It did, however, undermine Congressional faith in the Army's tank program.[21]

The last of the new triad of tank designs established after WWII was the

T43 heavy tank. Wartime experiences with German Tiger tanks and the postwar threat posed by the JSIII inspired this design. The T43 would support medium tanks, providing the necessary firepower to destroy heavier Soviet tanks like the JSIII and its successor, the T10. Design work began in 1948, but the outbreak of the Korean War resulted in a crash development program. The Army feared that an expansion of that conflict might result in American tanks entering combat against more heavily armed and armored Soviet models that they could not defeat. The Army authorized production of the T43 in 1950, despite the incomplete state of the design. Chrysler Corporation received an initial contract to build 80 tanks, later boosted to 300. All were complete by the end of 1954.[22]

The T43 became standardized as the 120mm Gun Full-Tracked Combat Tank M103. Armament consisted of a 120mm gun capable of direct or indirect fire, a coaxial .30 caliber machine gun, and a .50 caliber on top of the turret. Its fire control system included a stereoscopic sight for the tank commander for long range accuracy. The Continental AV-1790 gasoline engine provided 810 horsepower. The tank's weight of 62.5 tons, however, limited its top speed to 21 miles per hour, and it possessed a range of only 80 miles.[23]

The M103 suffered a number of shortcomings. Tests conducted at Fort Knox in October 1954 indicated substandard turret and main gun controls. The main gun ammunition required two loaders, and it proved erratic in flight.[24] Repeated firings of armor-piercing ammunition damaged the gun tube. Worse, the M103 initially proved underpowered for European terrain. Its engine and transmission required replacement after only 500 miles, and it threw its tracks easily. Early problems with the tank were considered correctable, but the Army suffered Congressional criticism in 1957 for fielding a defective tank. The Seventh Army, stationed in Europe, refused to accept the M103 until it demonstrated its ability to provide overwatch for the M48 and conduct mobile defensive operations. Corrective modifications permitted the tank to satisfy these requirements. In 1958, the M103 equipped the heavy tank battalions of the 1st and 2d Armored Divisions.[25]

The same year the Army abandoned the heavy battalions from its organization. Inspection of Soviet tank models captured by the Israelis during the 1956 Arab-Israeli War found the capabilities of the Soviet heavy tanks overrated. No need existed for American heavy tank units.[26] The Army also preferred to merge the capabilities of the heavy and medium tank into a single vehicle. The Marine Corps thus became the beneficiaries of the M103, continuing to employ and modernize it through the 1960s. Principal changes included improvements to the fire control system, turret, and the installation of a diesel engine. Although the tank never entered combat, tank crews assigned to the M103 liked it and appreciated its firepower.[27]

The M41, M48, and M103 symbolized the Army's initial postwar reaction to the threat posed by massed Soviet armor. All three vehicles experimented with advanced rangefinders and/or fire control systems intended to improve long range accuracy and the probability of a first-round kill. All suffered extensive teething troubles because of rushed production. None were considered ideal for their class, resulting in a reevaluation of the direction tank development would follow in the 1960s. In 1957, Army Chief of Staff General D. Maxwell Taylor directed that new design efforts focus upon two vehicles: a universal tank that merged the roles of the heavy and medium tanks, and a light tank to perform both cavalry and airborne support operations.[28]

The new policy bore the influence of the Ad Hoc Group on Armament for Future Tanks or Similar Combat Vehicles (ARCOVE), a study group under the Assistant Secretary of Defense for Research and Engineering. ARCOVE believed the state of fire control system technology inadequate to improving long range accuracy for kinetic energy weapons. It therefore embraced missile technology as a more promising alternative. ARCOVE recommended that:

"Maximum effort should be made to equip tanks, by 1965, with small guided-missile weapons with line-of-sight command guidance. To achieve this step within the framework of budgets, it is recommended that conventional-weapons programs, including hypervelocity fin-stabilized penetrators and guns, be sharply curtailed."[29]

A gasoline engine limited the range of the M47, above. Most were exported. Instead, the U.S. adopted the diesel-powered M48, below.

Pending development of new tanks carrying missile weapons, the Army opted to maintain production of the M48 through FY 1961, while completing development of a replacement vehicle designated T95. This new tank would fulfill the heavy and medium tank roles. Design had begun in 1954 and focused upon creating a lighter tank with a diesel engine and an armament capable of penetrating the current and anticipated armor of Soviet tanks. The first prototypes became available for test purposes in 1958. The T95's range of 150 miles doubled that of the M48. The design also offered better protection and incorporated a hydropneumatic suspension that enabled the vehicle to raise, lower, or tilt itself.[30] Several different turrets were built to experiment with different weapons, including large caliber smoothbore guns and hypervelocity ammunition.[31] A new rangefinder known as the Optical Tracking, Acquisition and Ranging (OPTAR) system measured the time taken for a pulse of light to travel to and from the target to provide an accurate range. OPTAR was the precursor to the laser rangefinder and more accurate than optical ranging systems. However, OPTAR

often generated multiple returns, requiring the gunner to use a visual estimate to determine the correct range reading. It was also considered too vulnerable, since it required a large external mounting on the side of the turret.[32]

The T95 served an important role as a test bed for new tank technologies. Its associated cost and its experimental status, however, led the Army to abandon it as the M48's replacement. Instead, the Army opted to build a new tank based upon proven concepts and components from the M48. This new design would serve as an interim vehicle pending development of a more sophisticated vehicle that would possess protection against nuclear, biological, and chemical (NBC) weapons and a missile armament. This "interim" design was standardized in March 1959 as the 105mm Gun Full-Tracked Combat Tank M60. In various configurations it would constitute the backbone of the American tank fleet until the 1980s.[33]

Typical of its evolutionary nature, the original M60 resulted from mating a 105mm gun and an AVDS-2 diesel engine with an M48. Combat units in Europe first received the M60 in December 1960, and a total of 2,205 M60s were built. Subsequent modifications made the M60-series more distinctive. These changes included a longer turret more suited to the 105mm gun, better suspension, a redesigned commander's cupola, a T-bar instead of a steering wheel, better armor protection, an electrical computer, and a coincidence rangefinder. The last device proved much simpler to operate than the stereoscopic rangefinder. The viewer observed the target as a split image. Aligning the image determined the range. These modifications resulted in the M60A1 that replaced the M60 on the production line, starting in October 1962. The production run stopped in 1980 after 7,948 M60A1s had been built.[34]

The M60-series proved popular and reliable, free from the major teething troubles encountered by its predecessors. It represented the final evolution of a series of tank designs begun with the M26. Moreover, it fulfilled the roles of the earlier medium and heavy tank classes. Although only the engineer and bridgelaying versions of the M60 saw service in Vietnam, the Israelis used them in the October War of 1973. This war provided American military analysts a treasure trove of data on armored warfare and weapon systems, including the M60-series tanks. They outperformed the new Soviet T62, but were not invincible. Many became victims of Egyptian Sagger missiles and rocket-propelled grenades. Two features in particular lowered the vehicle's survivability: a flammable hydraulic system that horribly burned crew members if ruptured, and the turret ammunition stowage. A high probability existed that this ammunition would explode if a round penetrated the turret armor. In response to these vulnerabilities, a fire resistant hydraulic fluid was introduced into the M48 and M60-series tanks. New stowage arrangements were also proposed to move ammunition below the turret ring, but these changes required considerable change to the design. [35]

The pragmatism represented by the M60-series, however, did not end efforts to field tanks carrying missile systems instead of guns. The ARCOVE report had considered such an armament vital to ensure American tanks possessed superior lethality over their Soviet counterparts. Such a system appeared to be within reach with the Shillelagh gun/missile system. This weapon merged a conventional gun with an antitank guided missile launcher. Tests suggested that the missile had an 80%+ probability of a first-round hit at 1,500 meters and could effectively engage targets out to 3,000 meters.[36] This promising weapon became the key to the next generation of tanks intended to replace the M60 and the M41.

General Taylor's 1957 guidance also encouraged development of a single vehicle capable of performing the roles of reconnaissance and support of airborne operations. The emergence of the Soviet PT76 amphibious tank underscored this need. The PT76 possessed an amphibious capability that enabled it to maintain uninterrupted movement on land and water. The M41 possessed only limited water-crossing ability. Its weight precluded its use in support of airborne assaults.

As a replacement, design work began on the Armored Reconnaissance/Airborne Assault Vehicle. This vehicle would weigh 10-tons; offer protection from artillery blasts, 12.7mm machine gun fire, and antipersonnel mines; and be able to destroy tanks at 2,000 meters. Development priority initially went to the vehicle's amphibious capability and firepower. The Shillelagh gun/missile system was considered the " only weapons system acceptable." This weapon consisted of a 152mm conventional gun also capable of firing antitank guided missiles. The Shillelagh system would provide the light tank with massive firepower without a large increase in weight.[37]

Design work upon the AR/AAV, later redesignated the M551, began in 1959, and in 1961 General Motors Corporation began developing a pilot model. By 1964, prototypes had satisfactorily passed their initial engineering tests. In 1966, training preparations started and discussion commenced regarding the early employment of the M551 to Vietnam. In the same year, production timelines and funding streams were established. Behind this rapid pace lay a desire to place a promising weapon quickly into the hands of combat troops, especially in Vietnam.[38] From this point, however, an endless series of controversies began to plague the vehicle.

Despite the use of an aluminum-based chassis to keep the vehicle light, its 18 tons exceeded the original AR/AAV limitation of 10 tons. Nor did the M551 ever achieve its desired amphibious capability. Although capable of a low velocity air drop, this procedure was never used in an operational environment.[39] The principal source of the M551's problems stemmed from its armament. The Shillelagh missile promised the ability to kill any known tank at long ranges. Once fired, the missile received course adjustments via infrared transmissions from the vehicle. The gunner had only to keep the sight on the target; the electronic fire control system provided the necessary guidance to the missile.[40] Not only the M551, but the next main battle tank design and a planned M60A1 upgrade would carry this system.

The 152mm gun, however, required the design of new caseless ammunition, including a canister round. Firing the gun propelled the round out of the gun tube and burned up the casing. In an environment contaminated by the effects of NBC weapons, the gun could be fired from a sealed fighting compartment without allowing external toxins to enter the vehicle. Unfortunately, the caseless ammunition tended to absorb moisture, reducing its combustibility. Upon firing, smoldering debris often remained in the gun tube, resulting in the premature detonation of subsequent rounds. This problem represented a major safety hazard that plagued the vehicle until an effective scavenger system could be developed. The scavenger system removed debris from the gun tube after each firing. Even without the danger of premature ammunition explosions, the recoil of the 152mm gun lifted the front two road wheels off the ground and knocked the vehicle backward several feet. Special instructions had to be issued before firing to prevent crew injuries. Worse, the recoil tended to damage the delicate

electronics and sights necessary for the missile's operation. The gun was too powerful for the vehicle's light aluminum chassis.[41]

Operational tests done at the Panama Tropic Test Center in 1967 revealed most of these problems. They also indicated that moist tropical climates adversely effected the tank's electronics, especially the missile system. The engines tended to overheat and proved exceptionally noisy. The vehicle also did poorly in Arctic tests conducted in Alaska. Despite these flaws, the vehicle entered full rate production and deployed to Vietnam in early 1969. A belief existed that these flaws could be corrected and that use in combat would demonstrate the M551's potential effectiveness. Supporters of the vehicle also feared that delays in fielding would result in the withdrawal of Congressional funding, effectively killing the program.[42]

The M551: Its problems were never solved.

In Vietnam, the canister round proved devastating against personnel. However, the light chassis was easily torn and damaged beyond repair. Mine explosions that only immobilized the M48 resulted in catastrophic destruction of the M551. Fear of mines led some crews to ride outside the vehicle and rig the gun for remote firing. Several modifications were introduced based upon the recommendations of M551 tank crews in Vietnam. The most important of these changes included the provision of a belly armor kit to reduce the danger posed by mines and a gunshield kit for the tank commander's machine gun. The latter created an armored "crow's nest" that reduced the commander's exposure to sniper and small arms fire when operating the weapon. Other changes based upon combat experience included a winch kit for self-recovery, an increased capacity bustle rack, and efforts to improve the fire protection system following complaints from the field. In Europe, field units requested the vehicle be equipped with a laser rangefinder before accepting delivery. This request was met, and thus equipped, the tank received the designation M551A1.[43]

However, even when deployed to the more moderate European climate the M551 suffered an excessive part failure rate that sharply reduced its operational readiness rate. The vehicle's armament and turret proved exceptionally difficult to maintain, even with the availability of mechanics familiar with the tank's unique components. The complexity of the vehicle resulted in a four-volume operator's manual constantly undergoing change, ensuring that few soldiers understood how the M551 operated. An endless stream of product improvements failed to eliminate these problems, but sharply increased the expense of the M551 program.[44] In 1978, the Army withdrew the M551 from all active units except the 3-73 Armor Battalion of the 82d Airborne Division. It also continued to equip the OPFOR at the National Training Center.[45] In 1996, however, the Army inactivated the 3-73 Armor. The tank's NTC role will also end soon as funding for the M551 stops.[46]

The failure of the M551's innovative armament destroyed plans to upgrade the entire M60 fleet by equipping it with the Shillelagh gun/missile launcher. Although the M60A2 did enter service with this armament, it did not meet expectations. It, too, suffered development problems never entirely solved. It proved difficult to maintain in the field and earned the nickname "Starship" for its complexity. Although development began in the 1960s, the M60A2 did not reach combat units until 1974. Only 540 of these tanks were produced, equipping six armor battalions. By 1982, the M60A2 had been phased out of active service. Most of these tanks were sent to Anniston Army Depot for conversion to other M60 configurations.[47]

The priority given to the Shillelagh's development also slowed work on conventional gun designs. When the gun/missile system failed, the Army found itself without an effective conventional substitute other than the M68 105mm gun originally designed by the British. Congress viewed the M551's unhappy service life as a complete debacle, blaming the Army for again rushing a flawed design into production and making false promises of performance. Moreover, Congress became disillusioned with the Army's tank program and viewed subsequent tank designs with an unprecedented degree of skepticism and cynicism.

Nor did the development of a successor to the M60 series improve this negative perception. In August 1963, the United States and West Germany agreed to develop jointly a main battle tank design known as the MBT70. The design team identified weaknesses in the M60 and M60A1 and then planned a tank that would eliminate them. The MBT70 was specifically intended to operate in the high intensity combat environment of central Europe. Armament included the Shillelagh gun/missile system with an autoloader, a 7.62mm coaxial machine gun, and a 20mm cannon for the commander. A special air-conditioned fighting compartment in the turret housed the three-man crew. While this arrangement allowed the tank's height to be reduced and simplified protection against NBC weapons, it became an engineering challenge to permit the driver to continue to see forward while the turret rotated. Other features that would become common on tanks of the 1980s and 1990s included a digital computer, laser rangefinder, and a sophisticated gun stabilization system for firing while moving. The complexity of the tank and specific problems related to the Shillelagh gun/missile system slowed development and resulted in massive cost increases. The West Germans abandoned the program in 1969 in favor of a newer Leopard design. American efforts to continue the project as the XM803 finally ended in 1971, when Congress stopped funding the program.[48]

The growing problems and costs of the MBT70 coincided with the controversy surrounding the M551 development and fielding. The program further alienated support for the Army's tank program, and it ensured that any future tank design would receive critical scrutiny from a skeptical public. However, many of the MBT70's components would be developed and incorporated into the M1-series tanks. While the MBT70 overstretched the technological capabilities of the 1960s, it symbolized the pioneering efforts of the 1950s-1970s. In this period, American tank designs too often suffered from rushed production and a desire to compensate for numerical inferiority on the battlefield with technological gadgetry. Yet the continued interest in sophisticated components made possible the very real advances achieved in the de-

sign and operation of every major tank part. The M60A1 represented the culmination of lessons learned from the WWII generation of tanks. The failures of the M551, M60A2, and the MBT70 demonstrated the danger of over-reliance on unproven technology. Consequently, the Army adopted a back-to-basics design philosophy that merged the practical lessons learned since WWII with advanced technology in the final stages of development. One of the most effective American tanks resulted: the M1 Abrams.

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[33]Hunnicutt, *Patton*, pp. 152, 157.

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Robert S. Cameron, the Armor Branch historian, earned BA degrees in history and economics at the State University of New York at Binghamton and a doctorate in history at Temple University. Formerly a history instructor at Temple and several other colleges in the Philadelphia area, he also teaches history at the Armor Center.

THE DEVIL'S ADVOCATE

Sayonara AGS! Sayonara Scout? Sayonara Armor?

"Approximately a quarter century of taxpayer investment in R&D of light tank systems since the early '70s has not resulted in a light tank that the Army would commit to production."

Above, the late AGS

by Don Loughlin©

"*The US Army's armored vehicle programs are going nowhere*," I said in a recent article in the *Armed Forces Journal International*.[1] The article said that the XM8 Armored Gun System (AGS) has been canceled; yet another scout vehicle program has been started (Future Scout and Cavalry System, FSCS), but I concentrated my ire on the Future Combat System (FCS, intended to replace the tank sometime in the indefinite future) which is busy continuing its Science Fair, probably until it, too, is replaced.

My article criticized the FCS, but nothing I said about it was as to the point as the last sentence of former Congressman Jim Courter's article in the *AFJI*: "*That's a lot better than training for the next war in trucks marked "Future Combat System."*[2] The article also raised the question: "*Will the Army put itself out of the armored vehicle business?*"

The question can be answered in the affirmative: Yes, the Army most probably will shut down its armored vehicle plants, with the encouragement of the DOD. In fact, the numbers of Armored Force personnel are already ramping down faster than the rest of the Army. In a recent *ARMOR* article,[3] Colonel Mark Hertling said "*Since the Army began downsizing in the early '90s, Armor has taken significantly more cuts than other branches*."

This makes sense if the Army is going to close its armored vehicle plants. If the heavy force can't 'get there' in time to influence the outcome, why keep them? Without new vehicles to meet new threats, why would we need trained crews and officers? It would, of course, be a cold day in Hell when the Navy closed its last shipyard or the Air Force closed its last aircraft factory.[4] All the money saved by shutting down our industrial base can be used to help pay for the increased cost of salaries for the DOD civilian employees. Yes, the DOD civilian force has been cut back, but mainly in the lower pay grades. With bonuses for superior performance and periodic cost-of-living increases, the DOD civilian payroll costs are higher than ever.[5]

Sayonara AGS! Throughout the '70s and into the early '80s, the Army (with Marine participation) experimented with a number of lightweight weapon and vehicle programs intended to provide a new light tank. Some of these were MPG (Mobile Protected Gun, Army), and MPWS (Mobile Protected Weapon System, Marine); later, both were rolled up into the MPGS (Mobile Protected Gun System.) Somewhere along the line, the Marines spun off into a concept transportable by the CH-53 helicopter, the LAV-105, which was later dropped. In the early '80s, the Army focused on the 105mm tank gun as the preferred weapon of an air transportable light tank.[6] Then, in 1983, the Army established a program manager and a new program, AGS.

Army leaders established a demanding schedule for AGS that was too tight for the military's ponderous acquisition system to be able to move fast enough. At least two members of industry started development of the AGS in 1984 on their own funds. After that, the AGS was caught up in the struggles of the Army's developmental bureaucracy in trying to determine what its detailed characteristics really ought to be.

After many vicissitudes over the years, four companies ultimately submitted proposals in late '91: A General Dynamics and Teledyne Continental Motors team (that proposed the only system with an external gun turret), Cadillac Gage Textron, Hägglunds USA, and FMC. The then-FMC candidate won in June 1992,[7] and the privately developed candidate was tested and evaluated by the Army.

FMC delivered the first six prototypes in 1994, and production/fielding plans were well underway when the Army canceled the program in 1996. The cancellation was based upon a misguided willingness to believe that either air-landed MBTs, or a reliance upon then-state-of-the-art ground-fired AT missiles, could replace a proven, parachutable light tank in the assault phase of early entry options. Since the first production models of the M551 AR/AAV contract were delivered in 1966,[8] no light vehicle has replaced them. Approximately a quarter century of taxpayer investment in R&D of light tank systems since the early '70s has not resulted in a light tank that the Army would commit to production.

The excuse that funding shortages were the cause for the demise of the AGS is a poor one. What was lacking in the case of the AGS was a true commitment by the 1996 leadership to an earlier decision made by the early '80s leadership. A true commitment would involve mounting a sales campaign and fighting for the funding needed. The Congress is very sensitive to loss of jobs in the defense sector. With true commitment and a real sales effort, support for funding can materialize. The Congress has tried to fund more B-2 bombers that *the Air Force did not want and these bombers cost over a billion dollars each*!

The Army's acquisition bureaucracy was of no help in preventing another long term exercise (AGS) with no useful

output.[a] The development cycle is too long, and a pitfall when such programs drag on is the changing perception, over time, by the ever-changing leadership of what is needed. This is usually justified as being driven by 'a change in the threat,' but that's not true. The real long term threat was the size of the Soviet military, a military consistently noted for its adherence to the doctrine that "quantity has a quality all its own."

If every decision made in the past is to be re-evaluated in the light of today's perturbations, then no commitment is safe. In speaking of the Army's delays in fielding a new tank, MG Stan R. Sheridan, USA (Ret.), said in a 1994 Letter to the Editor of *ARMOR*, that the Army "*... must bite the bullet now and set the tough dollar, technical, and schedule priorities and adhere to them through development and into production against an established fielding date; and most important, the Army must have the courage of its convictions to stay the course.*"[9]

Not the least lost here is the Army's credibility with what's left of its industrial partners, particularly those who did bite the AGS bullet for the Army. There has been no public outcry about the AGS cancellation, since these executives are well aware that they operate in a market with many sellers and one buyer. The company that originally designed and built the first AGS with its own funds, and those of many of its contractors, is now out of the defense business.

Sayonara Scout? The Future Scout and Cavalry System (FSCS) is a cooperative development effort between the US and the UK.[10] It has a requirement for reduced signature, advanced sensors and communications, sustained cross-country mobility, tailored weapons for specific missions, and RO/RO for three vehicles on the C-17 (with C-130 lift desirable.) Reduced signature and state-of-the-art sensors will be expensive, but surely necessary. If the vehicle is to be kept affordable, it is important to avoid an FCS-like Science Fair. They especially need to avoid spending money on failed ideas. Will they do that? Probably not, because some in the user community favor an external gun turret[b] (EGT); and there is also pressure to buy the elderly Cased Telescoped Ammunition and Gun Technology (CTAGT.)

1. Confirmation of preference for an external gun turret is in a statement made to AFJI**:** *"... To keep the FSCS's signature as low as possible, the scout will likely not have a turret. ..."*[10] That is a euphemism for using an EGT.

2. CTAGT has already consumed more than 40 years and approximately $213 million in 'then-year dollars' (over $470 million in FY 98 dollars!) *without ever getting into production*, and people are still trying to sell it.[11] In the early '90s, the CTAGT supporters exported the data and concept (undoubtedly with DOD authority) to a British/French joint venture.[12] Now the 'new and improved' CTAGT has been offered to the US as an automatic cannon candidate.[13] The Army's CTAGT development contractor, who participated in the data transfer, has signed on as the marketing organization for selling it back to this country.[14]

The prognosis for FSCS is poor, but not yet terminal. Mired in international politics, it will face schedule delays and cost growth. If the Army couldn't make a decision to buy an AGS, or the earlier ARSV, then the new scout vehicle may also be doomed. Look for a later, directed procurement of a so-called non-developmental item (NDI), a foreign AGS and/or scout vehicle, when we run into an emergency – i.e., after we have shut down our vehicle plants.

Sayonara Armor? The Army's Armored Force is in deep trouble, most of it self-inflicted. No one listened three years ago when they were told: *"As a branch, we have been flirting with extinction, or at least significant modification of our utility, for a long time ... because we are too heavy, cost too much to operate, and can't really participate in a force projection strategy because we cannot rapidly deploy*."[15] Add indecision to that mix, and the Armor community is on its way to extinction. What the Army has accomplished in the last three years is to shut down AGS, create new paper programs, cut Armored Force personnel faster than the rest of the Army, and make plans to shut down our production facilities. Sayonara!

Notes

[a]"Worth Noting — A Pentagon source relates that following the last round of Army board promotions to full colonel, there are more O-6s in acquisition corps slots than in the infantry." "Washington Pulse," *National DEFENSE*, October 1995, p. 8.

[b]A variation on this bad idea is the Remotely-Operated Gun. See*:* "The External Gun Turret: 'Often a Bridesmaid, Never a Bride'," *ARMOR*, Jan-Feb 1996, and also Reference 3, below.

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

Through a Glass Darkly:

Exploring the Future of Armor by Examining the Past

by Lieutenant Colonel Arthur W. Connor, Jr.

For now we see through a glass darkly; but then face to face: now I know in part; but then shall I know even as also I am.

1 Corinthians 13:12

Divining the future of armor and cavalry in the 21st century is like viewing a movie through a glass darkly. Many scenes are unclear, and different people see different things. What is the role of the main battle tank in a force projection army? What are the requirements for scouts and cavalry in future contingency operations? What effect will digitization have on armor and cavalry forces? There are a myriad of other questions equally as germane and perplexing to the armor community. As a way of providing some perspective and guidance, I offer the views of the Army's leaders from an equally tumultuous time, 1949. The end of the Second World War left many Army leaders asking questions about armor and cavalry similar to those posed today. To answer those questions, the Chief of Staff of the Army (General of the Army Omar Bradley) tasked General Jacob L. Devers, the commander of Army Field Forces, to "provide a comprehensive and current statement of policy in matters of doctrine and material pertaining to armor."[1]

The U.S. Army of 1946-1950 was adrift, attempting to occupy Germany and Japan while searching for a role in the new national security environment of the nascent Atomic Era.[2] Reductions in personnel, equipment, and training continued unabated until the advent of the Korean War, with armor units suffering heavily. When war broke out in Korea on 25 June 1950, there were no tank battalions available to Eighth Army to fight the North Korean T-34 tanks. Tanks were taken off their pedestals at Fort Knox and pulled out of the jungles of the Pacific battlefields and shipped to Korea.[3] How then, did the Army view armor, tanks, and their role prior to the disaster of Task Force Smith and the initial fighting in Korea?

On 31 January 1949, a letter was sent to Major General Ernest Harmon appointing him chairman of the Army Field Forces Advisory Panel on Armor. The panel was to meet at Fort Monroe on 7 February, and Harmon was to present his findings to General Devers on 18 February. The panel consisted of representatives from Cavalry, Infantry, Field Artillery, Engineers, and the Marine Corps, and included Brigadier General Bruce C. Clarke and Colonel Paul A. Disney. Although the Office of the Chief of Cavalry was eliminated in March 1942, officers of the Armored Force of WWII were assigned to Cavalry after the war. Armor branch would come into being only after Congress passed the Army Organization Act of 1950.[4] The immediate cause for the formation of this panel was to present a coherent body of policy regarding armor to Great Britain and Canada at a series of joint standardization conferences on armor and field artillery to begin in March 1949.[5] The purpose of the panel was much greater, however:

The purpose of the study upon which this document is based was to establish, by review, interrogation, and critical evaluation, the doctrine of armor, and the policies affecting equipment requirements and development in order to provide an authoritative Armor policy statement, bearing Department of the Army approval, to all agencies of the U.S. Army. The report, as approved, will furnish guidance in staff planning, service school instruction, and troop training. It will provide a firm and sounder basis for R&D staffs and technical agencies in effecting the equipment requirements of the Field Army.[6]

A tremendous amount of work for only eleven days! Nonetheless, the panel issued their report on 18 February 1949 in ten sections, covering everything from doctrine to flame warfare policy. Section I of the report covers U.S. Army armor doctrine, a subject then barely nine years old.

The doctrine section of the report begins with a short history of armored warfare and defines armor as tanks, armored cavalry, armored infantry, armored engineers, armored artillery, and the service support required to "form an integrated and a balanced fighting force, the nucleus of which is tanks."[7] Armor combines its mobility and great firepower to concentrate its mass of power at a decisive point on the battlefield, upsetting "enemy time and space factors," while hindering "rapid enemy reaction."[8] What a prescient conclusion! At first glance, I thought I was reading from *TRADOC Pamphlet 525-5, Force XXI Operations*, or Army Vision 2010. The TRADOC pamphlet discusses future land combat operations as "designed to control-maintain, accelerate, or moderate as necessary the pace of battlefield events."[9] Isn't the massing of combat power at a decisive point while upsetting enemy time and space factors in essence a rudimentary definition of operational dominant maneuver? Dominant maneuver, however, consists of two elements: strategic and operational. "Strategic maneuver equates to the Army's requirement to project the force."[10]

The authors of the report understood the need for strategic maneuver, even in 1949. In writing on possible theaters of war, the authors go into great detail on the need to insure armor forces are deployable:

If war is forced on the United States, it is the policy of this nation that the war will be waged on foreign soil. However, this nation is so organized politically that it cannot choose the situation or the location under which it will fight initially. Initially we may have to fight in an area unsuited to Armor. Considering any potential enemy, there is little likelihood of fighting a major war without having to ship an expeditionary force across several thousand miles of water. Armor in the U.S. Army must be dimensioned by the requirement that it be transportable to overseas theaters.[11]

Once again, I am staggered by the clear vision of the future presented by General Harmon and his fellow panel members. The same conditions identified in 1949 are relevant for the employment of armor today. Increasing urbanization throughout the world dictates the use of armor in villages and cities, mandating vehicle designs that take that fact into account. More importantly, if our armored forces cannot get to the fight (strategic maneuver), they are irrelevant in a force projection army. An entire section of the report (Section III) deals with the issue of U.S. Army Tank Policy and

the need to make the armor force deployable.

Section III delineates the need to insure tanks can be transported via rail in "fighting condition," that all tanks must be able to "move on highways" without destroying the roadbed or bridges, and that tanks organic to divisions "must be transportable in assault type [LST, LCM] craft."[12] The authors recognize the importance of harbor facilities for off-loading tanks, and recommend that tank development "be coordinated with the Department of the Navy so that appropriate changes can be made to existing facilities and craft, and [for] the specifications for new equipment."[13] While recognizing the limitations of current transport aircraft, the panel is unambiguous on the need to make armored vehicles transportable by air. "It is obviously desirable, if not essential, that an armored division be capable of transport by air, as well as by rail or water. The adoption of a 36 ton medium [tank] is evidence of the ultimate possibility of making the armored division theoretically airborne."[14] Such a force projection division would have great utility today and in the next century, and had it been available may have mitigated many of the enemy advantages in the opening stages of the Korean War. Army Vision 2010 reiterates this fifty-year-old argument. A power projection force composed of lighter, more durable warfighting systems will be on the way to the area of operations "within hours of the decision to deploy."[15] In many instances, the airborne division is the first Army force to deploy in a crisis. The panel examined the issue of armor support for the airborne division.

In 1949, as today, there was wide disagreement over the issue of armor support to the airborne division. The 1949 table of organization for the airborne division included two heavy tank battalions as attachments and one cavalry reconnaissance company (equipped with 1/4-ton jeeps and M-24 Chaffee light tanks). The panel recognized that it was impossible to get the heavy tank battalions into the fight with the airborne division until well after the parachute assault, unless it was used as regular infantry. Additionally, the M-24 light tank could not enter the fight via parachute, and an adequate armored car was not in the inventory.[16] In essence, the panel encapsulated the exact same problems facing the 82nd Airborne Division today following the deactivation of 3-73 Armor. The panel recommended an effort to produce an armored car for the airborne reconnaissance company with a weight of 20,000 pounds mounting a gun of not less than 76 mm. The same armored car would be used in the light cavalry regiment. "The development of an armored car mounting multiple machine guns as the only armament is considered economically and tactically unsound."[17] The reconnaissance troops of the light divisions and the scout platoons of tank and mechanized battalions today all contain a light armored car that mount only a single machine gun or grenade launcher, the HMMWV. Is it possible to project force anywhere in the world today without a viable armored car or light tank?

General Harmon's panel specifically addressed the issue of the role of the light tank and armored car. The justification for a light tank and armored car can be found in how we approach reconnaissance. The current edition of *FM 17-95 Cavalry Operations*, defines reconnaissance as "an inherent part of security and other combat missions." There are six fundamentals of successful reconnaissance operations, including gain and maintain contact with the enemy.[18] Existing U.S. doctrine in 1949 also considered reconnaissance as an element of security "requiring fighting capability." The light tank (M-24) allowed the Light Armored Cavalry Regiment of 1949 and the Reconnaissance Battalion of each armored division to fight for intelligence. In order to replace the light tank, an armored car "must have equivalent armament and cross country mobility."[19] Can the 2d Cavalry, the reconnaissance troops of light divisions, and our scout platoons fight for intelligence today without a light tank or an armored car equivalent?

The report concludes with a lengthy inclosure {sic} that summarizes the conclusions of each of the ten sections. The authors are vehement in their belief that armor enables the Army to conserve manpower and "obtain decisive results in the shortest period of time," considerations that color the employment of all armed forces today. Armor must "be dimensioned" by the ability to deploy to overseas theaters, and balanced combined arms teams must exist, "or be easily formed in all echelons."[20] As the members of the panel gazed into the dark glass of the future in 1949, so too must we gaze into the equally dark glass of the 21st century. Today's force projection Army "must be able to quickly project lethal and survivable combat power" anywhere in the world.[21] In order to remain viable on the next battlefield, armor and cavalry must contribute to the Army's unique capability "to exercise direct, continuing, and comprehensive control over land, its resources, and people."[22] Otherwise, our branch and purpose will fade into the tapestry of history, much as the horse cavalry did in 1942.

Notes

[1]Office, Chief of Army Field Forces, "Report of Army Field Forces Advisory Panel on Armor" (Fort Monroe, Virginia), 19 February 1949. Photocopy in author's possession. Hereafter cited as Report, followed by section and page number.

[2]See Roy K. Flint's excellent chapter "Task Force Smith and the 24th Division: Delay and Withdrawal, 5-19 July 1950" in *America's First Battles, 1776-1965*, ed. Charles A. Heller and William A. Stofft (Lawrence, Kansas: University Press of Kansas, 1986), 266-270.

[3]See Arthur W. Connor, Jr., "The Armor Debacle in Korea, 1950: Implications for Today," *Parameters* XXII (Spring 1992):66-76.

[4]James A. Sawicki, *Cavalry Regiments of the U.S. Army* (Dumfries, Virginia: Wyvern Publications, 1985), 124.

[5]Report, Annex, 2-3.

[6]Report, Introduction.

[7]Report, Section I, 5.

[8]Report, Section I, 6.

[9]Department of the Army, U.S. Army Training and Doctrine Command, *TRADOC Pam 525-5, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century*, (Fort Monroe, VA: 1 August 1994), 3-20.

[10]Department of the Army, *Army Vision 2010*, 11.

[11]Report, Section I, 8-14.

[12]Report, Section III, 5-6.

[13]Report, Section III, 7.

[14]Ibid.

[15]*Army Vision 2010*, 11.

[16]Report, Section VII, 4-7.

[17]Report, Section VII, 5.

[18]Department of the Army, *Field Manual No.17-95, Cavalry Operations* (Washington, DC: 24 December 1996), 3-3.

[19]Report, Section IX, 2.

[20]Report, Inclosure 1, 1.

[21]*TRADOC Pam 525-5*, 4-7.

[22]*Army Vision 2010*, 12.

LTC Arthur (Buck) Connor is currently the Deputy Director of the War Theory and Campaign Studies Department at the Air Command and Staff College, Maxwell AFB, Alabama. He received a BS from the U.S. Military Academy in 1981 and a MA in History from Temple University in 1991. He is a graduate of the Command and General Staff College and the Armed Forces Staff College. He has served in a variety of command and staff assignments in the 82d Airborne Division, 1st Infantry Division, and 3d Infantry Division.

Someday Soon, Your COFT May Be Built Into Your Tank

Embedded Simulation For the Army After Next

by Claude W. Abate, Hubert A. Bahr, and John M. Brabbs

The power projection Army of the 21st century will require a flexible, go-to-war, on-board training capability. Individual, crew and unit training currently conducted in stand-alone simulators will not meet the needs of rapidly deploying forces and geographically dispersed Reserve Component units. Emerging technologies and miniaturization are advancing at such a rapid rate that a totally embedded training capability will be doable and affordable. Embedded training systems will replace the current suite of stand-alone external trainers, like the conduct of fire trainer (COFT), simulation network (SIMNET) and the close combat tactical trainer (CCTT). This fully embedded technology would provide an autonomous trainer that would literally allow soldiers to train as they would fight, using their combat systems.

Sustainment training can then be accomplished at home station, at combat training centers, at unit armories, or enroute to and while deployed in the combat theater. The embedded simulation technologies used to support training can also be exploited to support vehicle operational/warfighting systems. This technology can enhance the presentation of critical information needed by commanders and thereby avert an information overload situation. The Inter-Vehicle Embedded Simulation Technology (INVEST) is a technology exploration program with the goal of identifying those key technologies that have the highest pay-off. This paper outlines a program that will set the course for a totally embedded training (ET) and embedded simulation (ES) capability targeted for Army After Next (AAN) ground combat systems.

The ES relationship figure shows the relationships between the Training, Operations and Combat Development/Testing arenas. Simulation plays a central role in all three of these arenas. ES is the subset of the fully integrated simulation arena. ES will play a role in the combat vehicles of Army XXI and Army After Next (AAN) by providing a capability to integrate training networks, training support automation systems, and all battlefield operating systems. ET is all embedded training technology, including those not requiring simulation, and will be an integral part of the training arena. Embedded Operations (EO) which include the operational enhancement functions of situational awareness (SA), battlefield visualization (BV), mission rehearsal (MR), command coordination (CC), critical decision-making (CDM) and course of action analysis (COAA) will be an integral part of combat operations. ES will permit commanders to seamlessly migrate from ET into EO and vice versa.

To date the most prevalent target for (ES) has been to support embedded training. It allows the soldier to train, either individually or collectively, using the operational system. ES has other potential uses over the total system life cycle. For example, ES can support vehicle development from concept development through acceptance and operational testing. In the future, it will enhance the decision-making process and reduce information overload for our leaders through automated filtering tools. Digitization provides the raw data, and simulation enhances or presents that data as an information aid to the commander. Making simulation available for operational use adds to the information dominance capabilities needed for Army XXI and AAN.

It is becoming apparent that an onboard ES system will be useful to meet operational/mission support requirements such as: battlefield visualization, situational awareness, mission rehearsal/planning, critical decision making, course of action analysis, and the development of artificial intelligence (AI) filtering tools. ES technology available to support both training and operations is referred to as "dual use."

Battlefield Visualization. The process whereby the commander develops a clear understanding of the current state with relation to the enemy and environment.

ES, when integrated into the battlefield TOCs, will aid the company and battalion commanders' ability to plan, research, and analyze alternative courses of actions and their resultant outcomes. Expert systems could eventually be built into the operational software to assist in route selection, deployment of forces, and use of assets. These systems could help determine the most effective uses of troops and their equipment, or the best sectors of fire given the terrain and force level.

Situational Awareness. Timely recognition of both enemy and friendly situation such that the warfighter can gain and sustain the initiative.

ES can perform filtering of incoming data. The commander requests display of only certain high priority targets or essential elements of information. The resultant filtered output to the human decision-maker will permit faster and more accurate battlefield decisions.

Command Coordination. The ability to coordinate the three functions of command and control (plan, conduct, and sustain operations) and the correlation, fusion, and display of information needed by commanders at all levels.

The advent of Interface Design Specifications (IDS) for ES of various combatant vehicles will standardize informational interchange on tomorrow's battlefield. This will heighten and improve the command coordination between elements of the 21st century force. The evolution of embedded simulation will enable the force to use a seamless multiuse simulation environment. ES will allow users to set up and diagnose com-

"The ES technologies can be mated with expert systems to help analyze different courses of action. Quick-run simulations can determine possible results of the planned engagement or mission."

munication nets, plan missions, and analyze logistical support requirements.

Mission Rehearsal. The use of modeling and simulation applications to facilitate mission execution.

Mission rehearsal is an inherent strength of ES as planning and rehearsing against an intelligent Computer Generated Force (CGF) adversary is always possible. Weaknesses in the plan or human performance levels required by the plan will be easy to determine with easy adjustment to the plan as equally possible. The mission rehearsal will increase unit awareness of mission requirements and difficulties, and will allow the unit to maintain proficiency and practice against intended targets immediately preceding the actual mission.

Critical Decision Making. The ability to identify the critical decisions that emerge within the combat decision-making cycle and reduce information overload, and the stresses associated with the combat decision-making process.

An inherent advantage of the U.S. Army has always been the initiative and intellect of the ground commander. ES capabilities will allow leaders to make tactical decisions based upon a better understanding of the developing tactical situation. The pace of modern warfare dictates that commanders need timely, prioritized access to combat-critical information. Extraneous information needs filtering to prevent human overload and clutter on displays.

Course of Action Analysis. The ability to support the tactical/operational decision making process by selection of the best course of action based upon a rapid COA wargame modeling and simulation comparison.

The ES technologies can be mated with expert systems to help analyze different courses of action. Quick-run simulations can determine possible results of the planned engagement or mission. The commander can make better decisions siince he will have a better understanding of the attendant risks and possible outcomes. The battle staff's mission presentation could be linked electronically to unit leaders at their TOC locations. This linking will allow the rapid development and transmission of subordinate unit actions and orders via the tactical internet. This planning would be via the on-board ES technologies. Electronic planning and stealth reconnaissance will maximize the use of planning time and minimize exposure to enemy observation and fire.

Training Enhancement

The ability to train and practice anytime and anywhere in the combat system affords a capability never before enjoyed by any modern fighting force. Training Aids Devices Simulators and Simulations (TADSS) previously strapped on and tethered to combat systems, and look-alike crew stations, may be part of our training past if the same technologies can be reduced, embedded, and injected into the fire control and sensor systems. A simple method needs developing to transition the crew from a combat mode to a training mode and vice-versa.

Those individual, crew, and collective training tasks currently conducted on part-task trainers and stand-alone simulators may in the near future occur on the combat vehicle. This on-board capability will place the training responsibility back under the unit cadre, vice separate instructor operators (IO) and observer controllers (OC), and support training in unit motor parks, training areas, and ranges. There will no longer be a need to centralize scheduling and time sharing on limited trainers/devices.

The primary tasks currently needed to attain and sustain combat proficiency include gunnery training, tactical training, and a secondary task of driver training. Current training for these tasks is on stand-alone gunnery and tactical trainers like COFT, SIMNET/CCTT and driver trainers. These simulators are in permanent facilities or shelters and require contractor support and centralized management. Embedded autonomous trainers may stop or reduce any further tradeoff of OPTEMPO dollars and contractor support costs.

Gunner

Gunnery training currently conducted on stand-alone trainers will have similar capabilities built into the combat system. Multiple vehicle exercises may occur by use of digital communications over the tactical internet or a supplemental wireless LAN. With an autonomous trainer, gunnery exercises are possible by the using unit with on-board semi-automated forces (SAF) or through exercises developed at battalion level and ported down electronically or sent by CD-ROM to the using unit.

Commander

Tactical training similar to the tasks scheduled for CCTT will be conducted using the combat vehicle. Again, on-board SAF and terrain/image generator (IG) provides the means. The tactical radio or wireless LAN will provide the inter-vehicle communications link and pairings required for force-on-force training. The use of synchronized player model technology will promote live vs. virtual vehicle interaction. This interaction and use of digitized terrain brings a combat training center (CTC) level virtual tactical engagement simulation (TES) capability to every home station. The migration of ES/ET to the command and control systems will round out the Bn/TF tactical training package.

Driver

Driver training will have a similar on-board capability, less a motion platform, when training in a stationary mode. In the stationary mode, the driver will have terrain graphics injected into his vision blocks or sensors to give the appearance of moving over the terrain database. Driver participation would be an advantage over the UCOFT where the IO plays the role of driver.

After Action Review (AAR)

The requirement for a standardized and automated AAR system is a reality with ES. An automated ES system can be programmed to electronically capture data on key actions/events during the battle for playback and analysis. Recorded training and operational execution will help the OC during AAR preparation and execution to assess training effectiveness, record battle damage assessment (gun camera) and determine enemy tactics, techniques and procedures (TTP).

Training Transfer

There will be a direct training transfer associated from ES use because the crew

will: (1) train on its combat system, (2) operate under real conditions and under the watchful eye of unit cadre, (3) gain increased availability of the system for training and (4) realize a synergistic benefit from the dual use autonomous training and an (their) operational system.

Today's training simulators present tactical information in a form intuitive to the trainee. He see it in the form of map displays similar to the paper maps using standard military symbology and scene displays that emulate the actual view seen by the combat crew. Advanced ground combat systems are taking advantage of electronic visual technology to provide better battlefield visualization from the "buttoned-up" vehicle. These same combat systems have moved to the vehicle electronics (VETRONICS) open-system architecture; this approach converts all controls to digital signals, which then activate the appropriate subsystems. These trends in vehicle architecture, digital displays, and electronic controls, have simplified the challenge to integrate embedded training/simulation.

In the past, ES technologies have had their greatest use in the domain of training, exercise, and mission operations (TEMO). ES technologies can also provide payoffs in the research, development and acquisition (RDA) and advanced concepts and requirements (ACR) domains. The evolution of a weapon's system or platform from ACR to RDA to TEMO presents unique challenges and requirements for embedded systems. Technology being developed under the INVEST Science & Technology Objective will allow Simulation Based Acquisition to become reality. ES will allow utilization of simulation for the entire acquisition process from concept to production and continued through training and maintenance of a vehicle. During ACR, embedded simulation will provide the Army with the capability to migrate advanced concepts from the battle labs to the field units for testing. This will provide the leaders with a realistic view of future fighting capabilities for the next generation of combat vehicles.

During RDA, ES is useful in speeding up the vehicle development process. This process allows quciker integration and problem solving. The next step is to utilize ES technology to combine virtual and live vehicle testing. This combination will allow more realistic operational testing of the vehicle; it may also be the only way to test the Army's future vehicles. Embedded Simulation provides the capability to model, test, and model.

During TEMO, the training goal is to emphasize the correct doctrine and refine specific skills. Training and Doctrine Command will develop instructional scenarios/databases for possible mass-production and distribution to units as a training library. Each vehicle will have a scenario reader and the appropriate computer technology to inject sensor and visual information into the vehicle's sights, displays, and targeting systems. Interconnecting the vehicles with local area networks using high level architecture (HLA) protocols would accommodate team and force level training. This would also allow the interaction with other units and systems. Mission-specific preparation would be accommodated by providing, at the battalion headquarters, the tools to rapidly generate a scenario based on expected battle plans that would support mission rehearsal preparation. The ultimate level of training would be possible by replacing the simulated terrain with actual training sites and integrating live and virtual forces into the scenarios.

Key technologies that need development for cost effective embedded simulation include low cost image generators, virtual target injection into sensor displays, live/virtual entity interaction, synchronized semi-automated player models, simulation information filtering tools, intelligent tutoring systems, scenario generation, and scenario players. The embedded training starts as an autonomous capability, where one vehicle and crew is all that's needed for effective training. The embedded simulation concept will also require synchronization techniques to keep all of the vehicles on the same scenario during collective training. References one and two cover these topics in further detail. Areas that require enhancement include burst on/off target effects, determination of aim point, live to virtual image registration, and reduction of simulation communications overhead. The key challenges that need tackling will be integration and safety. The vehicle software design will need to allow easy integration of all the new ES features into the vehicle. Safety will be a major design requirement of the ES System, providing the necessary features to lock out firing the weapon during the embedded training mode and also provide a quick, fail-safe way to return to combat mode.

M1A2 System Enhancement Package (SEP)

The M1 Abrams main battle tank is the U.S. Army's primary combat weapon for closing with and destroying the enemy. The M1A2 SEP has increased capability and capacity over the M1A2. These include electronic color digital terrain maps, Army Standard C^4I architecture, under-armor auxiliary power unit (APU), improved thermal imaging, improved vehicle intercom, improved position/navigation, and improved VETRONICS architecture.

Future Scout and Cavalry System (FSCS)

The FSCS will be an optimized system for scout and cavalry units to conduct reconnaissance, surveillance and target acquisition on the Force XXI battlefield. This system will have improved survivability, mobility, lethality and deployability over existing platforms. To ensure tactical information dominance, the FSCS will have a sensor package for rapid target acquisition, identification and, destruction. It will also have a fully integrated and shared C^4I system.

The INVEST-STO evolution is explainable in terms of several distinct phases from inception to fielding an ES system on a future ground combat system. The phases of evolution span a six-year period from FY 97 to FY 02. The demonstration phase (FY99-00) starts with a hot bench or brass board and ends with vehicle prototyping at a Systems Integration Lab (SIL). The proof of concept phase (FY 01-02) will occur in three steps: (1) ES on stationary vehicle, (2) ES on a moving vehicle, (3) ES as an operational enhancement to the combat systems. The transition phase (FY 99-02) will involve transfer of technology to the vehicle PMs and the integration of ES

into future and legacy systems. The fielding phase will occur sometime after transition with the intent of the first fully embedded fielded ES/ET system being operational on the Future Scout and Cavalry System (FSCS) (in FY 07).

The current practice of developing militarized equipment to last the service life of the vehicle needs to be re-addressed to properly take advantage of computer hardware and software evolution.

Today's technology allows us to demonstrate the initial capabilities of tomorrow's implementation. Over the past decade, we have seen in the commercial world the impact of the evolution of computer technology. In the business arena, we have seen the acceptance of this ongoing evolution with planned replacement of the desktop computer every three years to incorporate new capabilities. The current practice of developing militarized equipment to last the service life of the vehicle needs to be readdressed to properly take advantage of computer hardware and software evolution. Ever-increasing sizes of databases, driven by higher fidelity representation of terrain and targets, can be used by higher fidelity models, executed on faster processors and presented on higher resolution displays to give our warfighter a better picture of the battlefield. The commercial world is placing similar demands on computer technology, and takes advantage of the products industry delivers. We must structure our fielding plans to do the same.

An issue beyond embedded training which INVEST will address is reapidly reconfigurable force and equipment capability player models. This capability supports concept development and exploration. INVEST will provide repeatable results from scenarios executed for identical sets of inputs, for thier later use during operational testing. The program will explore simulations to prediction tools for opponent strategy, thus enhancing the commanders' situational awareness.

The goal of the INVEST-STO is to develop/demonstrate the technology that will lay the foundation for incorporating embedded simulation into future as well as legacy combat vehicles. This simulation capability will support training ranging from individual training, through crew training, to force-on-force training exercises. Along this continuum; however, there are many technological challenges. These range from the injection of artificial terrain into the driver's viewport for individualized training, to the intermixing of live and virtual images in the commander's and gunner's display for gunnery and tactical training. This includes all possible types of interaction, e.g., live on live, live on virtual, etc. Finally, there is the need to develop embedded simulation technology for command and control systems in order to provide complete and productive multi-echelon training.

The ES/ET application provides a new look at an age-old dilemma of what TADSS are needed. For the combat ready deployable force, electrons have overtaken stand-alone TADSS. Just imagine embedding the likes of MILES, TWGSS, TSV, SAWE, and CCTT into the ground combat system plus the added benefit of embedded simulation to attain: information dominance, situational awareness, battlefield visualization, mission rehearsal, critical decision-making, and course of action analysis. As the former CSA Sullivan said in his book, "Success is a journey, not a destination." The road to a fully embedded training and simulation system will be a journey to attain training and operational superiority in the 21st Century.

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Claude W. Abate is a Senior Military Analyst for Sherikon, Inc. and is currently supporting the Simulation Technology Division, Research and Engineering Directorate of STRICOM. He is a graduate of Florida Southern College and has a Masters of Science Degree from Florida State University. Prior to joining Sherikon, Mr. Abate was a career Army officer with a variety of command and staff assignments in the U.S. and overseas. As a retired Colonel, his experience includes a perspective as a training and doctrine developer and Training Brigade Commander at the U.S. Army Armor Center and School and as an opposing force commander at the National Training Center. He has two years experience working with PM CATT on training support materials for the Close Combat Tactical Trainer. His military schooling includes the Command and General Staff College and the Army War College.

Hubert A. Bahr is a Decorated Vietnam Veteran with 28 years of Federal Service. He received his BS degree in engineering from the University of Oklahoma in 1972 and his Masters Degree in computer engineering from the University of Central Florida in 1994. For the past 18 years, he has been involved with instrumented Force on Force Ranges. He is currently the lead engineer for the INVEST STO in the Research and Engineering Directorate of STRICOM. His research interests are in the areas of parallel processing, artificial intelligence, and computer architecture. He is also pursuing his Ph.D. at the University of Central Florida.

John M. Brabbs is a Senior Project Engineer at the U.S. Army's Tank-Automotive Research, Development and Engineering Center, where he has been employed since 1987. He is currently the Team Leader of the VETRONICS Simulation Facility (VSF) Team. His research interests are in distributed simulation, virtual reality, and software engineering. Mr. Brabbs holds a B.S.E degree in Computer Engineering and a Master's of Science in Computer Science both from Oakland University in Rochester, Michigan.

WHY THREE TANKS? *Continued from Page 29*

The T-64 series was essentially terminated in 1985, other than rebuilding of older models as T-64Rs (the R stood for "remontirniy" or rebuilt). The Morozov bureau (now under Sholin) started work on an as yet undisclosed tank prototype called "Molot" (the Hammer). They also put the definitive T-64 family engine, a six cylinder (twelve piston) engine called the 6TDF and producing 1,000 HP, in a modified T-80U chassis and produced the T-80UD in 1987. Leningrad and Nizhniy Tagil continued their upgrade battle. In 1988, the *Vagonka* announced the T-72BM, using a new generation of reactive armor called "Kontakt-5" and with the first elements of a self-protection system called "Shtora." This tank was offered for sale abroad. However, due to the poor performance of the export T-72M and T-72M1 tanks in Iraqi hands during 1991, they found no market for their tanks abroad.

The T-80 designers unsuccessfully adopted a turbine engine, dropped later for unreliability and poor fuel economy. It also shared the T-72's autoloader, a major vulnerability.

They found no market for them at home either. In 1989, when the Berlin Wall came down and the Soviet Union began to break apart, all orders for tank production came to a sudden end. Undaunted, both Leningrad (now producing its tanks in Omsk, as the Leningrad Kirov Factory was now just the "home office" and not a production center) and Nizhniy Tagil continued to produce tanks under the philosophy, "if we built it, they will buy it for the Army." No longer. The Omsk-produced T-80UM and T-80UK, both which were announced in 1992, have yet to find a buyer. The reborn T-72BM, now called the T-90 or T-90S as an export tank, appeared in 1990 and has likewise found no market yet.

But tradition continues. In 1997, at an arms display in Omsk, the Omsk tank factory displayed a number of their products, including a new version of the T-80 called the "Black Eagle." This appeared to use a new turret with a bustle mounted autoloader, which corrects the one fatal flaw of the T-80: when the fighting compartment is penetrated by a projectile, the ammunition detonates and blows the tank apart. This appeared to have some sort of blow-off plate arrangement like that found on the M1A1. And, in Russian tradition, it was done without the knowledge or approval of the Popov bureau in Saint Petersburg.

Conclusions

The Russians have always placed great stock in the "cult of personality." It was essentially due to that feature of their national personality, plus the sheer power of the *Oboronka*, that three tanks with nearly identical combat capabilities were in production at the same time. However, when compared with Soviet thinking and their artificially generated Military Science, only the T-72 really stands out as the tank which met all their requirements and needs.

Soviet thinking on tanks was that, while they had to fully flesh out the three qualities of a tank — protection, mobility, and firepower — they also had to be simple, reliable, and capable of moving long distances under their own power. The T-64, which was a true quantum leap forward in tank design in 1962, proved to be too troublesome and difficult to maintain. While the tank never saw combat, its legacy — the awkward autoloader device — was cited by authorities such as Colonel General Sergei Mayev and Colonel General Aleskandr Galkin as being indirectly responsible for the massive destruction among T-80 tanks sent into Chechya.

The autoloaders in both tanks were quite similar, and extrapolation would show that the T-64 would have been as vulnerable to penetration of the fighting compartment as the T-80 was.

The T-72 was a hybrid; for it combined the best of the past with the best of the new. Its autoloader was not as vulnerable or dangerous, and the tank was far more mechanically reliable and faithful. However, the T-72 garnered its own share of problems in the Gulf War, as the less capable T-72M and T-72M1 tanks were easily destroyed by first-line US and UK tanks.[4] This is one of the main reasons that the last model, the T-72BM, was hastily redesignated the T-90 to try and shake off the stigma from Iraq.

The T-80, initially thought to be a world-beating tank, has proven itself to be a dog in service. Still plagued with low mileage — even the most current advertisements for T-80UM do not claim more than about 485 kilometers road range, including the auxiliary tanks — the T-80 was shown in combat to suffer from the problems that Kartsev warned them about in 1964. The tanks burn nearly as much fuel at idle as they do at road speeds, and as a result most of the tanks which made the attack on Grozny on New Year's Eve 1994 ran out of fuel while awaiting assignments. The Chechens then simply picked them off. While current models have an onboard 18 kW generator set, the ones used in Chechnya were the same T-80BV tanks which once worried commanders in Germany when they sat across the border in the Thuringerwald.

There have been some signs that the Russians are trying to fix the problem which the *Oboronka* left them, and are planning to settle on only one tank for the future. But the squabbling still persists as to whose tank it will be, and whose philosophy will be dominant. The fight today is between "*parketniye generali*" — the armchair generals in Moscow, so named because of the elegant parquet flooring in their offices — who still dream of sweeping across Germany to the English Channel on fleets of tanks, and the reformers, who want first-rate weapons for the scores of local conflicts and regional wars which they see as more likely in the future.

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Notes

[1]The Soviets saw tank generations in this manner: 1920-1945, first generation; 1946-1960, second generation; 1961-1980, third generation; and 1981-present, fourth generation. Since the last really new tank design, the T-80, came out in 1976, they feel that they have not produced a true Fourth Generation Tank Design. In comparison, they count the M1, Challenger, and Leopard 2 as Fourth Generation and the LeClerc as Fifth Generation.

[2]This number reported by Colonel General Dmitriy Volkogonov soon after the breakup of the Union.

[3]All Soviet-era military equipment went through five developmental stages: conceptual design work, prototype construction work, factory testing, service testing, and series production. The KV was accepted after Step 2.

[4]A recent study pointed out that the T-72 export models, of which eight different ones were produced, were to be made using alternative materials, and not the first-rate materials in the Soviet domestic models. Reports in Russian press articles seem to indicate that the tanks used in Chechnya, T-72A models, were far more survivable than once thought.

Stephen L. "Cookie" Sewell entered the Army in 1968 as an Army Security Agency linguist, retiring as a chief warrant officer in 1990. Over the course of a 21-1/2 year active duty career, he learned both the Vietnamese and Russian languages, and also earned a BA in English Literature from the Regents College, University of the State of New York, in 1977. His active duty time was evenly split between strategic intelligence assignments and duty assignments in four heavy divisions — 1st Infantry, 1st Cavalry, 2nd Armored, and 3rd Armored. While serving with the 3rd Armored Division (1986-88), he was editor of the "OPSINT," the Division G-2 open source intelligence publication for the division, and produced three unclassified models of the Soviet T-80B, T-80BV, and 2S6 Tunguska AA vehicle for USAREUR training posters. He is currently an analyst for the National Ground Intelligence Agency.

Commander's Hatch

(from Page 8)

eral means. The battalion is composed of three companies, for a total of 44 tanks. Four companies with three tanks in each platoon, and three companies with four tanks in each platoon were the two competing options. The Armor and Infantry Centers participated in a thorough analysis in conjunction with TRAC and supported by personnel from the National Training Center. The three-tank platoon was found to be currently too fragile within the context of the larger organization and doctrine. Retaining a fourth company with three tanks in each platoon provided only an illusion of greater maneuver flexibility. This smaller, three-company battalion, equipped with near-real-time common situational awareness, is more agile, lethal and capable of precision maneuver.

A reduction in battalion size was also achieved by removing most CSS assets and centralizing them in a forward support company organic to each forward support battalion. New CSS doctrine and organizations will reduce the unit's footprint and provide a greater tooth-to-tail ratio. This enhanced logistics should produce efficiencies not possible through the current system of decentralized logistics operations.

The tank/mech battalions and brigade recon troop scout platoons were standardized at six vehicles per platoon. For the near term, these vehicles will continue to be HMMWVs and will be equipped with the Long Range Advanced Scout Surveillance System (LRAS3) beginning in 2001, and M3s in division and regimental cavalry.

Two other changes are important to the mounted community. The mortar platoon is reduced to four mortars and one FDC, vice the current six tubes and two FDCs. Complete elimination of this capability was deemed not prudent. Finally, the Mechanized Infantry Platoon is reorganized to three squads of nine riflemen each to address a recurring problem apparent from numerous NTC rotations and training exercises.

These are the major changes made in the heavy division. The Force XXI Division TOE is planned for first implementation [4th Infantry Division (M)] in FY 2000. A good deal of work is yet to be done in preparing doctrinal changes and restructuring school-house POIs. We must now get on with it. The esprit and dedication of tankers and cavalrymen in the Armored Force will make the Army's transition to the Force XXI Division a success.

Combat Medic Allocation:

Doctrine Works

by Captain Jeffery S. King

Task Force 1-67th Armor is conducting a movement to contact. As the lead team in the diamond formation, A Company is the first to come within direct fire range of the enemy. Although the team is doing well, they are taking losses. The first sergeant needs to get his injured off the battlefield and back to the medics at the aid station. His M113 and his maintenance track are picking up wounded and bringing the wounded back to his company casualty collection point (CCP). He has five soldiers on the ground and more are expected. The medics with their M113 ambulance are collocated with him and have treated the wounds. Now he must evacuate the soldiers to the aid station. What will he use to move them back? If he sends the medics, then he will have no medical treatment at his CCP. He has no other vehicles to use because they are forward evacuating to him. He finally calls the aid station requesting evacuation. He now waits for a vehicle to move to his location, pick up his patients, and return to the aid station so his soldiers can receive definitive medical care from a physician or physician's assistant. Time is running out, and his soldiers are nearing death. If only he could save some time.

This is an all too common scene at the National Training Center (NTC) at Fort Irwin. Although company/teams develop good maneuver plans and supporting logistical plans, they tend to start their rotation behind the power curve when it comes to medical treatment and evacuation. Most task forces improve in their medical evacuation and treatment by the end of the rotation. For the last 14 rotations, the Died of Wounds (DOW) rate tended to drop from an average of 48% to 35%. In researching the reason behind the DOW rates, "time" and "left on the battlefield" account for the preponderance of soldiers, as seen in Figures 1 and 2. The other categories for died of wounds are "improper treatment," "improper evacuation," and "ROE violators/lost MILES cards." Of all of the categories of DOW, time, and left on the battlefield are the most affected by improper planning and execution of the medical evacuation system. If units can master the planning early, they will evacuate all soldiers off of the battlefield in proper time to save lives and conserve the fighting strength.

Most units that come to NTC plan on using the senior medic riding in the supporting pre-positioned M113 ambulance as the company medic. This is the concept which causes first sergeants a great deal of frustration, as seen in the previous example. The time spent trying to acquire evacuation assets results in the urgent patients losing time and becoming DOW casualties.

To counter this problem, units only need to research their MTO&E and aggressively use doctrine. In armor and mechanized infantry battalions, the medical platoon is divided into four sections or paragraphs by the MTO&E. (See Figure 3)

The intent is to use the combat medic section as the treatment for the company teams. The company medics are attached to those companies and are with them 24 hours a day. The senior medic rides with and works alongside the first sergeant and provides the medical expertise to the company's logistics plan. The combat medic ensures that all combat lifesavers are trained and fully stocked with Class VIII. It is the combat medic's responsibility to run the company CCP and provide lifesaving care to patients awaiting transportation to the aid station. The company relies on the combat medic to synchronize evacuation with the aid station. In this role, the company combat medic will become the "ad hoc squad leader" for the company's medical team, which includes the pre-positioned M113 ambulance. As the squad leader, the combat medic will brief the ambulance team on the company's mission and concept of operations. This medic will conduct the pre-combat inspections of the ambulance team to ensure that all company PCIs are completed.

Should the battalion cross-attach the company to another heavy task force, the combat medic will stay with the company. The new task force will position another M113 ambulance forward for evacuation. If the company is attached to a light task force, the M113 ambulance should then become part of the attach-

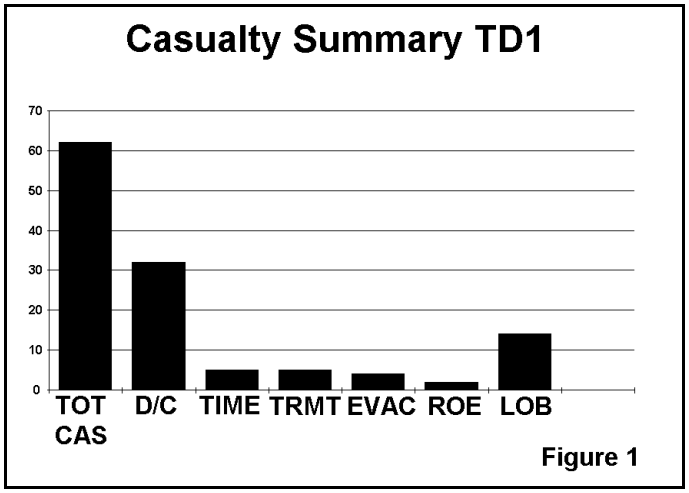


Figure 1

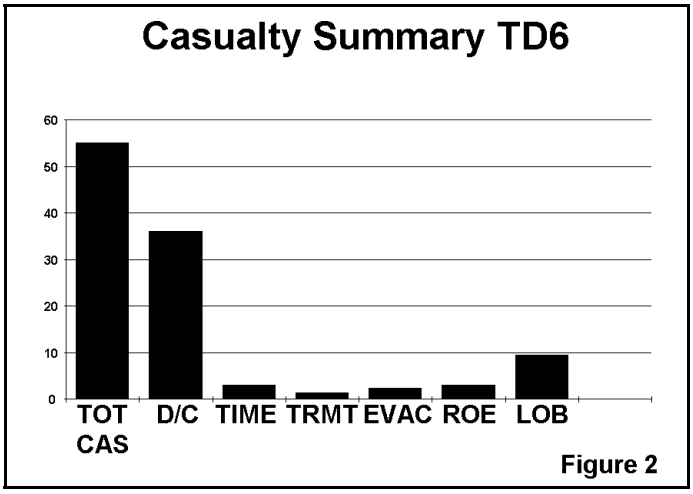


Figure 2

ment. Using this concept of the combat medical section, the evacuation of soldiers should become less trouble for the first sergeant. The pre-positioned evacuation vehicle can now transport patients to the aid station while the senior combat medic runs the CCP. There is no loss of medical care at the company/team level.

The above technique secures the command and control of evacuation vehicles moving within a task force's maneuver space. The assigned medical platoon must understand their task force's Standard Operating Procedures (SOPs) for marking and movement during offensive and defensive operations. There will then be less likelihood of fratricide due to direct fire and obstacles. Again, the senior combat medic, working with the first sergeant, is the key to coordinating the evacuation with their new supporting medical platoon. This provides the ability to rotate evacuation assets to the company/team. As the evacuation M113 moves to the aid station, they can call in a casualty report which could be the trigger for the aid station to send another ambulance forward to the company team. Using this technique, the medical platoon will shorten the time that the first sergeant does not have standard evacuation assets in the company/team. (See Figure 4)

Using the combat medic section in this way also provides the medical platoon leader more flexibility in his support of the task force. In the scenario, each company/team had an evacuation vehicle which was used as its company medic transportation vehicle. This strips the medical platoon of four ambulances and, as a result, the task force of fifty percent of its standard evacuation assets. As a result, the task force would only have four standard evacuation platforms to transport patients from the company/teams to the aid station. This is a total of 16 litter patients prior to nonstandard assets being utilized. This also limits the ability of the platoon leader to position his assets to the area of casualty densities. A technique to help the medical platoon leader to better manage his assets is by anticipating the casualty densities through participating in the task force's wargaming process. From this, the medical platoon leader can identify which company/team is expected to receive the most casualties at the outset of hostilities, and he can position more ambulances with that company's first sergeant. With the use of all eight evacuation vehicles, the medical platoon greatly enhances its ability to conduct proactive pre-positioning to a specific unit without jeopardizing the support to the rest of the task force.

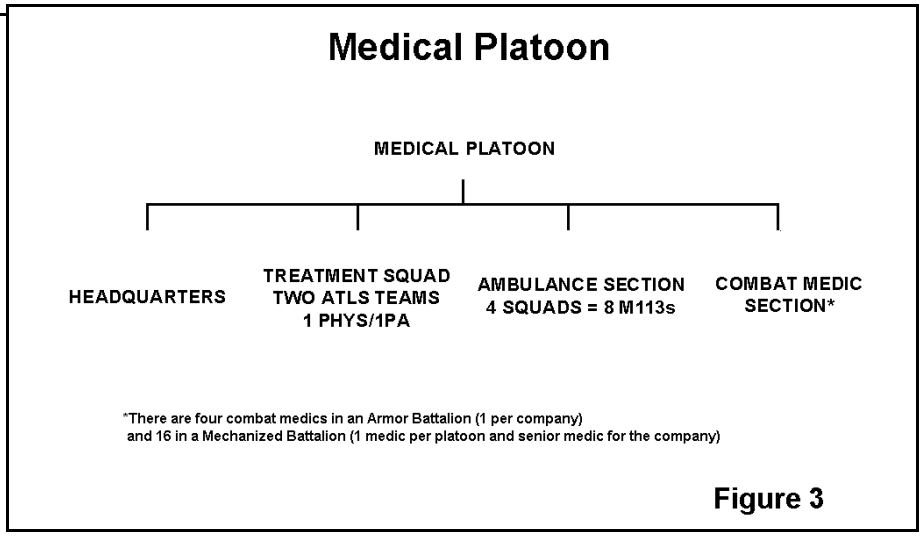


Figure 3

Most units that come through the National Training Center say that they do not have the manpower to fill the combat medic section. The platoon has the personnel to use the combat medic section, but priority goes to filling the driver and TC positions in the evacuation vehicle positions. The combat medic section is the first one to be stripped. A technique to fill the medical platoon and maintain the combat medic section is to prioritize the combat medic section first and then the drivers and TC position. Those that are left open are priority fills for the task force.

Should deployments or critical training events occur, these positions should be on the critical shortage list. The task force should request augmentees from the supporting forward support medical company. In this technique, the combat medic will already be positioned with the company/team. The first sergeant will have his point of contact for medical information and medical evacuation.

This relationship should not only exist in tactical environments, but should maintain strength in garrison. The combat medic should take an active role in the unit's training and everyday life while conducting daily routines at the unit. During this time, the combat medic could continue the education of the combat lifesavers and conduct necessary classes requested by the first sergeant. The combat medic should also keep the first sergeant informed on the medical status of the company for deployments. In this way, the combat medic will become an integral part of the company/team.

By properly using the combat medic section of the MTO&E, task forces can aggressively attack the problem of treating and evacuating all soldiers from the battlefield to the battalion aid station. In using the combat medic in the planning and execution of the medical fight, the DOW rate will drop for both time and left on the battlefield. The combat power will stay ready to face the enemy. And the will to fight and win will increase because soldiers know that they will be taken care of should they get injured.

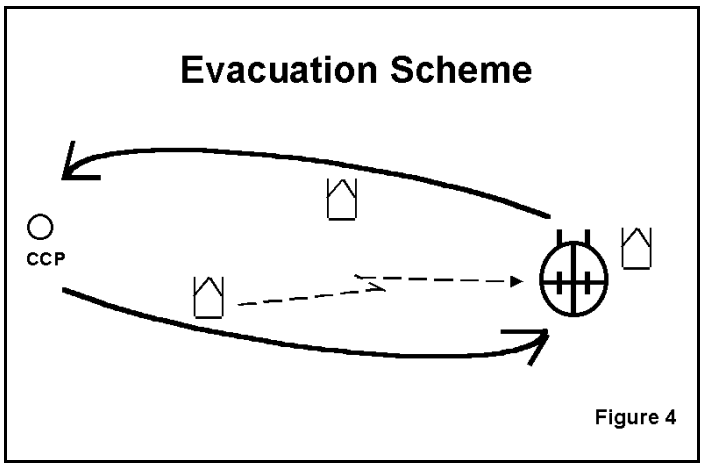


Figure 4

CPT Jeffery S. King received his commission in the Medical Service Corps from Texas Tech University in 1987. He has been a medical platoon leader in the 82nd Airborne Division, and a forward support medical company commander in the 10th Mountain Division. Since September 1996, he has been the medical platoon Armor and Cavalry trainer at the National Training Center.

TACTICAL VIGNETTE 98-4

Stability and Support Operations in Athia

"Showdown at Bruechville"

Scenario:

You are deployed in theater as part of a United Nations force where you have been assigned stability and support type operations (SASO), primarily peace enforcement and support of the humanitarian assistance efforts of non-governmental organizations (NGOs). The threat in the area is from the Athian faction, which is not satisfied with the United Nations' resolution of border disputes or redistribution of international aid. Athian equipment includes BRDM-1s and OT-64s, which they have been flaunting in violation of the U.N. accord by using their armored vehicles to escort other vehicles and equipment around in your area of operations**.** Additionally, Athian activity has thus far been limited to mild anti-United Nations demonstrations and graffiti. Recent intelligence indicates insurgent forces are suffering food shortages brought on by harsh winter months. Current rules of engagement now allow the use of deadly force when necessary to protect lives, critical equipment, and all U.N./host nation facilities.

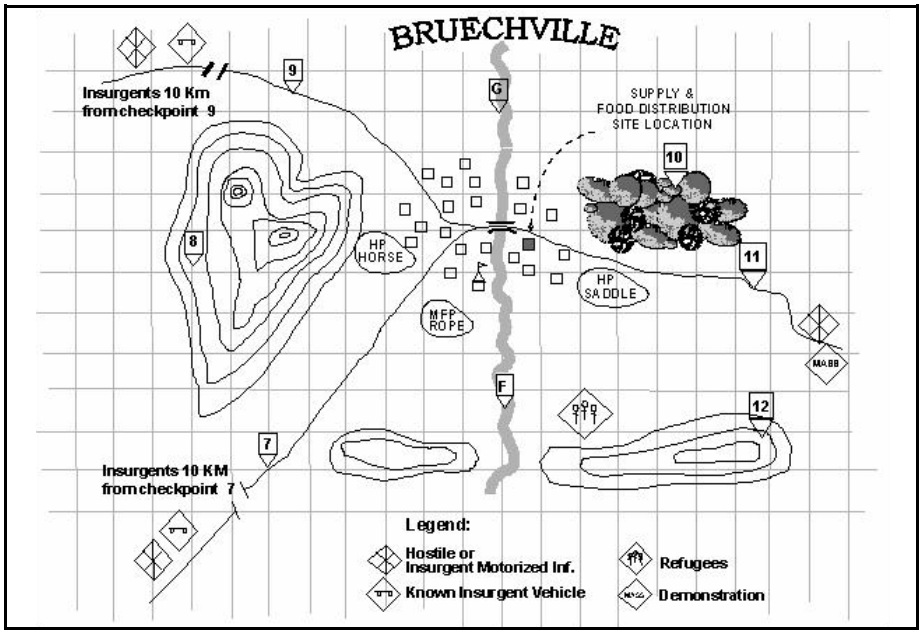
General Situation:

You are the commander for Blackhorse Troop 1-23 Cavalry, an armored division cavalry squadron. Your assets include two scout platoons (1st and 3rd Plt) of M3 Cavalry Fighting Vehicles, two tank platoons (2nd and 4th Plt) of M1A1 Abrams Main Battle Tanks, a mortar section, one up-armored fire truck and one tank and pump unit, carrying high-pressure water cannons. Additionally, there is a team of OH-58D(I) Kiowa Warriors (KWs) on station from Delta Troop that are under squadron control. The KWs are each carrying 300 rounds of .50 caliber and two Hellfire missiles.

Mission:

B/1-23rd Cavalry conducts area security operations centered on the village of Bruechville to protect food distribution points and other critical facilities against Athian insurgent threats.

You have been issued non-lethal weapons for crowd control, to include water cannons, pepper spray, and CS grenades. You are conducting an area security mission to protect and control the distribution of food and medical supplies at a recently resupplied food distribution center. Your 1st platoon is assigned Check Points 7 and 9, the terrain west of the river, with its sister platoon (2nd) established in Hide Position Horse. Your 3rd Platoon is responsible for the river and the terrain east of the river, with its sister platoon in Hide Position Saddle. Your mortars are in Mortar Firing Position Rope.



The Action Begins:

Ten minutes ago, the squadron S2 informed you that JSTARS reports two convoys approaching your position from the west on each of the major roads. Both convoys have approximately 20 vehicles, of which about half appear to be armored. The **squadron commander FRAGOed** the KWs to reconnoiter the convoys to determine their exact location and disposition. You plot their location to be approximately twelve kilometers west of CPs 7 and 9.

You receive the following **SPOTREP** from your 3rd platoon: "*Black 6, this is Blue 1. We have a crowd of approximately 200 pro-Athian sympathizers on foot, moving on the road toward the resupply area, current location is two kilometers west of CP 11. We have identified known Athian black list personnel among the demonstrators. Also, a roving patrol has found five empty dump trucks hidden in the wooded area north of HP Saddle. The truck drivers state they are taking a lunch break from their road construction project*." Although you have been briefed on all construction projects in your area, you are unaware of any projects in your immediate AO.

The **KWs report** that both convoys are approximately ten kilometers west of CPs 7 and 9 respectively. The northern convoy consists of 3 BRDMs, 5 OT-64s, and 12 GAZ cargo trucks. The southern convoy consists of 5 BRDMs, 6 OT-64s, and 9 GAZ cargo trucks. Every armored vehicle has women and children riding on top. The OT-64s are equipped with 14.5mm heavy MGs, and BRDMs equipped with 12.7mm heavy MGs. The paramilitary soldiers have RPGs and SA-7s. They further report that the road is bordered on both sides by restricted and severely restricted terrain.

Requirement:

Take five minutes to assess the situation and formulate a FRAGO. Issue your FRAGO as if talking on the radio. Submit your solution to the Cavalry Branch by e-mail at: HoskinsonT @ftknox-dtdd-emh5.army.mil, or mail your solution to ARMOR, ATTN: ATZK-TDM, Fort Knox, KY 40121-5210.

SOLUTIONS - Tactical Vignette 98-2

THE PROBLEM:

"Defense of Kozda" from the March-April 1998 issue of ARMOR

Situation

Enemy. The S2 reports that within the brigade's area of operations, the 13th MRD is conducting an attack to seize Kodza Airport, a key logistical site, that will allow enemy forces easy access into the theater of operations. Within the battalion's area of operations, the 3rd MRR is conducting an attack to seize the city of Kodza. This will allow the regiment to seize additional logistical sites (hospital, stores, and water) that will support the division.

The most probable course of action is for the 3rd MRR to attack along Avenue of Approach 1, enveloping the TF from the west, and maximizing its combat power. The most dangerous course of action is for the 3rd MRR to attack with two MRBs abreast, forcing us to fight in two directions and denying us the ability to concentrate our combat power.

Friendly. TF 3-37 defends BP 22 at 260630SEP98 to destroy enemy forces in EA Crush in order to protect the western flank of the brigade's main defense in the vicinity of the Kodza Airport.

Company Situation. You are the commander of Charlie Team (tank heavy), TF 3-37. You are the main effort of TF 3-37 that is defending in sector. The brigade commander wants the task force to protect the west flank of the BDE main effort TF 2-10 AR, which is defending a key logistical site (Kodza Airport) east of the city of Kodza. Delta Company has been attached to TF 2-10. TF 3-37 is arrayed with two companies forward and one back. Bravo Team is occupying BP 1, oriented on TRPs 2 and 3. Alpha Team (mech) is occupying BP 3, oriented on TRPs 2 and 4. The TF commander's intent is to destroy the enemy in EA CRUSH by establishing a deliberate defense on BP 22, reinforced by extensive obstacles in the engagement area; this will deny the enemy from seizing the city of Kodza (See Figure 1).

Your team consists of two M1A1 tank platoons and one infantry (BFV) platoon and a MANPACK Team. You have priority of mortars and are responsible for triggering artillery targets AB001 through AB003. Currently, the company is occupying BP 2, oriented on TRPs 1 and 2, and is backed down in turret down positions, having withstood an initial artillery bombardment. However, you have taken some losses.

1st Platoon (mech) is down to 3 BFVs, while 2nd Platoon reports that one tank has received heavy track damage and another suffered severe gun tube damage. 3rd Platoon reports no damage to any of its tanks.

Bravo Team has just made contact and destroyed three BMPs, and the TF scouts in the west report that the MRB will be in their sector within the next 15-20 minutes. As you are monitoring these reports, you hear Terminator 6 (TF commander) trying to raise the Alpha Team commander or his XO. He has lost all radio communications with Alpha Team, and the last transmission the A Team commander sent was that he was engaging three armored vehicles and was down to 9 vehicles. The TF commander now believes that the MRR is attacking with two MRBs abreast along Avenues of Approach 1 and 2. The TF scouts in the east confirm this by reporting that an MRB is moving fast along Avenue of Approach 2 and will be in Alpha Team's sector within the next five minutes. The TF commander believes that the enemy will successfully penetrate Alpha Team's position, leaving his flank exposed. He orders you to block penetration of Alpha Team's sector. You must act now! What do you do?

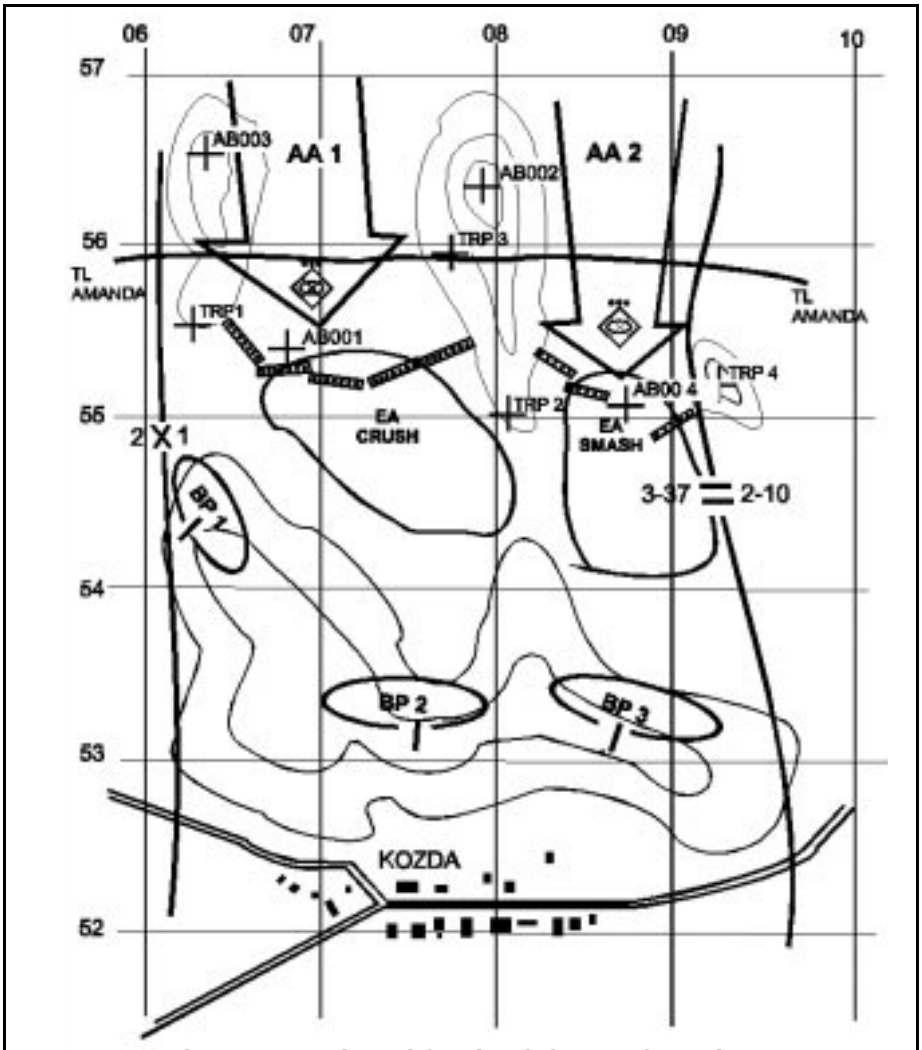


Figure 1. Mapboard for the defense of Kozda.

THE SOLUTIONS:

Author's Solution

FRAGO

GUIDONS, this is BLACK 6, FRAGO follows.

Situation: The TF scouts have reported a second MRB moving in the east and closing on TM A's position. The TF commander has lost all radio communications with TM A; the last transmission the TM A commander sent was that he was engaging three armored vehicles and was down to nine vehicles. The TF commander is concerned that the enemy will successfully penetrate TM A's position, leaving the TF eastern flank exposed. BREAK.

Mission: TM C establishes a hasty defense vicinity 083537 to destroy enemy forces in EA SMASH to prevent penetration of the TF's eastern flank. BREAK.

Intent: We will accomplish this mission by splitting our team in two and fighting on two fronts. BREAK.

Tasks to subordinate units:

RED (MECH), maintain your current position and be prepared to reinforce BLUE in the east. BREAK.

WHITE, have Alpha section maintain their current position (damaged vehicles) and have Bravo section follow BLUE to the east. Once BLUE establishes a hasty defense, have Bravo section establish a position to BLUE's left flank. BREAK.

BLUE, move your platoon to 083537 and establish a hasty defense oriented on EA SMASH. You are the main effort. BREAK.

BLACK 5, maintain your current position and take control of the fight in the west. I will move with BLUE. BREAK.

FIST, follow me and establish a position where you can call for effective fires. BREAK.

BLACK 7, maintain your current position. Be prepared to conduct logistical support across two fronts. BREAK.

RATIONALE

The TF commander has ordered me to block the penetration of TM A's position. However, leaving my current position entirely leaves the center of the TF's defense vulnerable to penetration.

Splitting my company team in two will allow the TF to maintain greater lethality on two fronts. Furthermore, leaving my XO, a section from RED, and the two damaged tanks from WHITE at BP 2 gives me organic assets to protect my western flank as I reposition the rest of my forces to BP 3. To maintain command and control of the company team, the XO will control the fight from BP 2. I will move with Blue and a section from RED. As the most experienced officer, it is logical for me to take charge of the fight in the east (BP 3). My first priority once I get to BP 3 will be to establish a hasty defense anchored on the left flank of TM A. Second, I will attempt to regain communication with TM A. Third, I will determine what TM A's combat strength is and take control of those assets if the leadership of TM A has been killed. Fourth, I will contact the TF commander and update him on the situation and provide him with any recommendations, if applicable.

AUTHOR'S NOTE: We purposely reduced the unnecessary verbiage staying away from the perfect school house solution that would be unrealistic in the heat of battle. We want to provide to the readers a quick realistic FM fragmentary order from the company commander to his subordinates.

SOLUTION A

(Submitted by SFC Gregory Burbo, doctrine writer, assigned to B CO, USAARMC, Fort Knox)

COMANCHES, this is COMANCHE 6, FRAGO follows. The enemy is attacking along both northern axes of approach. Terminator 6 has lost commo with the Apaches, their last message stated that the Apaches had taken some losses at BP 3. We must assist the Apaches in stopping the enemy in engagement area SMASH to protect the battalions flank. (BREAK)

COMANCHE 5: Move yourself and the remainder of RED with WHITE'S 2 FMC tanks to a position vic grid 079634 orient on EA CRUSH between AB 001 and TRP 2. Control all indirect fires from your position. Be prepared to reinforce myself and BLUE vic grid 094553. Report when set. (BREAK)

WHITE: Move your 3 and 4 tanks to a position vic grid 076534 have them report to COMANCHE 5 when set. Move yourself to a position near your 2 tank and attempt to get his track repaired. Be prepared to resupply Comanche 5 and your 3 and 4 tanks as needed. Report when you are set. **(**BREAK)

RED: Move your remaining elements to a position vic grid 076534 and report to COMANCHE 5 when set. (BREAK)

BLUE: Move your platoon with me to a position southeast of BP3 vic grid 094533 to block the enemy penetration. We will orient from TRP 2 to TRP 4. (BREAK)

STINGER: Move your team to a position vic grid 075533 and provide the team with Stinger support. Report when set. (BREAK)

FIST: Move to a position vic grid 075533 and prepare to provide fires to the company team. Report when set. (BREAK)

COMANCHE 7: Move the company trains to a position vic grid 085523 and execute our CASEVAC plan. On order conduct emergency resupply of BP2 and/or my location vic grid 094533. Report when set. (BREAK)

COMANCHE 6 will be located with BLUE vic grid 094533 send all calls for fire through COMANCHE 5. (OUT)

ONE MINUTE LATER THE FOLLOWING RADIO TRAFFIC IS SENT:

TERMINATOR 6 this is COMANCHE 6, I am moving myself and BLUE to a position vic grid 094533 time now. I will attempt to regain contact with you once set. (OUT)

FIST this is COMANCHE 5, Fire AB 002 and AB 003 time now. (OUT)

FIVE MINUTES LATER THE FOLLOWING RADIO TRAFFIC IS SENT:

TERMINATOR 6, this is COMANCHE 6, set vic grid 094533. I have commo with the Apaches 6; he is down to 6 operational victors and engaging 4 enemy

vehicles vic grid 087545. I am engaging 7 enemy vehicles vic grid 093548 heading south along the hardball. (OUT)

COMANCHE 5, this is WHITE 1, I am with White 2 set vic grid 071534. (OVER)

COMANCHE 5, this is RED 1, all Red elements are set vic grid 077534. (OVER)

COMANCHE 5, this is WHITE 4, White 3 and myself are set vic grid 079533. (OVER)

COMANCHE 5, this is FIST. I am set vic grid 075533. (OVER)

COMANCHE 5, this is STINGER. We are set vic grid 075533. (OVER)

FIST, this is COMANCHE 5 fire AB 001 time now. (OUT)

COMANCHE 5, this is COMANCHE 7 set vic grid 085523. (OVER)

RATIONALE

We have been ordered to block the enemy penetration of Apache's sector. However we have not been totally relieved of our original mission of defending BP 2. By taking BLUE with me to a position southeast of BP3, I can reinforce the Apaches and should have enough firepower to force the attacking MRR to ground in or near EA SMASH.

I should also be able to regain commo with Terminator 6. This also puts me in a position to be able to take charge of the Apaches should I find their command elements dead. By leaving COMANCHE 5 with White's 2 FMC tanks and the remaining RED elements and moving them to the east side of BP 2, I am able to still engage the enemy in EA CRUSH. This also places them in a position from where they can quickly reinforce the Apaches on BP 3, or my element vic grid 094533, if needed.

By moving WHITE 1 to a position near his down tank he may be able to get it up and give us that additional firepower. If not, he is in a position to resupply COMANCHE 5 and his two FMC tanks as needed. The Stinger team and FIST is now in a more secure position, which will still allow them to give the company protection from air attack. Comanche 7 is now in a more secure position from where he can execute our CASEVAC plan and resupply either BP 2 or BP 3 as well as my element vic grid 094533 as needed.

SOLUTION B

(Submitted by CPT Ukeiley, USMC)

FRAGO

Guidons, this is Charlie 6 FRAGO follows.

Situation: MRB advancing south AA2. FSE at 55 Northing in 5 mikes. Bravo in good position to cover AA1. Alpha needs help.

Mission: Team Charlie establishes hasty battle position overlooking EA Smash in order to destroy enemy advancing along AA2.

Tasks to subordinate units:

FSO: Immediate obscuration fires to screen company movement.

1st Plt (Mech): Establish hasty BP vic grid 083536 oriented northeast on EA SMASH in order to destroy MRB. Conduct physical link-up with Alpha's left flank.

2nd Plt: Company reserve. Maintain current position and mission. Get damage fixed ASAP. Be prepared to reinforce.

3rd Plt: Main effort! Establish hasty BP vic grid 081539 oriented northeast on EA SMASH in order to destroy MRB.

XO: Get maintenance contact team to 2nd now!

RATIONALE

No plan survives contact with the enemy; the plan is nothing more than a common basis for change. With a confirmed MRB on AA2 and no answer from Alpha, I must act decisively in order to accomplish the brigade CO's intent. His intent is to destroy the enemy in order to retain possession of key terrain, Kodza. Whether Charlie destroys the enemy in EA CRUSH or EA SMASH makes no difference so long as the enemy is destroyed and we retain Kodza. This is why I must understand not just my TF commander's intent, but my brigade commander's as well.

In order to accomplish this, the MRB advancing into EA SMASH must be destroyed. With only nine of fourteen vehicles remaining, Alpha is in trouble and must be reinforced. This is the decisive action that will accomplish the intent. Bravo is in good shape and position to defeat the MRB advancing into EA CRUSH. Additonally, by changing battle positions, I am introducing doubt into the enemy commander's perception of the battlefield.

With heavy incoming artillery and the chaos and confusion of my troops in combat for the first time, I must keep things simple and direct. I must leave my subordinate leaders maximum room for initiative by providing clear mission and intent. Each platoon has been given a very specific task and purpose over the tac net.

With less than five minutes before MRB is expected in EA SMASH, speed is critical. Concise and direct orders facilitate this. Team Charlie must be in its new hasty BP before the bulk of the MRB combat power is in direct fire range. As the move from our current BP to our new BPs is less than 500 meters, time and space factors must be considered. Even with such a short move, it will be close.

First, the accurate enemy targeting of my BP and Alpha's confirms that I am under observation of enemy FO teams. I must blind them in order to regain freedom of maneuver and retain tactical surprise. I am dropping smoke to blind enemy FO teams. I doubt they have thermal sights within their FO teams. Even if the smoke alerts the enemy as to movement, he will not know what I am doing or why.

I sent 1st Plt to actually link up with Alpha for numerous reasons. First, I want to gain situational awareness as to what is happening at their position. Second, the mech infantry platoon with dismounts provides flexibility in coordination, linkup, and assistance to Alpha that an armor platoon will not.

With 2nd Plt degraded, I leave them in position as company reserve and task my XO with getting them mission capable. In addition, this leaves the XO as my directed telescope with eyes on the original EA to deal with unexpected contingencies. If the situation requires, there is still a platoon of shooters overlooking EA CRUSH to destroy any enemy forces that bypass Team Bravo. If not, I can mass the company at EA SMASH.

3rd Plt is now my main effort as they are still at 100% effectiveness and their four tanks (plus mine) will provide the mass of company combat power. 3rd Plt is my decisive bid for victory at EA SMASH. As the terrain dictates that enemy mechanized forces will be naturally channelized to the east along AA2, this will present 3rd Plt with flank shots as the enemy closes.

The mission has changed, yet the intent remains the same. Destroy the enemy MRB and prevent enemy seizure of Kodza.

when I first read it. The mildest thing I can say is that it is an unproved conclusion drawn from faulty assumptions. As serving soldiers, it is our duty to train our soldiers to win on the battlefield. How can we do this is we believe defeat to be inevitable? If we really believe this, then why are we continuing to draw pay and wear funny clothes?

MATTHEW D. STANCHFIELD
SFC, MT ARNG

Marine Light Armor Tested "Global Cavalry" Concepts

Dear Sir:

The ideas contained in "Global Cavalry" are becoming more and more important as the U.S. Armed Forces further evolve into a joint force for the next century. Light armored forces can provide a unique capability to the warfighting CinC. The Marine Corps has been looking hard at this concept for the last two years. Many of the concepts put forth in Captain Riggs' article were put to the test during Exercise Deep Strike, conducted in the American Southwest in the summer of 1997. It provided some insights which may be helpful in further developing the ideas presented in the article.

Captain Riggs argues that a strategically airlifted light armored force can provide "...a rapidly deployable mounted force to get where it is needed (within hours) and have credible combat power once on site." The Marines have tested this concept principally, but not exclusively, from a maritime perspective. The Deep Strike Force was organized with a modified MAGTF structure, consisting of a TF Command Element, primarily sea-based CSS and Air Combat Elements, and a Deep Maneuver Element deployed ashore composed of three light armored reconnaissance battalions. The force was introduced into an immature theater by multiple means; a 900 km overland road march from a friendly host nation (Utah); by operational maneuver from the sea by a naval expeditionary force (off the coast of Southern California) and by strategic airlift into a 'safe haven' (in Arizona) seized by, in this case, a helicopter-borne force.

Light armor offers great flexibility in projecting forces. The article puts an emphasis on the forced entry of light armored units into a land-locked theater. Light armored forces can be introduced by strategic airlift; however, for Marine light armor to forego maritime sustainment for an extended period of tirne, Deep Strike planners determined that:

(1) A safe haven (including an airfield) had to be seized prior to the LAV force's arrival.

(2) A sizable light armored force could be quickly landed at the airfield (lift capability ranging from 8 LAVs per C-5 to one LAV per C-130).

(3) A robust CSS capability had to be established at the safe haven.

(4) Heavy forces (one company of M1 tanks) had to arrive at the safe haven (NLT D+3).

Thus, the land-based tactical footprint of LAV units becomes more extensive and more complex if sea-based support is severed. Regarding the ingress of airlifted LAV forces, we did not explore the problematic issue of a forced entry by LAVs via aircraft without securing the landing sites by infantry forces. If the situation is sufficiently developed, perhaps a minimal control agency (probably provided by TF SOF) could insert pre-D-Day and guide the LAV-laden aircraft to their landing sites. If inserting an 'LAV-pure' battalion/squadron is difficult, then getting them out is more so. Only when planning for short duration limited (company raid) operations does the footprint at the departure site become small enough to quickly egress an LAV force by air.

It is impossible to create a viable light armored force on the battlefield that is not built around a Family of Vehicles. The essential mobility, survivability, and supportability of Marine light armor is built upon this fundamental. Direct fire weapons, antitank missiles, and indirect fire mortar vehicles are on one LAV chassis. One strength of Marine light armored forces is that the company and battalion combat trains are equipped entirely with LAVs; only battalion field trains are not composed of LAVs. This allows an LAV-pure force to maneuver on the battlefield, often for days, with unprecedented independence of action.

As the author points out, light armored forces depend upon "the effects that the organization can bring to bear." LAV forces need weapons that kill their opponents. That is the factor in optimizing the lethality and survivability of LAVs. When weighing the tradeoff between less crucial factors, such as mobility, and armor protection, LAVs should lean heavily in favor of mobility. If you have a weapon(s) that can destroy your foe, the need for armor protection "equal to or greater than that of the BFV" is secondary to vehicle mobility and agility.

The author's proposed troop structure is fundamentally sound. The need for organic 120mm mortar fire support is critical and the rake/mine detector capability will be effective in reconnaissance missions. The ability to receive data from ASAS, UAVs, and JointSTARS should provide the situational awareness needed on the modern battlefield. One problem area is the LAV-90mm/105mm gun. LAV hulls are poor platforms for large caliber guns. A more likely solution would be the TOW or LOSAT. It is more probable that a 'fire-and-forget' missile system or energy weapon will be developed before a large gun can be made for an LAV hull.

At the LAV battalion/squadron level, the independent nature of LAV forces brings one command and control issue to the fore. The author points out that a robust C^4I capability, or lack thereof, will make or break an LAV force. Due to the operational distances involved when deploying an LAV force, many tactical information systems are stretched to the limit. Tactical satellite communications are essential for all maneuver battalions. A key requirement for LAV forces is the ability to use satellite communications while on the move. This is often the C^4I Achilles heel of LAV forces.

Captain Riggs makes a compelling case to create a light armored option for the warfighting CinCs. The foundation for his squadron/troop structure is solid. Is he replicating a capability already extant in the Marine light armored reconnaissance battalions? Perhaps so. The current Marine structure possesses the capabilities of Captain Riggs' "global cavalry," to greater or lesser degrees, save one: The detailed and comprehensive C^4I architecture. The author builds a unit that would allow the light armored force to operate independently in the joint arena. The big question is: Is the C^4I difference significant enough to warrant the investment in resources and structure to create a global cavalry capability within the United States Army?

LTC MICHAEL M. WALKER, USMCR
Commanding Officer
4th Light Armored Reconnaissance Battalion

Best "Global Cavalry" Mounts Are M113s, Not LAVs

Dear Sir:

In "Global Cavalry," *ARMOR*, Mar-Apr 98, CPT Riggs argues convincingly for a "mounted rapid deployment force." The article seems well thought out, in every aspect... except for one: Like so many articles and letters before, CPT Riggs wishes to equip this cavalry force with variants of the USMC LAV.

LAV proponents continually ignore the reality that the leadership has said **there is no money** to buy a new light armored vehicle that would be unique to one or two units. Why would the Army be willing/able to buy LAVs, when it can't/won't purchase XM8s?!

There is a fiscally-viable alternative, however, and it's already in the system: The M113 APC (and certain of its variants). The M113 is the equal of the LAV in most respects, and superior in some.

Categories where the M113A3 and the LAV-25 are equal:

- Armor protection.
- LVAD/LAPES capability.
- Swim without preparation.
- CH-47D transportability.
- Combat weight.
- Acceleration.
- Cross-country speed.
- Maximum grade climbed.
- Vertical wall crawled over.

Areas of LAV-25 superiority:

- Stabilized, turret-mounted, 25mm cannon.
- Much higher road speed.
- Greater cruising range.

- Maximum trench width that can be crossed.

Areas of M113A3 superiority:

- Armament can be "tailored" to mission requirements.
- Can carry almost twice as many dismounts.
- Externally-located fuel tanks.
- Track is less vulnerable to damage from small arms fire, flame, debris, than are tires.
- Maximum side slope that can be traversed.
- Minimum turning diameter.

It is only necessary to look to the Vietnam War to see that M113-variants have been successfully employed — **in combat** — in all of the roles envisioned by CPT Riggs. We don't need to buy a new light armored vehicle — we need to make full and effective use of the one we've got!

STANLEY C. CRIST
San Diego, Calif.

Correction

Dear Sir:

A correction to the article, "Back from Haiti, then on to Bosnia, The Army's "Light ACR" remains "Always Ready," (Nov-Dec 97) is in order. The Regimental Aviation Squadron did not relocate from Fort Benning, Georgia, as published but from Fort Bragg, North Carolina.

Incidentally, in August 1997, the squadron deployed its 31 OH-58D (I) Kiowa Warrior helicopters and 15 UH-60 Blackhawk helicopters to Bosnia. After a trip spanning 5 countries, the squadron closed on Comanche Base in early October, assuming all responsibilities for aviation in Multi-National Division North on 17 October 1997.

To date, the squadron has flown nearly 5000 hours in support of Task Force Eagle. The squadron remains an integral part of the regiment in Bosnia. Consistently developing air-ground integration with the Cougar and Wolfpack Squadrons, the "Winged Dragoons" also provide support to the Danish, Swedish, Polish, Russians, and Turkish elements that make up Task Force Eagle.

DAVID L. LAWRENCE
LTC, AV
Commander, 4/2 ACR

Author Seeks Respondents

MAJ Donald E. Vandergriff, a frequent *ARMOR* contributor, is preparing a new book entitled *Atmosphere of Thought: The Impact of Institutional Culture on Combat Effectiveness,* which deals with reform of the Army's culture and personnel policies. He is seeking retired general officers willing to complete a questionnaire assessing their opinions of these subjects. His address is 12852 Mill Brook Court, Woodbridge, VA 22192.

Is Our Spur Program Identifying Excellence?

by ANCOC Class 98-01D

The "Cavalry Spur Programs," administered by many cavalry units to recognize excellence, have in many cases lost their focus, according to 11 sergeants first class in 1st Platoon of ANCOC Class 98-01. They have suggested guidelines for tightening qualifications and standardizing the programs. -Ed.

The cavalry spur program has always been used to recognize those soldiers who have displayed excellence amongst their peers. As a group, after reflecting on the various unit spur programs we have seen or been a part of, ANCOC Class 98-01D, 1st Platoon, has identified a concern that many programs have become misguided. The spur program should be administered and conducted in such a manner as to increase CMF 19 *esprit de corps* and protect the integrity of the program.

Other CMFs have their own methods for recognizing soldiers of distinction, such as the Expert Infantry Badge or the Expert Field Medical Badge. The cavalry spur program is ours, and as unit commanders and senior NCOs, we control the direction in which it develops. As 11 sergeants first class, from 11 separate cavalry assignments, we have generated a guide that we believe will offer units the tools to create and manage a program that will continue to uphold the spirit of the spur.

These are the basic requirements which we believe will continue to maintain the "Order Of The Spur" as a distinctive program for the United States Cavalry.

• **The Order of the Spur should be reserved for CMF 19 soldiers only.** The programs are a traditional concept derived from the horse cavalry. Soldiers in CMF 19 are the only ones who continue to perform the original horse cavalry missions.

• **Holders of the Order of the Spur should be at the rank of corporal or above.** The spur represents skill and experience as a cavalry trooper in the performance of leadership roles during reconnaissance and other cavalry missions. Earning the right to wear spurs should require years of development, not simply passing a spur ride, therefore it should be reserved for NCOs and officers.

• **The only units that should maintain a Spur Program are MTOE scout platoons and MTOE or TDA cavalry organizations.** The spur is a symbol originating from the horse cavalry, thus the program should remain only with those units still participating in or existing as the cavalry.

• **Spur candidates should be required to have completed either a real-world deployment or a training center rotation to the NTC, JRTC, or CMTC**. Regardless of test scores or garrison performance, an individual must display superior skill and experience in the actual performance of cavalry and reconnaissance missions as a part of a significant and challenging unit mission.

• **Candidates must meet the prerequisites of the Excellence in Armor Program.** Enrollment in EIA should not be required; however, those prerequisites demonstrate the same superior skill and knowledge that the Spur Program should be establishing as a standard.

• **A Spur Program candidate must be nominated by another spur holder who is senior in that individual's chain of command.** To uphold the integrity of the program, only spur holders should retain the authority to nominate. The candidate should work directly for that spur holder to prevent individuals from taking care of a buddy.

After all of the above requirements have been met, the candidates should have to prove themselves by participating in a spur ride. The spur ride itself should be both physically and mentally demanding. It should include a road march and land navigation. The tasks selected for the ride should be battle-focused and oriented to the unit's real world mission. The entire ride, and each separate task during the ride, should be oriented toward reconnaissance and other traditional cavalry skills.

The Order of the Spur must continue to be a program looked upon as a symbol of excellence. Each unit must be able to develop a program that is distinctively its own. The integrity of the spur is in question. Commanders and unit spur holders need to look at their programs across the Army. Wearing spurs is a cavalry tradition, and it must be respected and honored. Let all Cavalry Troopers help to ensure that we have the Order Of The Spur, not the Broken Spur Award.

Trends in Mounted Warfare: Part II

BLITZKRIEG

And the Operational Level of War

by Lieutenant Colonel Kris P. Thompson

Part I appeared in the May-June 1998 issue. - Ed.

Introduction

The introduction of the internal combustion engine into the military at the beginning of this century changed warfare in a fundamental way. Mobility and mounted warfare took on a whole new meaning. The ability to use the engine to power all sorts of vehicles caused military theorists to compete in developing the best way to employ this new way of waging war. In the previous two thousand years, only the advent of gunpowder had such a revolutionary effect.

Blitzkrieg - The Theory

After WWI, which proved to be a bloody experiment for the proponents of tanks, there was rigorous debate in every country that was a major power about the proper employment of motorized and mechanized forces. One man eventually dominated the debate — Heinz Guderian.

He had a friendly face with piercing eyes and a close-cropped, graying mustache. He had a lopsided smile with a dimple in one cheek when he smiled — which was not often. It was said of him that he was a difficult officer to work with, a poor listener, critical and direct to those (even his superiors) who disagreed with him, and that he had little feeling or tact. Yet, at the same time, he was imaginative, analytical, energetic, and tenacious.[1] Heinz Guderian had originally been an infantry officer. In January 1922, Guderian was appointed to the Motorized Transport Department of the German Army as a captain. For the next 15 years, Guderian studied, analyzed, experimented, reasoned, and finally developed a concept for using mounted forces to win campaigns.

What was Blitzkrieg, as envisaged by Guderian? Everyone has their own version. Len Deighton, in *Blitzkrieg*, focused on the materiel side, listing infiltration tactics, tanks, and the radio as the three vital components.[2] Bryan Perret lists tanks, the use of air power, the indirect approach, effort aimed at a strategic objective, with the "keystone" of blitzkrieg being a breakthrough with pursuit of the routed army until its will to fight had been broken.[3] Of course, both Mr. Deighton and Mr. Perret, as well as many other authors who have written on the subject, are correct in some aspects. But because of the fascination with the material side, analysis often gets bogged down on tactics. Many writers focus on how the panzer division conducted business. This approach, I think, misses a major component of the blitzkrieg philosophy — which is at the operational level of war.

Guderian's Concept

Guderian's refined ideas were published in 1937 in *Achtung - Panzer*! This is a remarkable book, and is must reading for every armor officer. His true genius was demonstrated by his conceptualizing how tank and motorized forces could bring about tactical victory "and then exploit it into the operational dimension."[4] He placed great emphasis on this basic theme.[5] Winning rapidly in the operational dimension was a must because of the economic stress of warfare. Guderian viewed mounted warfare as a "means to bring an armed conflict to a rapid and tolerable end."[6]

Guderian's basic principles for employment of tank forces were:

- Surprise - attained through speedy and well-concealed movements, or new technology.
- Deployment *en masse* - the concentration of tank forces where we seek to gain the decision.
- Suitable terrain - enough to allow the tank forces to move through it in sufficient breadth and depth.

Guderian also pounded away at several other main points. He stressed combined arms in mounted units. He believed all combat arms necessary to support the tank formations had to be mechanized or motorized and able to move at the same speed. This brought about the forming of panzer and panzergrenadier divisions which were, at least in theory, completely mounted.

His writing strongly stresses the use of joint air-ground operations. He repeatedly emphasizes the use of close air support in halting or delaying the movement of enemy reserves. He also repeated a Sheridan theme — that the maneuver of mobile forces, now mounted in tanks rather than on horses, should not be tied to the infantry and artillery:

> *"Tanks will lose the capacity to concentrate on the decisive spot if they are incorporated as organic elements of all the infantry divisions...The possibility of speed is killed stone dead, and we forfeit all real hope of attaining surprise and decisive success in combat... We will...lose thereby the means of exploiting at speed any successes on the part of the first echelon. We will grant the enemy time to bring up reserves, re-establish themselves in rearward defenses, beat off our enveloping movements, and concentrate for counter-attacks."*[7]

Of course, by concentrating tanks en masse for the breakthrough **and exploitation**, moving them deep into the enemy rear at speed, the enemy does not have time to commit reserves, construct new defensive positions in depth, or launch counterattacks. Guderian predicted this would result in operational level success. It is interesting that Ger-

Panzers in Poland. Guderian's concept — the use of armor penetrations to break through and paralyze enemy command and control — was further developed in France in 1940, when the numerically inferior Germans quickly defeated the French and the British.

man panzer leaders, such as Guderian and Von Thoma, routinely favored lighter, faster tanks with longer ranges (able to go deeper and faster in penetrations to the operational level) for the main armor force.[8]

Guderian was somewhat vague on what would be the principal target of the mounted forces. Given the raging debate going on at the time, he probably did not want to tie himself down. At one point, Guderian suggests the tanks are meant to "execute deep breakthroughs aimed at reaching the enemy command centers and reserves and destroying the hostile artillery."[9] At another place, Guderian adds in the necessity of victory over the enemy anti-tank defenses and tank reserves as the gateway to a pursuit. At still another point he lists the tank forces' "principal foes" as hostile tanks, antitank guns, and artillery, in that order.[10] But then Guderian returns to his theme of having an impact at the operational level:

> *"One could imagine how at the beginning of a war the armored forces could strike at vital enemy airfields or other relevant objectives close to the border; again, after successes on the ground at a later stage of the war, the tactical aircraft, airlanding troops, and tank forces could be assigned common objectives deep in the enemy rear, with the aim* ***of breaking the enemy's power of resistance with the least loss of life.*** *This is a concept of warfare which has so far received little attention."*[11]

Thus, "blitzkrieg," in Guderian's mind, was a mounted force centered on the tank (supported by mounted infantry, ground attack bombers, and mobile artillery), used to break through enemy defenses with mass and speed, and then exploit to break the enemy's will, resulting in **operational level** victory. Indeed, Guderian's subtitle for the book was "The Development of Armored Forces, Their Tactics **and Operational Potential**." (emphasis added)

The 1940 Campaign in France

We all know the story of how the German Army ran roughshod over France in 1940. This campaign was certainly conducted very close to Guderian's blueprint for success. This campaign gives us a stark comparison of two ways to employ mounted forces.

The Germans adhered to Guderian's principle of mass. The Germans attacked with 2,400 tanks and around 2,600 aircraft. The French and allies defended with approximately 3,400 tanks and 1,700 aircraft. The Germans concentrated their armored units into compact, all-mounted forces with five of the ten available panzer divisions concentrated in a Panzer Group (two corps) at the main point of attack. These divisions were followed by three motorized infantry divisions. The French and British frittered away their tanks by scattering them among the infantry corps, for the most part. Of the 3,400 tanks available, about half were penny-packeted in battalions to the infantry, one quarter were formed in cavalry divisions for security missions, and the remaining quarter were formed into small tank divisions.[12] Even this small tank reserve was not under a corps headquarters.

The Germans also achieved surprise. The French, much like the Americans four years later, negligently ignored many intelligence indicators of an assembly of German forces in the area of the main attack.[13] They were banking on the assurances of the French Intelligence Service that they would give the Army 24 hours warning of any invasion.[14] And one aspect of the surprise was the terrain considered by the Germans to be suitable for a large armored thrust. The attack came through a "no-go" area — the Ardennes. The French had declared this region "impenetrable."[15] In the German planning process, however, Guderian had personally certified the area as feasible for the maneuver of the armored forces. Another aspect of the surprise was the use of airborne and airlanding units in surprise pre-invasion assaults on key enemy positions.

Further, the Germans directed their main attack so as to avoid the most strongly held portion of the French position — the Maginot Line to the south of the intended decisive point. It also avoided the area in Belgium to the north where the Germans expected the Allies to advance and occupy defensive positions. The main effort of the attack came in the middle, against Sedan, which the Germans knew was the boundary between two second-class divisions. This was an operational level weak point. And although the invasion planners were not counting on political turmoil in the allied governments to aid them, the launching of the attack happened the day after both the English Prime Minister, Neville Chamberlain, and French Prime Minister, Paul Reynaud, had offered their resignations.[16]

The Mechanisms of Defeat at the Operational Level

The employment of the German panzers clearly resulted in the rapid, operational-level victory promised by Guderian. What were the mechanisms of defeat in the way the exploitation and pursuit was carried out by the panzers? There were both **physical and psychological** effects which reduced, and eventually broke, the enemy's will and capability to carry on the fight.

Physical Effects

There were two significant physical effects. The first is **isolation.** The penetration by the German main effort was designed to go all the way to the coast and thereby cut off the allied forces in Bel-

gium. These isolated units would be destroyed in an attack from the rear,[17] while the French reserves to the south were prevented from massing by spoiling attacks by forces on that flank of the penetration. Then, after defeating these isolated units, France would be on its own. This plan was strikingly similar to Napoleon's "central position" concept. It was key that the penetration occur quickly, preventing the two allied wings from reestablishing ground lines of communication with each other. It also cut lines of communication within the French Army on the southern flank of the penetration.

After the penetration by the massed mounted units of the German Army, there was no delay or slowing. Just the opposite occurred — the pace of the maneuver quickened. The average rate of advance was about 30 miles per day, with some units achieving a staggering 60 mile advance.

The second physical effect is **exposure and destruction/displacement of command, communication, logistics and other "soft" assets**. By penetrating faster than the defending Army could prepare a cohesive defense in depth, all of the "soft" targets and installations necessary for an army to function were continually subject to direct attack by tanks, infantry, and dive bombers. These soft targets include logistics sites, command posts, transportation assets, and airfields.[18] The exposure to direct attack caused these soft targets to be destroyed, or to continually be displaced, which greatly reduced their effectiveness. It is very clear that it was the intent of the German plan to destroy the isolated allied units in the north by attacking their vulnerable rear areas and destroying or cutting them off from their ports.[19] Thus, the "target" of the penetrating mounted units was the "soft" assets of the Allied units in Belgium.

Rommel reported that French soldiers from artillery and supply units "tumbled headlong into the woods at the approach of our tanks..." Such units cannot provide fire support or supply hard-pressed combat units. The displacement led to destruction as the panzer troops fired on the move, destroying military vehicles, and sending soldiers and civilians alike into "wild flight."[20] Artillery units disappeared without ever firing a shot after unexpected encounters with Rommel's tank columns.

When the Allied air assets were forced to displace, their usefulness eroded quickly as secondary airfields were not as good as the original airfields, and the transportation and supply organization were not quite up to the task.

Psychological Effects

FM 100-5 apparently defines "shock" to mean firepower, armor, and speed.[21] Yet, shock emanates from the psychological makeup of soldiers, not the physical. It was the psychological effect of the German attack which caused the French will to fight to "spring a leak," then gush, then flow away as a raging torrent. What sprung the leak was the fear in the hearts of those soldiers at the "soft" targets — the artillery gunners, the truck drivers, the headquarters personnel — of having to undergo an attack from tanks with no real means of defense.

The decisive point in the campaign occurred shortly after the assault crossing by the infantry at Sedan. A colonel from the French corps artillery in the area issued a report that he was displacing his headquarters and some heavy batteries to the rear and that "German tanks were arriving" as he was moving out.[22] This officer's rumor spread like wildfire. An officer from a French infantry unit in depth then witnessed:

> *"A wave of terrified fugitives, gunners and infantry, in transport, on foot, many without arms but dragging their kitbags, swept down the Bulson Road. 'The tanks are at Bulson!' they cried. Some were firing their rifles like madmen... Gunners, especially from the corps heavy artillery, and infantry soldiers from the 55th Division, were mixed together, terror-stricken and in the grip of mass hysteria. All these men claimed actually to have seen tanks at Bulson and Chaumont... Panic brooked no delay; command posts emptied like magic."*[23]

In fact, no German tanks were actually in that area, although they were preparing to cross the Meuse.[24] This "leak" quickly impacted the French center of gravity — its artillery. For 150 years it had been the case that if the guns stood fast, the Army stood with it. When the guns pulled out, so did the rest of the Army. The hysterical mob grew and grew as the word spread that the guns had pulled out. The rumors became worse. Everyone started spreading reports of panzers in the rear areas. Command posts displaced without warning their subordinate headquarters. Officers began assuming there was a general withdrawal and issuing orders to pull out. Communications centers were abandoned. Demolitions were triggered prematurely. Jittery infantrymen shot first without confirming targets, resulting in fratricide. All this displacement, of course, took place on the road, which made these units great targets for the dive bombers and fighters to strafe. Commanders issued conflicting, indecisive orders. This is breaking the enemy's will to fight.

Blitzkrieg - Refined

For the remainder of WWII, commanders on all sides attempted to emulate the 1940 campaign. There were notable successes — such as Operation Cobra, the breakout from Normandy; the initial stages of the campaign in Russia in 1941; and the Afrika Korps' initial campaigns. There were also notable failures — such as Operation Goodwood, Operation Market Garden, and the Ardennes campaign of 1944. The successes were generally characterized by Guderian's recipe of mass, surprise, and suitable terrain, together with attacking a weak point, exposing "soft" targets to attack, speed in the penetration, and penetration to operational level depths. The failures were caused by one or more of the following: attacking strength or locations where the enemy had positions in depth, failure to have local air superiority, terrain difficulties, or by having a slow rate of penetration (allowing the enemy to maneuver reserves to defeat the attacking units).

The American Experience

Of course, General George S. Patton, the "Godfather" of the Armor Force and the most successful practitioner at the operational level of using American armored forces, was very much influenced by Guderian's concepts. He read *Achtung Panzer* immediately after the book was translated,[25] along with numerous other books and treatises on German armored doctrine. After the Carolina Maneuvers of 1941, he railed about being "reduced to the speed...of the infantry" by having the Armored Force under the control of an infantry headquarters.[26] His train of thought on the use of armored forces, expressed prior to his involvement in WWII, mirror Guderian's concepts in many ways:

- 1940 - The brigade he commanded was "designed to strike and penetrate weak points in the enemy's defensive line; or else to outflank and envelop the enemy's defenses. In either case, the brigade was to destroy enemy command posts, communications centers, supply

dumps behind the front and thereby paralyze the enemy's ability to react."[27]

• 1940 - Patton addressed a lawyers' club in Columbus, Georgia and noted that once a defensive line is pierced, tanks poured through the hole in order to "give the enemy a spanking from behind. You can kill more soldiers by scaring them to death from behind with a lot of noise than you can by attacking them from the front."[28]

• 1941 - He wrote an umpire for an upcoming war game: "...the primary function of an Armored Force is to disrupt [enemy] command, communications, and supply."[29]

Our opponents, the Germans, gave Patton high marks for his skill in mobile warfare. Von Mellenthin praised Patton as a commander "who thoroughly understood the character of armored warfare..."[30] Rundstedt said Patton and Montgomery were the two finest commanders he dealt with.[31] But while Americans had a "keen sense of mobile action,"[32] the American leaders at the operational level, including Patton, did not "mass" their armored divisions for any operation. Even Operation Cobra, which most historians view as a massing of armor, was a relatively small operation in terms of mobile units taking part in the penetration. The final plan called for three non-motorized infantry divisions to make the initial penetration, followed by two armored divisions and one motorized infantry division completing the penetration and exploitation. This pales in comparison to the concentration of armored forces by the Germans in 1940 and during the Ardennes campaign of 1944.

Operation Cobra was not even designed to result in a successful campaign upon completion — it was merely to set the stage for further exploitation. By way of mitigation, it must be said that this concentration of forces was certainly powerful compared to the opposing forces, especially when enhanced in combat power with air power and sustained artillery bombardment. And, the impact of the three mobile divisions used in the exploitation was very great, and far out of proportion to the number of battalions involved.

Patton and other operational leaders have been criticized for failing to mass armored units. The U.S. Army in France habitually assigned one armored division and two infantry divisions in each corps. There were no armored corps formed, which is clearly distinguished from the German practice. The German battle studies at the end of 1944 attributed this organization to an abundance of caution and hypermethodical thinking.[33]

This demonstrated a tendency on the part of Americans to think at the tactical level when employing mobile units. Corps commanders parceled out the combat commands of their armored divisions for independent attacks. This, in turn, resulted in dramatic tactical success — such as CCA and CCB, 4th Armored Division in the encirclement of Nancy — and a failure to turn the tactical successes into operational level victory because of a lack of mass. The "broad front" strategy must also be labeled as a culprit in encouraging this organization. The Germans felt that American armor usage had deteriorated by the end of WWII, as compared to the breakout by mobile units during Cobra. Von Mellinthin commented on the use of armor in the Lorraine campaign:

> *"I think that Patton would have done better if the 4th and 6th Armored Divisions had been grouped together in a single corps, reinforced possibly by the French 2nd Armored Division. These were all very experienced formations and were ably commanded... I think the Americans made a grave mistake in coupling their armored divisions too closely with the infantry; combined as a tank army under one commander, these three armored divisions might well have achieved a decisive breakthrough."*[34]

Apologists for this employment of armor will contend that the high degree of truck transportation available to the normal infantry division prevented it from being a "drag" on the armored divisions. Yet, a number of incidents occurred where the "drag" effect or parceling hampered the effectiveness of the mobile divisions.

Surprisingly, Patton did not regard mass, in the literal sense, as a requirement. To him, a "charge" with tanks, especially against a defense with antitank weapons, was "futile and suicidal."[35] The widespread belief that the function of the armor division was to attack and destroy the enemy was "erroneous."[36] Like Guderian and Von Thoma, he viewed the armor force getting into the enemy rear by attacking a weak point, and then disrupting the command and supply systems. What was critical was not so much that the armored units move or attack together, but that they have impact at the decisive place at the proper time. In this sense, he was somewhat in accord with the Guderian approach march technique whereby the attacking armored units start in dispersed assembly areas, move forward towards the enemy "front line," then converge on a breakthrough point. Thus, Patton was more like Stonewall Jackson — able to move **everyone (no matter whether they were mounted or dismounted**) faster — rather than J.E.B Stuart or Phil Sheridan who massed their cavalry.

The American experience in WWII resulted in discarding the concept that the tank was an offensive weapon not intended for defensive combat against other tanks.[37] The inability to find a feasible way to employ tank destroyers led to their phasing out. From that point forward, it has been the U.S. Army mindset that the best and primary antitank weapon is another tank. This resulted in a "heavying" and upgunning of the American tank fleet.

Conclusion

The end of WWII led to a great deal of study and debate about the future of the armored forces. This period proved that mounted combat units, when used correctly, were the dominant force in warfare. They were the campaign winners. In the coming years, their dominance would be tested in a wide variety of terrain and modes of warfare.

Notes

[1]Cooper, *The German Army 1933-1945* (Bonanza Books, 1984) p. 153.

[2]Deighton, *Blitzkreig* (Ballantine Books, 1980) p. 119.

[3]Perret, *A History of Blitzkreig* (Jove Books, 1983) pp. 1-41.

[4]Guderian, *Achtung Panzer* (Arms and Armor Press, 1995) p. 190.

[5]Ibid., p. 170.

[6]Ibid., p. 23.

[7]Ibid., p. 169.

[8]Ibid., p. 170; Hart, *The German Generals Talk* (Quill, 1979) p. 94.

[9]Guderian, p. 170.

[10]Ibid., p. 195.

[11]Ibid., p. 206.

[12]Horne, *To Lose a Battle* (Penguin Books, 1988) pp. 217-219.

[13]Ibid., p. 231-5.

[14]Ibid., p. 239.

[15]Ibid., p. 226.

[16]Ibid., p. 239.

[17]Manstein, *Lost Victories* (Presidio Press, 1984) pp.103-123.

[18]J.F.C. Fuller went so far as to advocate the designation and forming of a special mounted unit called a "disorganizing force" which would penetrate to destroy the enemy's headquarters before the main attack was launched. Perret, p. 40.

[19]Ibid.

[20]Horne, pp. 464-5.

[21]*FM 100-5* (1993) p. 2-22.

[22]Horne, pp. 347-8.

[23]Ibid., p. 348, quoting French General Ruby.

[24]Horne suggests the tanks were probably French tanks belonging to a reserve tank battalion.

[25]Nye, *The Patton Mind* (Avery Publishing Group, Inc., 1993) p. 119.

[26]Blumenson, *The Patton Papers 1940-1945* (Houghton Miflin Co., 1974) p. 44.

[27]Ibid., p. 10.

[28]Ibid., p. 16.

[29]Ibid., p. 29.

[30]Von Mellinthin, *Panzer Battles* (Ballantine Books, 1973) p. 375.

[31]Liddell-Hart, *The German Generals Talk* (Quill, 1979) p. 257.

[32]Blumentritt, as quoted in *The German Generals Talk*, p. 258.

[33]Center for Military History, U.S. Army, [H.M. Cole], *U.S. Army in World War II: The Lorraine Campaign* (1984) p. 591.

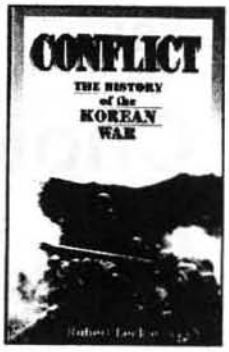
[34]Von Mellinthin, p. 402.

[35]Blumenson, p. 37.

[36]Ibid., p. 37.

[37]Gabel, *The Lorraine Campaign: An Overview, September-December 1944* (Combat Studies Institute, Feb. 1985) p. 35.

LTC Kris P. Thompson is the commander of 2-185th Armor, California Army National Guard. He has previously served as cavalry troop commander, squadron S4, and troop executive officer with the 1/11th ACR, headquarters troop commander for 4/11th ACR (Air Cavalry), staff officer with VII Corps during Desert Storm, brigade S3 for 2d Brigade, 40th Infantry Division (Mech), and battalion XO for 2-185th Armor. He is a graduate of CGSC and the Canadian Land Forces Command and Staff Course. He received a B.S. in accounting from Kansas State University and a J.D. (law) from the University of Kansas.



DA CAPO BOOKS:

A Great Source For Military Readers

by Jon Clemens, Managing Editor

For the military reader, Da Capo Books can be an indispensable source. Along with books on many other subjects, this New York-based publishing house specializes in reprinting military classics that have long been out of print or are otherwise unavailable.

Reviewing the Da Capo releases poses a problem for publications like this one. Normally, our book reviews focus on the new or at least the very recent. Da Capo's reprints have in most cases been reviewed many years ago, and the fact that they are reprinted at all is an assurance that the books have long withstood changing styles and hold up well for modern readers. Da Capo's reprint editions are full-sized quality paperbacks that are reasonably priced.

Among the many military books that might be of interest to our readers, I'd include such classics as Heinz Guderian's *Panzer Leader*, Martin Blumenson's two-volume *The Patton Papers*, J.F.C. Fuller's *Armament and History*, John S.D. Eisenhower's *The Bitter Woods*, Read and Fisher's *The Fall of Berlin*, Kenneth Macksey's *Rommel - Battles and Campaigns*, J.F.C. Fuller's *The Second World War*, COL Trevor N. Dupuy's *The Evolution of Weapons and Warfare*, Moshe Dayan's *Diary of the Sinai Campaign*, Fuller's *The Conduct of War*, and many, many others. This does not begin to scratch the surface of a very rich catalog.

Military biographies include the work of Lieutenant Colonel Theodore Ayrault Dodge, who lost a leg fighting for the Union at Gettysburg and later produced biographies of Hannibal, Alexander, Caesar, and Napoleon (a four-volume work). The fall list includes release of Dodge's biography of Gustavus Adolphus, the Swedish warrior-king who pioneered many military innovations during the Thirty Years War of the early 1600s. Dodge's history of the Civil War is also available, along with more than 50 other titles dealing with aspects of that struggle.

The works of B.H. Liddell-Hart are well represented, including his *Lawrence of Arabia, The Rommel Papers*, *Great Captains Unveiled*, and *Scipio Africanus*. J.F.C. Fuller, his equally influential contemporary, wrote a classic, three-volume *Military History of the Western World*, each about 600 pages and available for a nominal $16 each. Fuller's biography of Caesar is on the Da Capo list, along with his *Generalship of Alexander the Great.*

A catalog is available from Da Capo/Plenum/Insight, at 233 Spring Street, New York, N.Y. 10013-1578. Their catalog can also be seen on the World Wide Web at http://www.plenum.com. The e-mail address is info@plenum.com.

Interactive Books:

Different Choices, Different Outcomes

Combat Team: The Captains' War by John F. Antal, Presidio Press, Novato Calif., 1998. 370 pages, $17.95 (paperback).

Combat Team is John Antal's third release in his series of "interactive fiction" books. Like a "choose-your-own-adventure" book, each one is divided into numbered passages; at the end of each numbered passage, the reader is presented with two or three choices to make. Each choice leads to a different numbered passage, and, ultimately, to a different outcome of the story.

In *Combat Team*, Antal puts the reader in the position of a new company team commander during a fictional high intensity conflict in northeast Asia, similar to Korea. The reader is faced with the challenges of taking command and fighting his unit in restricted mountainous terrain. Most of the book's choices revolve around these two themes.

The book is undeniably enjoyable. Once Antal throws the reader into the scenario and the choices begin, the book becomes quite personal. From the very first choice, how to deal with a less than cooperative executive officer, I was determined to successfully accomplish the assigned raid mission the first time through. Dying repeatedly, however, is a much more likely outcome as the author has built only one path that leads to decisive victory. Antal has also added historical quotes at the beginning of each passage to make the book even more enjoyable.

Although *Combat Team* doesn't allow for choices where I would have done things differently than the book's main character, there are enough choices at critical junctures to keep the reader's mind perking and to allow for several significantly different results to develop. In this regard, the book is a good tool to stimulate some critical professional discussion about tactics in restricted terrain. At the end of the only path that leads to mission success, Antal provides his perspective on the lessons of the Korean War and how they apply to our tactics in restricted terrain today.

While *Combat Team* may not be rocket science, it is a great departure point for examining the way our Army should fight at the most critical level — the company — in tough terrain. It effectively bridges the historical gap from the Korean War to today, and shows intimately how old lessons learned the hard way still apply to our high-tech battlefield. This, I think, is the book's greatest strength: the way Antal gets the reader quickly thinking by placing him in the decision-making hot seat, and then leaves his stimulated mind with plenty of food for thought for further contemplation and discussion. Plus, it's just plain fun to read.

SCOTT D. MAXWELL
CPT, Armor
Fort Polk, La.

Alamein to Zem Zem by Keith Douglas, Chilmark Press, New York, 1966, 152 pages.

There are few books available that describe in detail what it was like to live and fight from armored vehicles during the Second World War. This is one of them. Keith Douglas was a 24-year-old lieutenant who studied literature at Oxford before joining a tank regiment of the Notts Sherwood Rangers Yeomanry in 1940. He eventually found himself serving in a meaningless position on a divisional staff. He essentially left his post and set out to find his regiment, six days after the epic battle of El Alamein began in October of 1942. The book describes his actions as a tank platoon leader as he fights from El Alamein to Tunisia.

Douglas has been described as "the most considerable poet of the Second World War" and in addition to this work, wrote a number of poems reflecting on his combat experience. He wrote this book while recovering from wounds in 1943. Sadly, Douglas did not survive the war and was killed on the second day of the Normandy invasion during a reconnaissance behind enemy lines, for which he was mentioned in dispatches. He certainly would have contributed more to the world of literature had it not been for his untimely death. Fortunately this work remains.

It is written in "a highly charged, violent descriptive prose, powerfully contrived but sufficiently serious to convey the humor, the pathos and the literal beauty of that dead world of tanks, sand scrub and human corpses." Douglas has a keen eye for detail, and his descriptions of life in a tank regiment are both interesting and recognizable to the modern tanker. Countless hours were spent on the endless detail of living on an armored vehicle. The crew performs maintenance, cleans weapons, checks radios, and cleans personal gear. The highlights of the day are found in the preparation of meals and the infrequent socialization between members of the unit. These moments are interrupted by the sheer terror of combat.

Douglas is completely candid about his emotions as a young and inexperienced leader. He feels the fear of facing the test of battle, but admits to desiring action in order to become initiated into the group of veterans. In his first action, Douglas performs bravely, but makes many mistakes. His many descriptions of desert tank battles are highly informative and reveal an environment of friction and confusion. Douglas describes one action. "*By shouting directions to my driver above the noise of the engine (internal communication having broken down with wireless) I was able to move my tank, using dips in the ground, to within about 660 yards of the telegraph poles, and saw that two or three Mk. III tanks were in support of the guns. When I had seen as much as I could, I turned my tank and moved back into Edward's little wadi, where I dismounted and ran across to his tank. I made two of these journeys, and Edward passed back my news to the regiment over the air. Each time I dismounted I still skidded about on the metal of the tank, the soles of my boots being covered with half-congealed blood from the pool in the bottom of my turret. Flies hung above the tank in a cloud.*"

The narrative continues bringing the reader along as this one tank regiment works its way along the coast of North Africa. Casualties continue to mount daily and Douglas loses friends and comrades he hardly knows. One is amazed at the tremendous morale of these men. For all the gravity of the general war situation, there seems to be little to depress their spirits. Although there are times of extreme fatigue and fear, they are able to face every morning, refreshed at the simple things such as a hot cup of tea or a fresh meal. They find strength in their bonds of comradeship and purpose. For these reasons alone, I recommend the book for its study of the human nature of combat. Additionally, the detailed descriptions of tank action provide a visceral experience for any combat leader. Douglas describes another action. *As we passed behind the Grant, laboring in second gear, a 50mm shot came through the side of our turret with an immense clang. The tank stopped and rolled back a few yards. My first sensation was that the whole turret had collapsed inwards on us and was pinning us in. I couldn't open my eyes, the right side of my face seemed to be*

very sore, and there was a small pain in my left leg. I heard the Corporal say: 'Get out, sir, we've been hit' as though from a long way off, and simultaneously I was able to move, as if the voice had broken a spell. I climbed out on to the back of the tank, with earphones still on and the microphone dangling on my chest. I was able to open my eyes for a second, but they closed themselves and tears poured out from under the lids. I realized the wireless was still working, and said "King Five, my horse has copped it.."

Although this work is apparently out of print, it might be found in military libraries and used book shops. I found it in the small library at Fort Irwin. It will certainly add to the professional experience of any mounted warrior who is interested in the experiences of combat. Technology might change, but the taste and feel of combat will remain very recognizable.

MAJOR BART HOWARD
Fort Irwin, Ca.

TANK ACES - From Blitzkrieg to the Gulf War by Lt. Col. George Forty MBE FMA, published by Sutton Publishing Ltd, Phoenix Mill, Thrupp, Stroud, Gloucestershire GL5 2BU England. ISBN 0 7509 1447 5. 200 pages, hardback. UK price £19.99

In two previous books — *Tank Commanders, Knights of the Modern Age* in 1993 and *Tank Action, From the Great War to the Gulf* in 1995 — retired RTR officer and Tank Museum curator George Forty examined armored warfare firstly from the level of senior commanders and in the second case by detailing specific actions from a variety of campaigns. Here he looks from a different viewpoint, that of great individual commanders.

This description applies in two ways. We have senior and middle-ranking officers who by their leadership and example led their forces to perform great feats, and we have individuals occupying the commander's position in the turret who was what the air arms would call an ace. In some cases, both definitions of 'great commander' apply, with individuals who would normally be some stages removed from the front line being drawn to combat as individuals. Forty is quick to point out that, unlike the fighter pilot, a tank commander must be part of a team to have any form of success.

Given these parameters, the combat records of 28 aces are examined using examples from several nations in various conflicts. In each case, the men concerned were awarded a variety of military honors, details of the awards and criteria for which are included. Those chosen for inclusion will include many who will be familiar to *ARMOR* readers, certainly those in the Americans sections, as names if not as colleagues. Those of allies such as Britain and former enemies such as Germany will perhaps be less well known, the single Polish commander perhaps not at all, those Russians maybe, the Israelis may fall into both categories, but those from India and Pakistan will be almost certainly new to you.

The campaigns where these men made their mark also cover areas which are well known and obscure. The World War II era deals with Europe, North Africa, and Russia, while the post-war conflicts include Korea, several Middle East and Indo-Pakistan conflicts, Vietnam, and finally Desert Storm. In most cases, protagonists from each side are included, though regrettably accounts of Egyptian and Syrian participants have eluded the author.

The appeal of this work will vary as to whether you are a veteran seeking accounts of those you served alongside or against, or as inspiration for yourself and those currently alongside you to show what may be termed 'armored spirit.' On its own, or in conjunction with the earlier books, you will find much to provoke thought here. Enough details of campaigns and equipment is provided to set the scene, together with photographs of both those honored here and their mounts and campaigns. Enjoy this book at whatever level you relate to.

PETER BROWN
Dorset, England

Secret Kubinka, privately published by Fraser Gray, text by Richard Stickland. ISBN 0 9532013 0 9. 44 pages, many black and white photos. UK price 9.99 pounds.

There have been various reports on Kubinka since it became known in the West. Some have been good, like their 'own' book which suffers mainly from being in Russian to Russian standards of production — despite that, mine is in regular use — to the Cecil book which I have and which stays on the shelf where it belongs. There are still areas which are not well-covered though, and this book helps fill in gaps.

As well as the collection of historical vehicles for reference purposes, Kubinka is also the location of the main AFV testing facility in the CIS. It is not surprising, therefore, that many unusual one-off adaptations find their way into the 'museum' collection, though many of these are not on full-time display. Reports of what wonders there were have ranged from M1 Abrams to Ramm Tigers, but neither are included here and may only ever have existed in the imaginations of those who wished them to be there.

What is covered is an array of vehicles which show insights into Soviet designs. Here are variations on T-64, T-72, T-80 and even older T-55 with Czech updates and Russian add-ons and T-62 with active armor, showing development trends which made it into production and some interesting 'dead ends.' There are also BMP-1, BTR-60 and -70 — including one with an 85mm gun! — a searchlight carrier and a BRDM-2 missile vehicle.

In some cases, the vehicles can be identified, but in others an air of mystery still remains. What we have here is a good photo study using large, clear photos with detailed and informative captions, which deserves a place in the collection of anyone interested in modern Soviet/Russian AFVs. Look out for in through specialist retail outlets.

PETER BROWN
Dorset, England

American Army Doctrine for the Post Cold War by John L. Romjue. Military History Office, TRADOC, Fort Monroe, Va. 160 pages.

Why did the Army replace AirLand Battle doctrine only two years after its success in Operation Desert Storm? These and other questions are answered in Mr. Romjue's lastest installment of the TRADOC Historical Monograph Series. As Chief of the TRADOC Military History Branch, Mr. Romjue is in a unique position to report on Army doctrine development as it occurs.

The book is logically arranged, beginning with an introduction by the author that states his thesis: "What were the questions and issues revolving around the rapid replacement, less than two years after its resounding success in the desert war, of the Army's recognized and successful fighting doctrine — the well known AirLand Battle?" Chapter one is a primer on 20th century U.S. Army doctrine development, focusing on Active Defense and AirLand Battle.

Chapters two through five introduce the new concepts of the 1993 version of FM 100-5, *Operations,* and trace the development of the new doctrine through an imaginative Army-wide consulting, or conferencing, technique that ensured the new doctrine included thoughts from a range of sources. Here you can find the origins of battle space, battle command, Operations Other Than War (OOTW), the new tenet of versatility, battle functions, and other new doctrinal concepts. Finally, a chapter-by-chapter overview of the new FM. Chapter six is an assessment of FM 100-5, focusing on the development of Force XXI, the concept of attacking simultaneously in depth, battle command and battle space, and digitization.

American Army Doctrine for the Post Cold War is well-written, documented, and thought-out. Its information is understandable; however, I would not recommend it as an addition to the average company grade officer's or soldier's library. It goes beyond understanding the mission and intent two levels up. Chapter one, a great essay on doctrine, should be required reading at the Officer and NCO Advanced Courses. The remainder of the book is a must-read for senior leaders or managers in the art of staffing major doctrinal or procedural changes in a large organization. The vision and ability of General Franks, the TRADOC commander at the time, is a lasting impression left by this book.

Available only on request from the TRADOC Military History Office*, American Army Doctrine for the Post-Cold War* should be acquired by the Armor School and Armor Center Library as a primary source for instruction and research.

CPT JERRY A. HALL
Fort Knox, Ky.

The T-80UK Command Tank

One out of every 30 T-80s being built for the Russian Army is the command tank variant

by Adam Geibel, © 1997, 1998

The Soviets have habitually created command versions of their standard tanks, a concept predating WWII that has been carried on to their latest MBT, the T-80U (Starting with the T-54A series, command tanks received a 'k' suffix). However, in addition to being a serious link in the communications chain, the 46-ton T-80UK has both offensive and defensive abilities beyond its regular stablemates.

The T-80UK is quite capable of engaging in tank-versus-tank combat, as it is mechanically identical to the standard T-80U in the majority of subsystems (built-in turret ERA, armament, power plant, transmission, running gear, and sights), but internal space needed for the extra radios and other electronics has limited onboard ammunition storage to 30 main gun rounds and 750 rounds of 7.62mm coax.

With production of the T-80U standardized for the Russian Army, every 30th tank taken into service has been outfitted as a T-80UK. These are reserved for regimental and battalion commanders, allowing them direct communications to higher headquarters. Previously, these duties had been handled by the Chief of Staff (in a regimental BMP-1KSh or battalion BMP-1KSh) or the unit staff (in a BTR-60R-145BM).

The most recognizable feature of the T-80UK is its three antennas: two four-meter whip (one UHF, one HF) and one 11-meter telescoping HF/UHF "symmetrical vibrator" antenna. The last is erected on the hull during halts and stowed in a tube over the transmission.

The R-163-U VHF FM radio operates in the 30-80 MHz range and generally uses the tank's four-meter whip antenna. The R-163-K HF radio is intended to support long-range communications when fitted with an 11 meter telescopic antenna and operates in the 1.5-30 MHz band.

The T-80UK carries a selection of supporting command gear; a TNA-4 navigation system (three-position indicator), a plotting board, gyro-compass, control panel, and aiming circle. An AB-1-P28 1.0 kw gasoline power generator (with self-contained power supply) is carried on board in order to charge the batteries during halts when the engine is not running.

In addition to the Shtora-1 electro-optical protection system, the T-80UK is also equipped to fire EhDKV rounds equipped with electronic remote control proximity fuses. Since the battalion and regimental commanders direct the battle from the rear, the Russians feel that their tanks are better suited to engage targets of opportunity that usually require mortars or artillery. EhDKV rounds have a range of 4,000m and can be fired at a rate of four rounds per minute. The T-80UK is also fitted with the AGAVA-2 thermal sight, which has a range of 2,600m.

In addition to the Russian Army, the T-80 is fielded by Belorussia, Ukraine, Kazakhstan, and Syria. In May 1996, Moscow also announced the transfer of 27 T-80U and 14 T-80UKs to the Cypriot National Guard. While the total package might reach just under 100 T-80s, this is still a surprisingly high ratio of command tanks. Furthermore, 33 T-80Us have been supplied to the South Koreans (presumably, there should be at least one T-80UK in this group).

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