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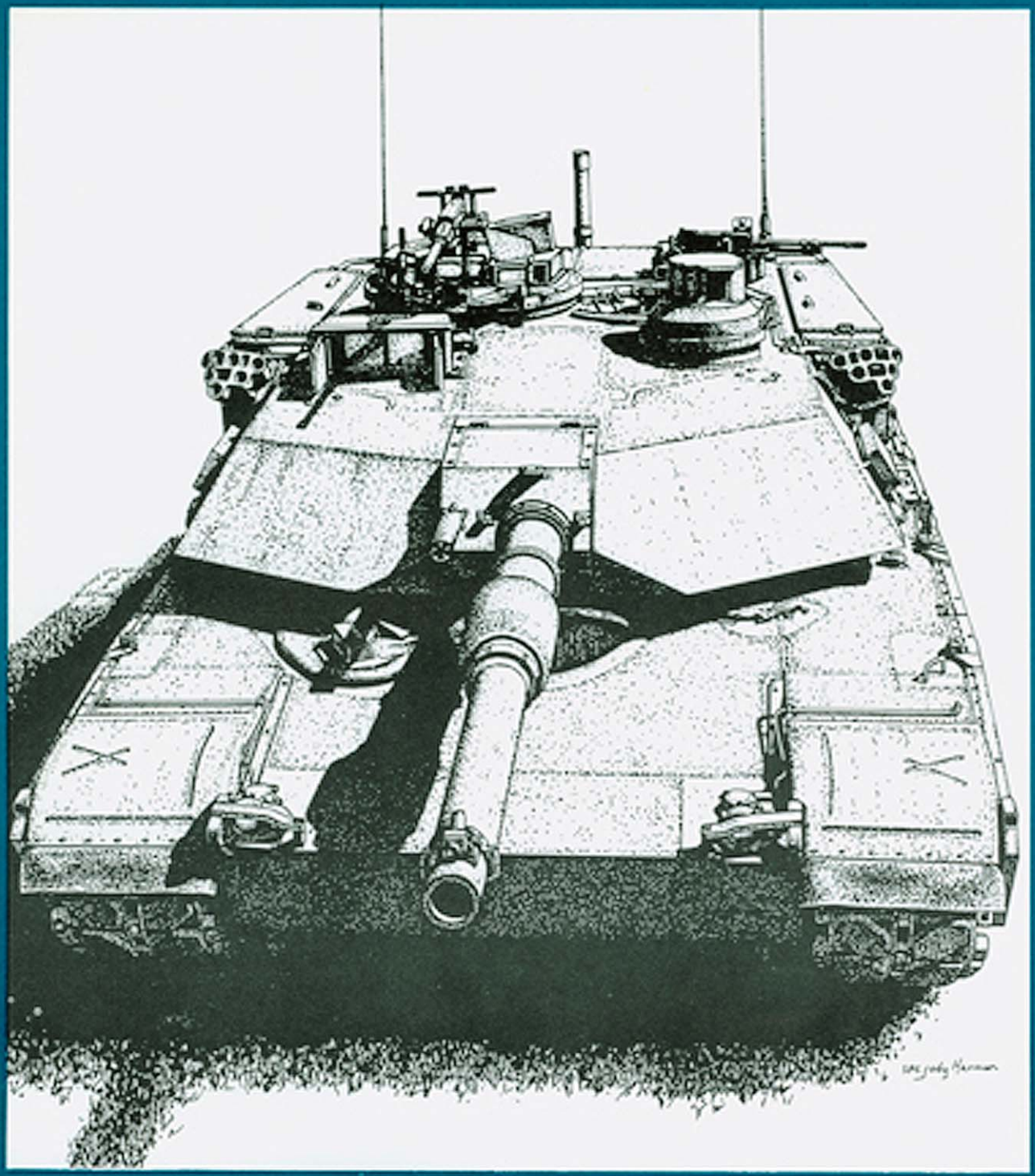

Special Issue: THE FUTURE OF THE ARMOR FORCE

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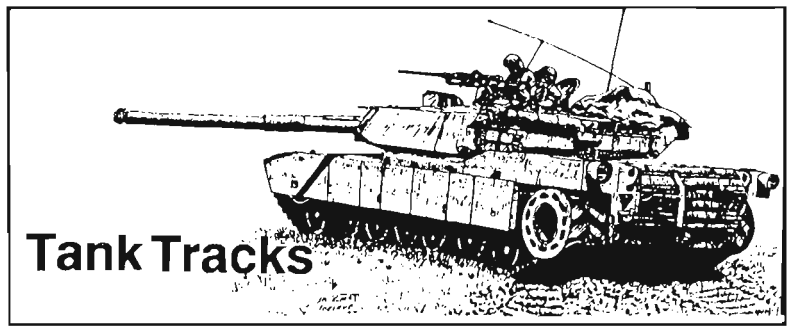

Tank Tracks

I think it was that great 20th Century philosopher, Casey Stengel, who said, "It is very difficult to make predictions, especially about the future." So, in this issue, in which we depart a bit from our broad-based content and focus on one issue — the future — we will shy away from making predictions. We do, however, provide a glimpse of what might be.

The Armor School's subject matter experts on training, doctrine, technology, and combat development have provided articles that throw onto the table some ideas of where the Armor Force might be headed and paint a picture of its capabilities. Almost anything is possible, given the resources. We hope these articles prompt discussion and prod readers to submit reactions that will contribute to the discussion.

There are a few givens. The Army will shrink over the next handful of years, and Armor will keep pace proportionally. While comprising only 4.1 percent of the active force structure, the Mounted Combat Arm of Decision will still provide 37 percent of the active combat battalions available to put on the ground against a future enemy. These battalions will deploy from a predominantly CONUS-based Army and will fight as a component of a combined arms team that is part of a joint force. The restructuring of this force and the sustainment of it at a level of peak readiness will be accomplished in an environment of constrained resources.

Thus, each man and each weapon system will count heavily toward the success of future operations, perhaps more so than before. Good training in the application of future technology will be absolutely critical. The key executors of the future Armor Force are the Armor and Cavalry soldier and his leaders. Thus, while great weapon systems, such as the M1A2 featured on our cover and in the article starting on page 26, stir our hearts and minds, we cannot forget that they take a man to employ them proficiently on the battlefield. Very appropriately, then, this year's annual Armor Conference has as its theme "The Armor/Cavalry Soldier" (See p. 12).

At the same time we look to the future, let's cast an eye to the past and examine the legacy left us by those who put steel on target a half-century ago. Congratulations to the men of the 7th Armored and 8th Armored Divisions as they celebrate their 50th anniversary. Well done "Lucky Seventh" and "Tornado."

— PJC

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

Milton H. Hamilton

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ARMOR

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LETTERS

Armor Badge Should Depict Service Accurately

Dear Sir:

Congratulations on, once again, going for the Armor Badge.

In response to Mr. Reichley's letter (November-December 1991 *Armor*), of course, it should be retroactive all the way back to WWI if anyone is left to receive it.

And if the soldier served in Armor in two or more wars, service should be depicted exactly as it is now shown on the Combat Infantry Badge, with stars appropriately mounted.

Be advised please that this is not the first time the badge application has been submitted. I have personal knowledge of at least two, and there may be more.

But, let's go for it once again!

GEORGE S. PATTON
MG, USA, Ret.
South Hamilton, Mass.

Incomplete Review

Dear Sir:

I have read your magazine for a number of years and have tended to enjoy and learn from your writings and the writings submitted to you. It is this previous positive experience that added to my surprise at a far less than complete review of *Desert Victory: The War For Kuwait*, written by Jon Clemens of your staff.

Continued on Page 5

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(The Armor Hotline is a 24-hour service to provide assistance with questions concerning doctrine, training, organizations, and equipment of the Armor Force.)

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Glasnost...and then some

There was something strangely familiar about T-72 Number 11039, all right. Among hundreds of other armored vehicles parked at a former East German Army NCO school, where deactivated Warsaw Pact vehicles were parked for inspection under the CFE Treaty, this tank sported on its glacis plate both the insignia of the U.S. Armor Branch and a red, blue, and yellow Armor patch from the Armor Center!

LTC Donald Snedeker, of the On-Site Inspection Agency — Europe, took the photos and sent them to ARMOR.

Armor Hotline Takes Your Call

The Armor Hotline has recently been updated to provide the Total Armor Force with a more extensive service than previously offered. This service includes a call-in capability to ask questions, and to retrieve messages from Armor Center organizations. A number of voice mailboxes have been installed on the Armor Hotline (DSN: 464-TANK, commercial: 502-624-TANK) in order to maximize its use. The system provides an initial greeting, then refers the caller to a list of Fort Knox organizations and to a list of subjects. Callers may then select any of the organizations, or subjects, in order to leave or retrieve messages.

The numbers at right can be used on a touch tone phone to access these organizations or subjects.

Callers using rotary dial phones will not be able to access these numbers, but will be asked in the initial greeting to stay on the line and leave a voice message. Important messages will be placed in the initial greeting so that rotary dialers will receive this information.

Personnel are reminded to leave their name, rank, unit, phone number, and address when they leave a message. Additionally, personnel should remember that this is an unsecure line. Classified information cannot be left on or retrieved from the Armor Hotline.

Mail Box Number	Subject
10	Initial Greeting
11	List of USAARMC Organizations
12	List of Subject Areas
13	Calendar of Events
14	Command and Staff Department
15	Directorate or Combat Developments
16	Directorate of Training Development
17	Weapons Department
18	Maintenance Department
19	TRADOC System Manager for Armored Gun Systems
20	Armor Magazine/Armor Association
21	Directorate of Total Armor Force Readiness
22	G-3/Directorate of Plans, Training, and Mobilization
23	12th Cavalry Regiment
24	1st Armor Training Brigade
25	NCO Academy/Drill Sergeant School
26	Armor Branch Safety Office
27	Reserve Component Support Division
28	School and Course Messages
29	Safety-of-Use Messages
30	Total Armor Force Training Support Division
31	Armor Unit Readiness Problems
32	Armor Crewman Response Hotline
33	General Delivery

MG Thomas C. Foley
Commanding General
U.S.Army Armor Center

The Future Battlefield

The theme of this issue is the Armor Force in the year 2000 and beyond. Regardless of the continuing budget cutbacks and reductions in our force structure, I can assure you that the Armor and Cavalry forces in the next century will be a vital member of the combined arms team.

The threat that we face in the next century will certainly be high tech. Presently there are several countries which have fielded main battle tanks with advanced target acquisition capabilities and sophisticated fire control systems. This technology will continue to spread throughout the world and we must be ready to defeat it.

To the future armored crewman armor operations will become more like the operations of fighter aircraft, extremely high tempo, anticipating and countering enemy actions, massing to destroy key enemy elements and quickly dispersing to deny enemy counterattacks. In short, a continuous but dramatic acceleration of the trend of fast paced maneuver which goes back to the beginnings of the armor and cavalry forces. I cannot imagine a more challenging or exciting environment in which to be a soldier or a leader.

Though the principles of war will remain unchanged armor leaders will be required to possess a whole new array of skills. Just as the founders of the armor force in the 1930s had to become experts in the demands and capabilities of a mechanized force, tomorrow's armor leader must be the absolute master of the application of advanced technologies which are the key to winning the combined arms battle.

Cavalry forces in the next century will be as vital as they were in the days of Hannibal. The reconnaissance squadrons of our armored and light cavalry regiments will go deep into the enemy's rear area and identify his center of gravity. They will continuously track these formations, gather essential information, and bring aviation and other fires upon them. At the same time the other squadrons will identify the routes and avenues which allow us to engage the enemy upon ground of our choosing. In defensive operations the reconnaissance squadron will identify the enemy's second echelon, track its movements, avoid any decisive engagements, and bring fires to bear upon it while the other squadrons track the enemy's first echelon. The basics of how the cavalry fights will not change but the pace will certainly be faster and the battles shorter but far more intense.

Tank battalions provide decisive combat. The arrival of the main battle tank on the battlefield defines decisive operations. This has held true since the First World War and will continue well into the next century. The cavalry will provide real-time intelligence and set the conditions for decision. The main battle tank battalions will maneuver against the enemy's weakness to destroy him. Future weapons systems will allow us to shoot accurately faster, move massed tank formations rapidly across the field, and maintain constant automated communications with not only the maneuver elements, but also all the other members of the combined arms team.

Just as in the 1930s the first reaction of many armor leaders will be to resist new technologies and preserve tactics, techniques, and procedures which are proven and familiar. But also, as in the 1930s, the victories of the future belong to those far sighted enough to harness men and unfamiliar developments making our soldiers masters of the battlefield.

Future battles will certainly be high tech. Armor and cavalry will be in these battles, and as always they will play the decisive roles. We must be smart in how we evolve to the future battlefield. We must forge tomorrow's thunderbolt today in order to maintain our edge tomorrow. FORGE THE THUNDERBOLT!

Letters

Continued from page 2

Clemens' "Cogent Quotes" box repeated a number of remarkably shortsighted, arrogant, and militarily naive comments made by the author Norman Friedman. I was dumbfounded that statements like "Third World countries are unlikely to defeat competently handled First World forces unless they modernize their societies" were printed without rebuttal. The tens of thousands of Frenchmen and Americans that lost their lives in the thirty-year war for Southeast Asia might tend to disagree. No, we did not lose the war in Vietnam, but Third World North Vietnam certainly did win it.

Clemens goes on to quote Friedman with "...any society wishing to stand up to Western Forces will have to modernize...the society itself has to change...it must produce a larger leadership and technically adept class." Soviet field commanders who had their armored columns stopped and effectively destroyed by illiterate men firing 90-year-old Lee-Enfield rifles and 1950s-era RPG-7 rocket launchers would have sincerely wished for the guidance of Mr. Friedman on subsequent forays into the mountains of Afghanistan.

Technology and education are definite combat multipliers, but they are far from the be-all end-all components of victory that Friedman describes. As always, it is the desire, will, and fortitude of the individual soldier that more often decide victory. The Iraqi Army, as a whole, simply did not want to fight the Coalition Forces. Had those hungry, sporadically equipped, and poorly supplied soldiers fought with the courage and conviction that an able leader and righteous cause would have given them, the sands of Babylon might still be wet with the blood of the Coalition Forces.

Self-satisfaction with our own success is dangerous. Blanket approbation of our technology, education level, and military ability is tantamount to spitting in the face of the many examples in history when those factors were less than relevant to the outcome of a particular campaign. We have reason to be proud of our accomplishments in Southwest Asia, but we can never believe that our relatively advanced society is a free pass to military success, regardless of the enemy.

CHARLES L. RUMRILL
1LT, Armor
Ft. Polk, La.

DRIVER'S SEAT

CSM Jake Fryer
Command Sergeant Major
U.S. Army Armor Center

A Farewell to the Force

Since I was twelve years old, I dreamed of, and aspired to be, a tanker. The day after graduation from high school in a small rural community in central Pennsylvania, I entered the U.S. Army to be an armored crewman with all of my worldly possessions, which consisted of a toothbrush. In a very short 23 years, I've served in every crew and leadership position available to an enlisted soldier in Armor and Cavalry.

In this, my last "Driver's Seat" column, I reflect on my career as a very profitable (memories—not money) and rewarding experience. I'd like to thank the many soldiers I've had the privilege of serving with and for. I hope in some small way I've made contributions to soldiers and their organizations.

Now, as I retire from our great Army, I do it with a feeling of knowing there are dynamic young soldiers and capable enlisted leaders to follow in my footsteps, and in the footsteps of those I've followed.

TANKS!

Forge The Thunderbolt!

The Army's Key Emerging Technologies

by Captain (P) Edward W. Payne

The Army Technology Base Master Plan (ATBMP) outlines 14 key emerging technologies that will give the future Armor Force the capabilities it will need to win future wars. The Department of the Army feels that the development and application of these technologies will increase the capability of future vehicles and soldiers, helping to insure their survivability, lethality, mobility, and deployability. Despite decreasing budgets, the Army appears to have decided to continue investing in key emerging technologies.

Historically, the Army devotes 25 percent of its technology-based resources to further the development of key emerging technologies that allow the Armed Forces to maintain the technological advantage on the future battlefield. These 14 key emerging technologies are derived from the Training and Doctrine Command (TRADOC) Battlefield Development Plan (BDP), and the technologies that are believed to represent the greatest barriers to successful development of future combat systems. The ATBMP serves as "top down" guidance to all Army laboratories; Research, Development, Engineering Centers (RDEC), and other technology-based organizations. This article discusses the key emerging technologies and the impact we believe these technologies will have on Armor Force modernization and performance. Some results of this research have already been integrated into fielded or soon-to-be fielded systems.

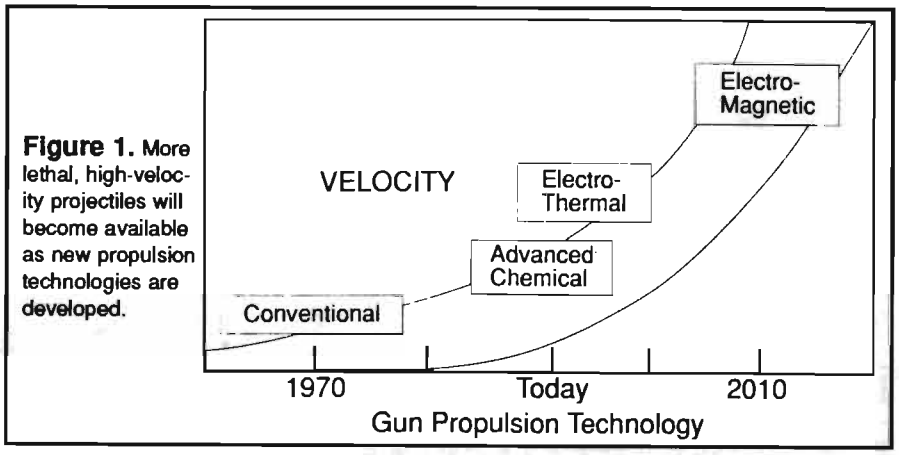


Figure 1. More lethal, high-velocity projectiles will become available as new propulsion technologies are developed.

Perhaps the most important of these technologies is **protection/lethality.** The goal of lethality is "killing" the enemy. The technology is oriented toward electric guns (Figure 1), lasers, and munitions. These technologies will allow future combat systems to deliver a killing mechanism to the target at its most vulnerable time and position, from as far away as possible, and with the lowest cost and logistics burden.

The applications of this technology include smart munitions, electromagnetic (EM) rail guns, electrothermal chemical (ETC) guns, propellants, and unconventional munitions, such as fuel-air explosives. The goal of protection is the inverse of lethality. These technologies enhance the countermeasures that prevent the enemy from killing us (Figure 2). Protection

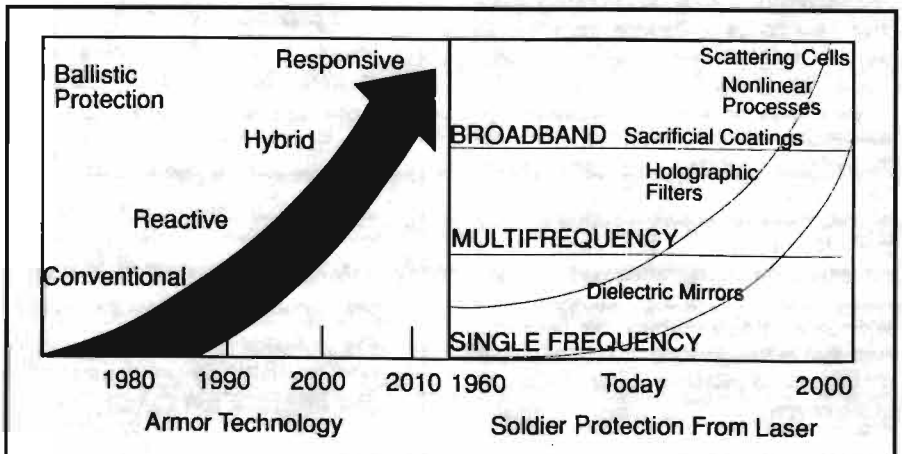


Figure 2. The ballistic protection of armored vehicles will continue to be improved as improved materials are fielded. Soldier protection from laser weapons will continue to be improved as more effective materials are developed, e.g., for eye protection.

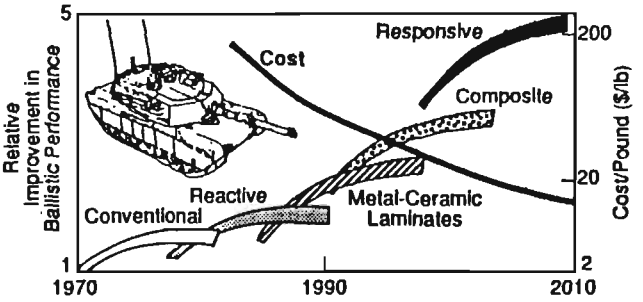


Figure 3. Advanced materials for armor will provide increased protection at reduced cost.

technologies range from improving the ballistic protection of armors to the electronics and munitions necessary for a Vehicle Integrated Defensive System (VIDS). Products of protection technologies include insensitive munitions; nuclear, biological, chemical (NBC) equipment; and laser eye-safe goggles. Defense Advanced Research Projects Agency's (DARPA) Kinetic Energy, Armor, and Vehicle Survivability Programs are greatly enhancing the developments in this arena. These technologies combine lethality of the future battlefield with the survivability of future systems and the soldiers who will man these systems.

Another technology closely related to survivability is **advanced materials and material processing,** such as advanced metals, ceramics, composites, and hybrid materials for future combat vehicles, aircraft, and personal armor. Examples are ductile ceramics, light-weight and high strength composites, advanced polymers/elastomers and novel electro-optical materials. New materials are being developed for heavy armor applications, which are producing improvements in ballistic performance and cost reductions (Figure 3). Materials with high specific strength are being produced as materials for more efficient weapons platforms. Ceramics in diesel engines are significantly reducing the weight and may totally remove the need for a cooling system. The potential advantages of these materials are lighter weight, increased system performance, a significant enhancement of maneuverability and an increase in operational effectiveness. The Army has already fabricated a Bradley Fighting Vehicle hull of composite materials that resulted in greater than 10 percent reduction in system weight. Future demonstrations of this technology include the FY97 Composite Armored Vehicle (CAV) Advanced Technology Transition Demonstrator. If successful, this technology will make the Future Scout Vehicle (FSV) and the Future Main Battle Tank (FMBT) more strategically deployable, while increasing their survivability.

Another contributor to survivability is **low observable technology.** Although most of these programs are classified, this is "stealth" technology. It could be used to reduce the signature of battlefield assets below the detection threshold of threat sensors (Figure 4). Low observable technology is most effective when designed into a system. The development of the technologies will permit a combination of optimal shaping, radar absorbing material, designs, which minimize thermal and acoustic signatures; and the appropriate manufacturing processes should greatly reduce the battlefield signature of the system. This technology has the potential to make combat vehicles nearly undetectable,

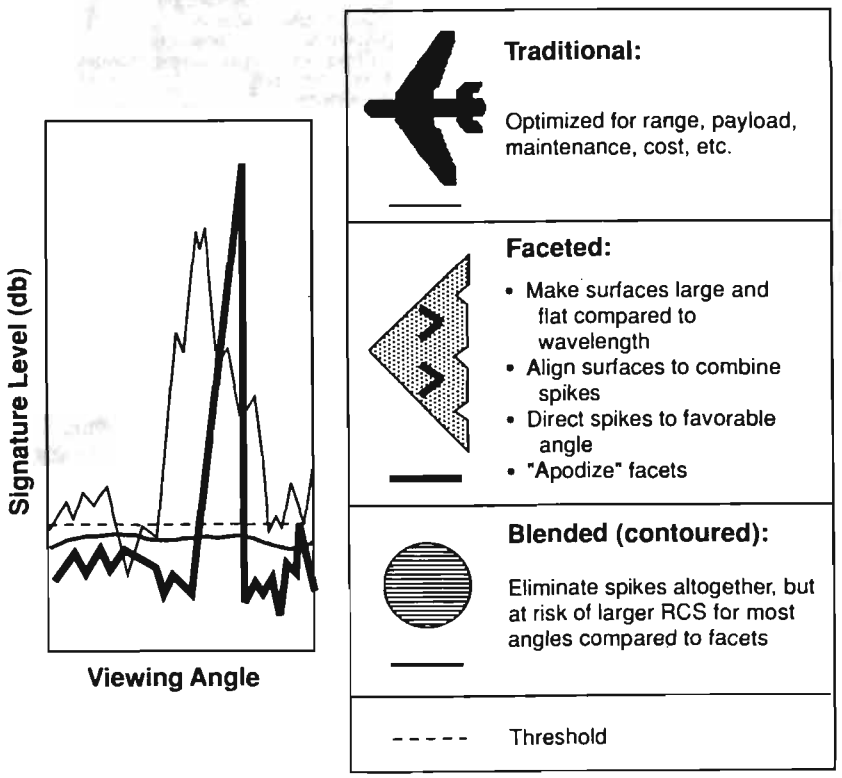


Figure 4. The effect of various shapes on the signature of radar cross sections at various viewing angles.

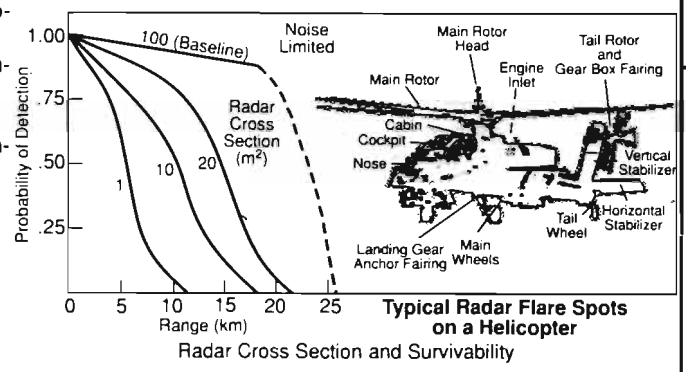


Figure 5. Low Observable Technology. Numerous components of military vehicles or aircraft, e.g. helicopters, contribute to radar detection. Survivability will continue to be dramatically improved as means to reduce detectable radar cross section are developed.

increasing combat effectiveness and survivability. The application of this technology will allow combat vehicles to be lighter, while significantly increasing the soldier's probability of surviving combat (Figure 5). Systems such as the Future Scout Vehicle, the Armored Gun System (AGS), and the Future Main Battle Tank (FMBT) could rely heavily on low observable technology to increase survivability.

A key to all survivability and lethality systems is **microelectronics, photonics, and acoustics.** These technologies underpin all Army systems for signal acquisition, communication, computation, and processing. The capabilities of these technologies determine the limits of performance for systems such as smart weapons, fire control systems, warning receivers, intelligence collection devices, and other sensors. The potential advantages of these technologies include the reduction of the magnetic signature of vehicles; small, high definition, color flat-panel displays for gun sights and helmet mounts; and integrated microelectronics for future Army RSTA/EW/C3I systems. This technology includes second-generation FLIRs, which will provide improved resolution in sights and will improve combat identification range determinations. This technology will be used in second-generation tank sights, and the electronics of X-ROD, a "smart" kinetic energy tank round.

Nearly all systems use **advanced signal processing and computing** to perform a variety of tasks in command and control, position/navigation, electronic intelligence (ELINT), reconnaissance, automatic target recognition (ATR, Figure 6), fire control, guidance and control, communications, and training. These technologies allow for the simulation and modeling of command and control, hardware systems, and wargaming to reduce training costs and to improve readiness (Figure 7). Optical and digital processing provide more power for battlefield management and weapons systems. These technologies will provide and advance the Standard Army Vetronics Architecture (SAVA), the standard electronics modules for all future combat systems. Other applications of this technology include the computers and processors of the Global Positioning System (GPS), Intervehicular Information System (IVIS) and the Close Combat Test Bed (CCTB) at Ft. Knox.

A technology closely related to the capabilities of future computers and information processors is **artificial intelligence (AI).** AI can be applied to

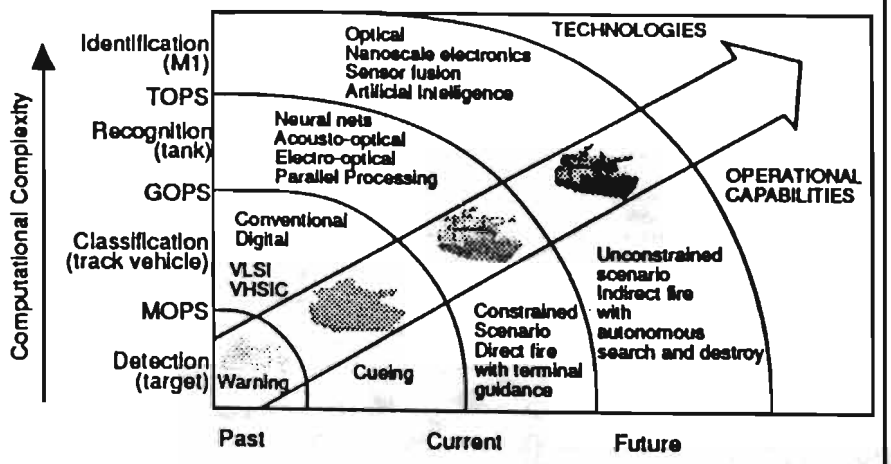


Figure 6. Processing technology developments are critical to provide ATR operational capabilities for brilliant weapons.

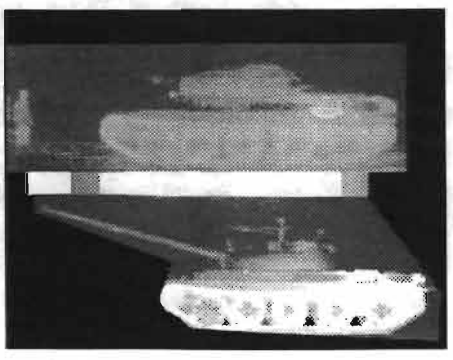


Figure 7. Infrared Modeling/Simulation. Developing effective computer simulations of IR observable targets allows the laboratory scientist to evaluate many possible ramifications via modeling without having to resort to expensive, time-consuming hardware development and testing.

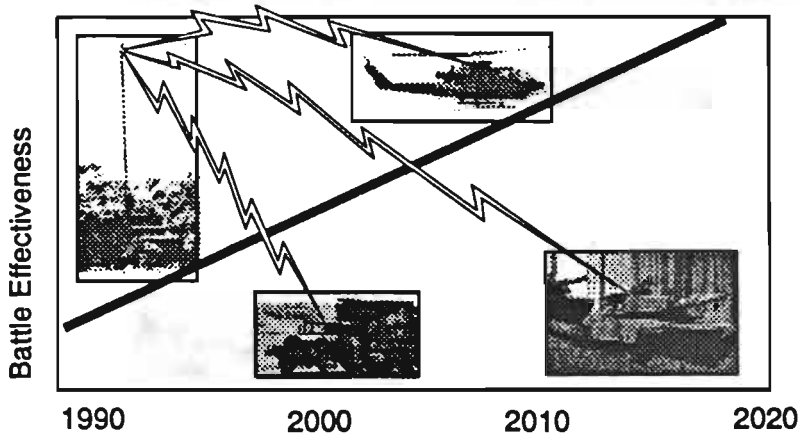


Figure 8. AI Application — AirLand Battle Management. Coordinated via AI, battle elements will operate more effectively. Effectiveness is measured by Lanchester Equation coefficients that describe combatant strength and forecast battle outcome.

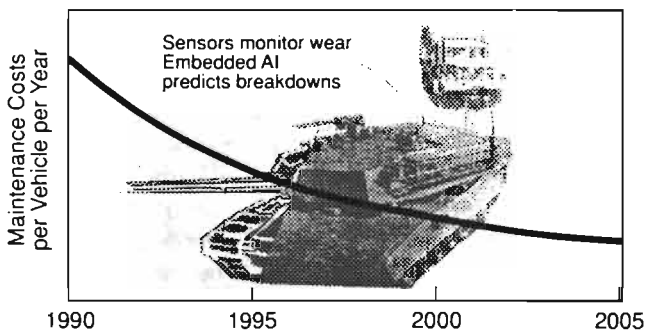


Figure 9. AI Application — Prognostics. AI-based prognostics, in conjunction with embedded sensors, will reduce annual maintenance cost per vehicle (and reduce downtime) through more efficient scheduling of preventive maintenance.

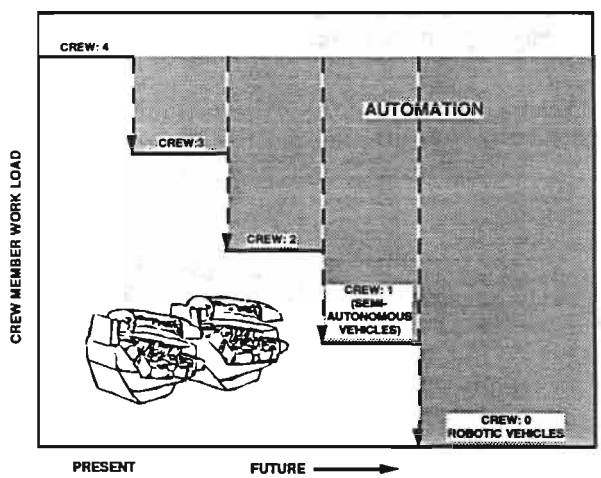


Figure 10. Reduction of the number of crew in future combat vehicles dictates the necessity of the application of AI in the automation of many crew tasks.

improve battlefield management (Figure 8), intelligence analysis, autonomous weapons and vehicles, and other systems. AI has the potential to coordinate an AirLand Operation, making the elements engaged in the battle more effective. AI-based prognostics, in conjunction with embedded sensors, will reduce annual maintenance costs per vehicle through more effective scheduling of preventive maintenance (Figure 9). The effective use of AI decision aids will improve the man-machine interface and improve combat effectiveness. An application of this technology is the research being done to reduce crew workload (Figure 10). The joint Human Engineering Lab/TACOM project, Integrated Two-Man Crew Station (ITCS) will employ AI to automate many of the crew's routine duties, freeing it to concentrate on more critical matters.

Artificial intelligence will help determine the capabilities of future **robotic** systems. On the battlefield, tele-operated and autonomous vehicles can be deployed in reconnaissance (Figure 11), countermine operations, rearming, refueling, sentry duty, environmental sensing, and route planning. Already, robotics technology exists to create systems with the ability to perform routine tasks such as ammunition handling, refueling, assembly line activities, material handling, and explosive ordnance disposal. Robots have potential as force multipliers, decoys, and for the retrieval of damaged vehicles. Robotic simulators will provide safe, low cost realistic troop training. Robotics have the potential to enhance automotive crew functions, ammunition loading, target acquisition, and maintenance prognostics and diagnostics. Current uses of robotics in the Armor Force include the development of the main battle tank autoloader, and the development of the Tactical Unmanned Ground Vehicle (TUGV). Current TUGV programs, such as TACOM's computer-assisted remote driving, DARPA's autonomous navigation, and MICOM's mission module research potentially will give robots the same capabilities as manned systems. Robotics also have the potential to increase force effectiveness and soldier survivability by augmenting the force and the current inventory.

Many of the technologies discussed so far will depend on the advances of **power generation, storage and conditioning.** To facilitate use with electric guns, ground-based lasers, and electric drives, very large, repeated

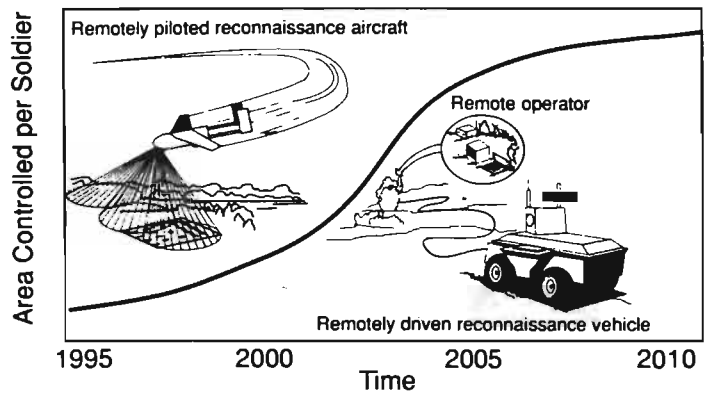


Figure 11. Robotic reconnaissance will provide an expanded point of view and command of the battlefield from a relatively safe vantage point.

energy pulses will be required. Power generation, storage, and conditioning research involves the reduction in size and increased efficiency of batteries, capacitors, switches, resistors, inductors, and compulsators. Advancements in capacitor technology have reduced the size of a 5 MJ energy store from 63 cubic meters to 0.9 cubic meters. Fuel cells, similar to those used on the NASA shuttles, have the potential to power future combat vehicles. Smaller, more efficient power supplies are necessary before the more lethal weapon systems can be integrated into future combat vehicles. These technologies also have the potential to increase tactical and strategic mobility by decreasing the size and weight required to power combat vehicles. Electric drives will make combat vehicles more responsive and maneuverable, while decreasing the logistics burden.

Advanced propulsion technologies will also increase the maneuverability of future combat vehicles. These technologies address increasing power-to-weight and power-to-volume ratios in vehicular platform performance, and efficiencies of their propulsion systems. Research is looking into replacing the mechanical transmission with an electric drive (Figure 12). Other critical ingredients of this technology include research into active suspension, lightweight track, and methods of reducing fuel consumption (Figure 13). Advancements in this technology have already allowed the size of the power-pack for the next generation tank to be reduced by 50 percent. Current propulsion research works with diesel, turbine, and all-electric systems. This technology has the potential to increase vehicle survivability through signature reduction, increased cross-country speed, and increased vehicle range. Smaller more efficient propulsion systems will increase reliability, availability, maintainability, and durability (RAM-D).

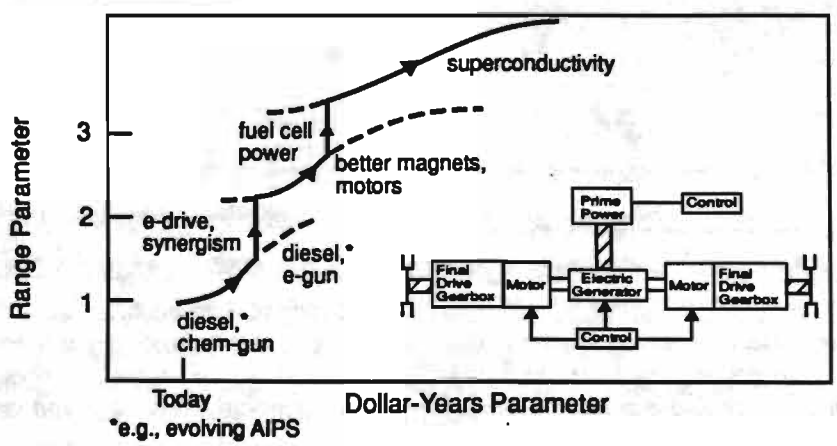


Figure 12. Electric Drive: Two S-Curve Jumps. Advances in several technologies support the use of electric drives for military vehicles and greatly ease logistics fuel burdens.

Directed energy weapons (DEW) may represent the ultimate future weapon system. There are significant technological barriers to the advancement of large-scale directed energy systems. These barriers include size and weight reduction, power requirements, higher energy/power input and better control of the radiated beam. However, the short time of flight of these systems, limited only by the speed of light, offer novel potential to cause damage and disruption to enemy forces. Lasers, radio frequency directed energy, and particle beam technologies have made possible the nearly instantaneous projection of large bursts of energy into targets. Directed energy weapons may cause damage to mechanical and electronic systems by ablation, melting, shock and spall, and interference with circuitry and information networks. These systems may cause damage to humans by incapacitation, tissue damage, and blinding. Applications of directed energy technology include laser rangefinders and low energy lasers designed to disrupt optics (Stingray and Laser Countermeasure System). Other applications of this technology will include nonlethal systems used to temporarily disrupt the operations of enemy systems, making them useless. High power microwaves are being considered for use in countermine operations. DEW research has unimagin-

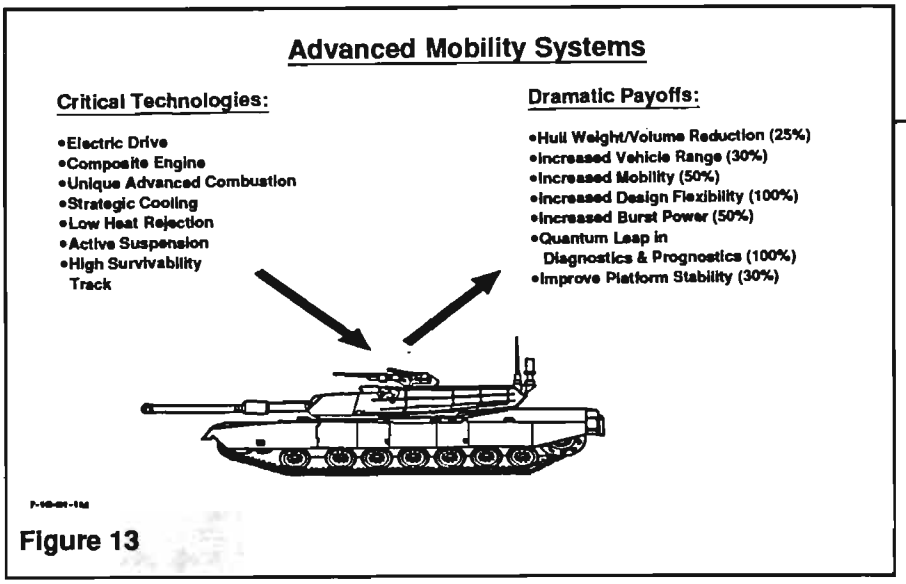


Figure 13

able potential and may eventually bring combat vehicles into the realm of what used to be science fiction.

There are other technologies that have less obvious relationships to the development of future armor combat systems. However, these technologies must be developed if we are to win on the future battlefield.

Future space-based systems will provide surveillance, communications, weather/terrain data, positioning, and targeting capabilities. When merged, they will provide a tactical commander with a comprehensive knowledge of the battlefield (Figure 14). The ability to assess the enemy's strength, location, and movement, and the ability to communicate and coordinate one's own forces over great distances, argue convincingly for the development of technologies to be used in space. **Space technologies** will result in active and passive sensors, on-board signal/data processors with real-time delivery of information, and communication relays from satellites. Current application of space-based technologies are the Global Positioning System (GPS) and JSTARS.

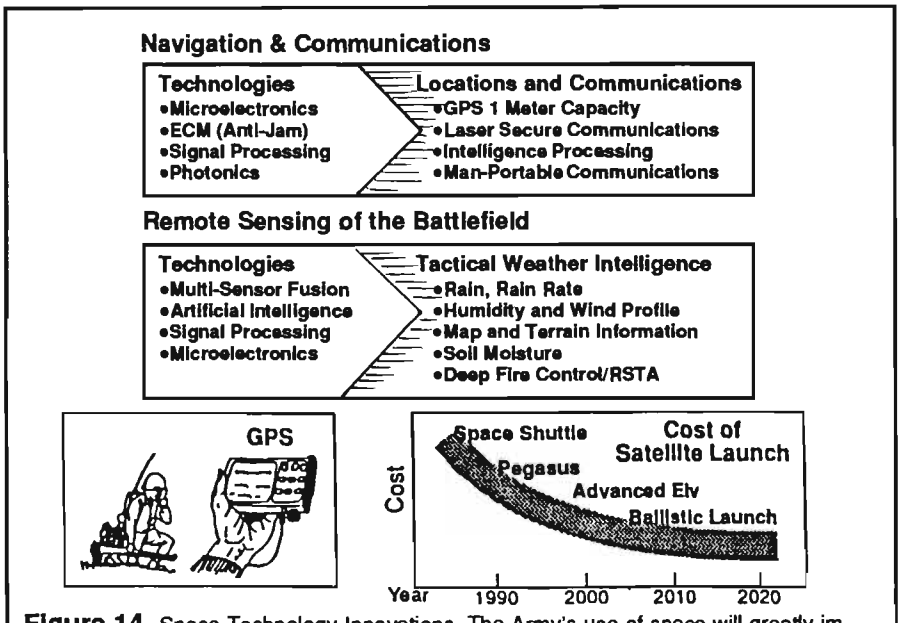


Figure 14. Space Technology Innovations. The Army's use of space will greatly improve the battlefield management of communications intelligence, position locations, remote sensing, and the ability to strike deeply behind enemy positions.

In another program, Tactical Exploitation of National Capabilities (TENCAP), the Army has fielded specialized ground terminals designed to process signal and imagery intelligence in support of corps and division operations. This program provides a method of passing satellite-derived information to the tactical commander.

There are two technologies that deal directly with improving soldier performance. **Biotechnology** involves the techniques of manipulating and controlling living cells, and the exploitation of biological processes and products. Current uses of biotechnology include the use of microorganisms to dissolve oil slicks and to control insects in agriculture, in lieu of harmful pesticides. Biotechnology is also used to genetically engineer spider silk, which has potential applications in body armor. Future applications of biotechnology include the use of biosensors for the detection of chemical/biological agents, the development of better vaccines, and bioengineered rations, which will enhance soldier performance.

Neuroscience technology investigates how information is processed in the body. The brain is very effective at detecting, recognizing, categorizing, and discriminating between objects and events in our environment, and then deciding on a course of action. Neuroscience technology is attempting to mimic this ability. A better understanding of the brain will allow a more effective interaction between man and machine, enhancing AI-based systems and robotics.

Perhaps the most overlooked of all technologies is **advanced manufacturing.** This technology deals with the production of goods in a more resource-efficient manner. Better manufacturing techniques have the potential to increase product life, reliability, maintainability, and cost savings. These product enhancements will be reached through the use of advanced

materials, increased automation, and systems integration.

The Department of the Army has over 40 research and development locations, staffed with some of the best scientists and technicians in the world, committed to the technologies that will most enhance the capabilities of the future force. Lethality, survivability (including mobility, agility, and penetration), deployability and sustainability are the TRADOC priorities for the Future Main Battle Tank (FMBT). Although these priorities change slightly for other vehicles, consistent with roles and missions, the technology base is supporting our needs. Lethality increases will be realized through microelectronics, photonics, and acoustics; advanced signal processing and computing; protection/lethality and directed energy technologies. The protection aspect of survivability will be enhanced with protection/lethality, low observables, robotics, protection/lethality and advanced materials and materials processing. Tactical mobility will be increased by advances in power generation, storage and conditioning, and advanced propulsion technologies. The need for strategic deployability will be attained through advanced materials and material processing. Sustainability will be enhanced through advanced propulsion; power generation storage and conditioning, and biotechnology. All of these technologies, when combined to develop the optimal combined arms fighting force, will ensure that the Armor Force will win and survive on the future battlefield.

NOTE: The definitions of these technologies and all the figures are from the Army Technology Base Master Plan.

CPT(P) Edward W. Payne is a 1980 graduate of the United States Military Academy and has a Masters Degree in Organic Chemistry from Purdue University. He has attended AOBC, AOAC, CAS^3, Ranger and Airborne Schools. He has served as a tank platoon leader, support platoon leader, tank company XO, headquarters company XO, and tank company commander in 5-32 Armor, 24th ID (Mech). His most recent assignment was as an Assistant Professor of Chemistry, United States Military Academy. He is currently serving as Chief, Technical Developments Branch, Directorate of Combat Developments, Ft. Knox, Ky.

1992 Armor Conference Schedule

5-7 May 1992

"The Armor/Cavalry Soldier"

Tuesday, 5 May 1992

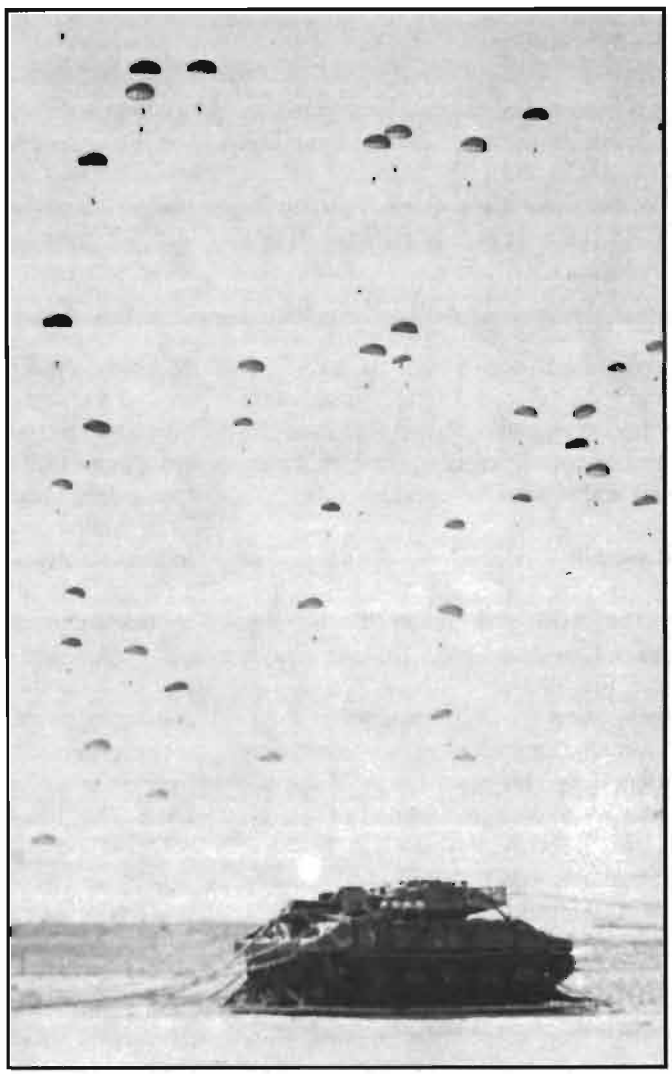
Time	Event	Location
0900-2200	Registration	Brick Mess
0800-1700	Displays	TBD
1530-1630	Honorary Colonels of the Regiment	HQ Conf Rm
1645-1730	Retreat Ceremony Korean War Armor/Cavalry Units	Brooks Field
1800-2000	CG's Garden Party	Qtrs #1
2030-2200	Buffet & Regimental Assemblies	Brick Mess
	Wednesday, 6 May 1992	
0630-0730	Stand-to Breakfast	Brick Mess
0700-1000	Late Registration	Gaffey #2
0800-0815	Welcome/Opening	Gaffey Auditorium
0815-0910	Keynote Address	Gaffey Auditorium
0910-0930	Break	
0930-1030	Report to the Force	Gaffey Auditorium
1030-1130	Presentation	Gaffey Auditorium
1130-1200	Armor Assn. General Membership Mtg.	Gaffey Auditorium
1200-1300	Lunch	
1300-1530	Presentations	Gaffey Auditorium
1530-1600	Panel	Gaffey Auditorium
1800-2200	Armor Association Banquet	
1800	Cocktails	Patton Museum
1900	Banquet	Armor Hall
0800-1700	Displays	TBD
	Thursday, 7 May 1992	
0630-0800	Armor Association Executive Council	Brick Mess
0800-1200	Presentations	Gaffey Auditorium
1200-1315	Chief of Armor Luncheon	Brick Mess
1330-1530	Presentations	Gaffey Auditorium
1530-1545	Farewell Remarks	Gaffey Auditorium
0800-1600	Displays	TBD

- POC for General Officers billeting: Protocol Office, DSN 464-2744/6951, commercial (502)624-2744/6951.
- Limited on-post billeting may be available for other personnel. Contact DEH, Mrs. Easter, DSN 464-3138/3943, commercial (502)624-3138/3943.
- POC for equipment displays: DCD, 1LT Byington, DSN 464-1250/1838, commercial (502)624-1250/1838.
- Overall POC for Armor Conference: CPT Franz, DSN 464-1050/1441, commercial (502)624-1050/1441.
- Conference uniform is battle dress uniform; banquet is coat and tie; garden party is BDU, casual, or Class B with short sleeve shirt and open collar.
- Tickets for social functions will be sold during registration. Ticket sales will stop promptly at 1000 hrs, 6 May 92 (estimated cost of social events - $60.00).
- Transportation to and from Standiford Field, Louisville, Ky., will be available on a limited basis.
- Security clearance notifications for this conference are not necessary because this conference is unclassified.
- Visit requests for foreign nationals must be submitted through their embassies in time to allow for normal processing.

The 13-year search for a Sheridan replacement nears an end

The Armored Gun System

by Directorate of Total Armor Force Readiness, Directorate of Combat Developments, and TRADOC System Manager for Armored Gun



A Sheridan drops with troops at Fort Bragg. Officials expect to select its replacement this spring.

The climatic events in Europe over the last three years have expanded the potential for contingencies in any area in the world. The problem, now and in the future, is the cascading of modern weapons systems into the Third World countries. Coupled with technology transfer, many countries continue to modernize their weapons inventory. There are 28 countries that have more than 1,000 main battle tanks. Our changing commitments confronted by a lethal and high-tech threat dictate that we be able to deploy highly mobile and lethal forces rapidly.

The Armored Gun System answers the need for a rapidly deployable, lightly armored system that can support the contingency forces in offensive, defensive and MOUT close combat operations with CE and KE direct fire that is accurate and lethal. The AGS is not solely a direct fire support asset for the dismounted infantry nor is it a light tank to replace the main battle tank. The AGS is a readily deployable, versatile and flexible fire support and maneuver asset that provides significant combat power when and where MBT's are not available. The AGS's enhanced mobility and high volume of firepower permit light forces to mass firepower quickly. This mobile direct fire support can fire antipersonnel, antimateriel, and antitank ammunition. Basic loads can be tailored for the mission with a mix of HEAT, SABOT, HEP, APERS and smoke to destroy the expected targets during the mission.

The Armored Gun System has had a long evolutionary history. In 1978 it began as the DARPA funded High Survivability Test Vehicle-Light, or HSTV-L. In 1980, the Infantry School completed the Cost and Operational Analysis (COEA) on the Mobile Protected Gun System (MPGS). The Mission Element Need Statement that firmly established a need to replace the M551 was approved by Department of Defense (DOD). In 1989, the XVIII Airborne Corps stated its urgent need to replace the Sheridan. As a result, a General Officer Steering Committee (GOSC) convened, reaffirmed the need for an AGS and outlined the resource requirements for an acquisition program. The requirements were redefined, and in August of 1990, the Army Acquisition Executive designated the AGS a project under the Program Executive Officer Armored Systems Manager for the purpose of acquiring a weapon system.

The program is supported throughout the Army and in Congress. As you read this, the Source Selection Board is reviewing all submitted proposals and working toward a contract award date in the spring of 1992.

The AGS has operational requirements in the areas of deployability, lethality, survivability, and sustainability, in that order of priority.

Deployability

Key to AGS equipped units' mission accomplishment is its deployability. The AGS must be capable of Low Velocity Air Drop (LVAD) from the C-17 if that system is available during fielding. LVAD from a C-130 is desired rather than required to reduce the technical and program schedule risks. After deployment by LVAD, it must be able to fight immediately after derigging. The AGS must be roll-on/roll-off capable from all strategic and tactical transport aircraft.

Lethality

The AGS will mount the government furnished XM35 105-mm gun. It can fire all North Atlantic Treaty Organization (NATO) standard and Armament Enhancement Initiative ammunition. This gives the AGS the capability to engage a myriad of targets, from tanks to personnel to bunkers. The fire control will be roughly equivalent to the M60A3. The system will have either a four-man crew or a three-man crew with an autoloader. It also will have a 7.62mm coax machine gun, and the commander's weapon station will be able to mount the M2 machine gun or the Mark 19 grenade launcher.

Survivability

The AGS will have greater mobility than the Sheridan and may incorporate crew protection features similar to those of the Abrams. It also will have three levels of armor protection to meet various threats. The base vehicle is level 1, and there will be two additional add-on armor packages. Add-on armor must be able to be installed quickly and easily by the crew. Armored Gun System commanders must enhance the survivability of the vehicle by using sound tactics, techniques, and procedures.

Sustainability

Sustainability will be critical to any contingency force. We may not have the luxury of a DESERT SHIELD with its long build-up time and sophisticated air and sea port facilities. Air lift assets may be constrained, thereby restricting spare parts flow and limiting the deployment of maintenance assets. To this end, the AGS will have a power pack that can be removed and replaced quickly. It will be able to do like-vehicle recovery. Modern diagnostic methods will contribute to system maintainability. Built-in Test Equipment (BITE) will be used to the maximum extent possible and it must be able to sustain a 90 percent operational availability rate.

The AGS will deploy as an integral part of a combined arms team to any contingency area and provide direct support to airborne, air assault, and light infantry as a mobile reaction force. That force with the AGS is capable of containing and repulsing a penetration by threat armored forces through counterattack by fire. Also, it will provide a lethal presence that forces the enemy to mass, thereby exposing himself to attack by air and indirect fire. The system is capable of night forced entry operations and can support the light force at squad through division level with direct fire. Units can be employed as AGS pure or can be task organized to suit the mission. When inserted (LVAD) at night with the initial infantry elements, the AGS can secure an airfield complex, block high speed avenues of approach or react rapidly to block enemy penetrations. When inserted with the follow-on forces by airland, or roll-on/roll-off operations, AGS units can conduct hasty attacks to destroy threat positions and obstacles, enhance security through reconnaissance, block high speed avenues of approach and serve as a reaction force. Follow-on missions include platoon- to battalion-size operations, including limited offensive operations, also defense, security, restoration of command and control, extended patrolling, convoy escort, rear area security, and non-combatant evacuation (NEO) assistance.

The current force calls for 300 systems to be built over a period of several years. The first unit equipped will be the 3-73 Armor (Airborne), a light armor battalion of the 82nd Airborne Division, in 1998. The AGS will replace its M551A1 (TTS) Sheridans.

Next year, the 2nd ACR will be reorganized but will not receive the AGS until after 1998. In this new light cavalry organization, the AGS will give those units the staying power for day and night all weather operations. The AGS will help the light cavalry units win the recon/counterrecon battle, and cause massed targets for the tactical air, attack helicopters, and indirect fire. These light cavalry units will be most effective at providing reconnaissance/counter-reconnaissance, delay, raid, and exploitation operations. Light cavalry gives the contingency force commander a force capable of performing similar missions and roles as armored cavalry units.

This new reality of force projection demands that we resolve the problem of how we project a force that is both deployable and lethal enough to defend against or deter attacks by a determined enemy. In the past, we have concentrated on forces that are rapidly deployable. In doing so, we have had to sacrifice lethality. The AGS will provide tenacious lethality to the contingency force that will enable these forces to set the conditions for the battle and to allow the commander to shape the battlefield. The troopers of 3-73 Armor in Panama and Southwest Asia have laid the foundation of this new era of light armor and cavalry. We must continue to build upon their efforts.

Training With Technology: Armor 2000 and Beyond

by Ms. Lou Edmondson

Racing across the frozen winter landscape, the gunner suddenly recognizes his target in the primary sight of the M1A2. He checks weapon system status, zeroes his aimpoint, and lases for range to the target, the turret of a T-72 almost hidden in a drainage ditch to his left front, 3200 meters away.

Meanwhile, the driver slews the machine into a 45-degree turn, keeping the tank's frontal armor facing the enemy. Excited fire commands echo on the intercom system just before the first round goes out, rocking the tank and inundating the crew in a wave of blast and sound. Almost instantly, the target disintegrates in a blinding flash of light.

All motion ceases, and the lights go on. The gunner notices that he is perspiring. The crewmen, still riding an adrenaline rush, talk nervously about their close call. But this was not real. This was simulation. The crew was not inside a tank, but in a virtual reality facility that may be a lot closer than you think.

In the past 100 years, we have gone from telephones and talking movies to VCRs, teleconferencing, and interactive video games. Applied science and technology, racing along at increasing speed, have produced a cornucopia of new goods and services, spurring greater and greater productivity and advancement. It is hard to imagine that, about 100 years ago, the U.S. Patent Office foresaw a new age when there would be nothing left to invent, "when human improvement must stop."

It hasn't... and it won't. Only those who are ready for it will be able to keep up. The U.S. Army Armor Force has made the commitment to be ready, and has set forth its blueprint for the future in a study called Armor 2000. The study defines how Armor's roles and missions will evolve, in keeping with the evolution of AirLand Operations. A major part of the study concerns the increasing use of high technology for training. As we approach the 21st century, technology promises to change the way Armor fights, and how it acquires, manages, and communicates information. But the greatest impact of technology will be on training. The scope of this potential change is staggering. At Fort Knox alone, the advent of technology-based training will affect the 30,000 Armor and Cavalry soldiers attending the Armor School's resident courses each year, and thousands more in non-resident training.

We enter this era with an attitude of enthusiasm, rather than apprehension. While many training challenges lie ahead, we should realize that armored forces have gained unprecedented esteem as a result of DESERT STORM. Programs such as Armor 2000 guarantee that we build on that success, combining the traditional resourcefulness of our soldiers and our civilian work force with an array of technological advances to develop an effective training program for the 21st century.

The following are a few of the technology-based developments that will determine how Armor trains in the year 2000 and beyond.

VIDEO TELETRAINING
Breaking the Distance Barrier

Long before the information age, a student sent in his money and received, by return mail, the very first correspondence course. Over the years, correspondence courses have remained a popular and effective way to gain knowledge. But in the past 10 years, electronic training media have begun to replace the written packets that arrived in a student's mailbox.

Corporations and universities the world over have been quick to recognize the instructional potential of broadcast media to extend instruction to people in their homes and other places outside the workplace. Since the early '80s, for example, AT&T and the National Technological University have used television to offer training programs and advanced degrees to people in widely-dispersed locations. These transmissions, which originate at the corporation's home office and on the campuses of the participating universities, are delivered live via satellite directly to the technical professionals and managers at their work sites and to students at regional campuses.

Trainers and educators know that television is an efficient and effective means of delivering information. It lets you reach many groups of people at the same time, when it is needed, and to gain access to experts anywhere in the world. These capabilities add up to a more efficient, faster delivery of resources. Today, military trainers are faced with a similar challenge, to provide quality training

for an ever-increasing number of globally-dispersed soldiers.

Currently, the National Guard and the U.S. Army Reserve (NG/USAR) make up 50 percent of the Armor Force. These units must have continuing training to ensure that they can be committed to battle because they will be essential to any future operation such as DESERT STORM.[1] The Armor Force is committed to ensure that its NG/USAR forces are just as capable of playing a combat role as their Active Component (AC) counterparts.

The NG/USAR urgently need more effective training methods because they have so little time to train and because these units are so dispersed geographically. Future training needs most likely will require a multimedia approach, to include television. Video Teletraining (VTT), one approach that maximizes the potential of television, might well play a strong role in meeting the need to train and learn at a distance.

VTT is a type of electronic conferencing that uses advanced telecommunication. An instructor in one location telecasts to one or more remote student sites where students respond via audio and video. The effectiveness of this electronic presentation of material has already been tested on the Kentucky National Guard. Under TRADOC guidance, the Basic Non-Commissioned Officer Course (BNCOC) was delivered directly to 19 local armories and Army bases using a satellite-based distribution system. VTT delivery proved successful; in fact, the students at the remote sites performed significantly better than the control group students, who learned using traditional instruction. There has been an extremely positive reaction from students, instructors, and training program managers. It is significant to note that more than 90 percent of Kentucky soldiers taking the BNCOC course via VTT were able to pass the examinations on the first try, while only approximately 65 percent passed on the first try in the traditional classroom.[2]

The benefits of VTT are well documented: reduced travel costs, presentation of timely instruction to a greater number of students, consistency of message delivery, increased access to subject matter experts, and more cost-effective use of talents, skills, and expertise because so many more soldiers are sharing these resources.

Currently, Fort Knox has two self-contained studios in operation to explore VTT technology. The Armor School is now determining which lessons are best trained with video.

By the year 2000, television-based instruction, coupled with print support and other resources, could provide the NG/USAR with the same high-quality instruction active duty soldiers receive, but without the need for soldiers to leave home stations, except for the equipment-intensive training that must be conducted at the Armor School.

COMPUTER-MEDIATED COMMUNICATIONS

Managed Communications for the Soldier

Inside armories across the United States and in Europe, soldiers at computer terminals can access the latest information on the Future Main Battle Tank. An instructor at Fort Knox answers questions on the tank's under-armor auxiliary power unit within minutes. A requirement for advanced communications has always existed. The Army is not excluded from this need.

Although VTT has many benefits, it does not provide for further communication between the soldiers and the instructor between telecasts, or after the telecast is completed. In the year 2000 and beyond, computer-mediated communications (CMC) may well serve as an adjunct program to fill this void. One of the newer technologies in distance training, CMC is a means of sending instruction and communicating with students from different locations at different times, using a computer network.[3] CMC supports electronic mail (E-mail), the transmittal of a message from one terminal to a storage location where it can be retrieved later from another terminal; messaging, which allows two users at distant terminals to communicate in real-time; and conferencing, which usually includes both E-mail and messaging capabilities, and may involve other users at multiple terminals.

In a CMC network, soldiers and their instructors, using personal computers, are linked by modems and phone lines to a central host computer. All can participate in the classroom from any location, and soldiers and instructors can use the system to receive or leave messages. CMC allows instructors to carry on electronic classroom instruction with soldiers separated by time zones and physical distance. The network would allow soldiers to work together in groups, to ask questions of their peers and the instructor, and to informally share training experiences. Instructors could conduct small-group instruction, provide prompt feedback on performance, or give remedial instruction.

For example, soldiers could discuss how to evaluate terrain following a VTT class on Intelligence Preparation of the Battlefield, then receive immediate critiques from an expert. The instructor could direct his classes to write company, battalion, or brigade OPORDs, discuss their OPORDs with their peers, and then receive feedback from the instructor. Individually, soldiers could access technical data on tanks and gunnery.

Another advantage of CMC systems is that the CMC class could be open 24 hours a day, seven days a week, easily accommodating the time schedules of NG/USAR soldiers at their home stations.

The question is not whether we should use CMC but how best to use

it. CMC has not yet fully developed its potential, but recent technical advancements, along with increased computer literacy, make it worth our attention as we move toward the year 2000.

DIGITAL VIDEO INTERACTIVE
The Civil War Meets Super Nintendo

A collaborative project between historian Ken Burns (Emmy-award winner for his series "The Civil War") and the Center for Interactive Educational Technology (CIET) at George Mason University uses computers in another innovative way to teach and train. "The Civil War Interactive" attempts to return history to an oral-visual tradition, but in a completely new form, one to which students are culturally responsive. The design of this multimedia application recognizes the importance of narrative in the study of history, the role of film in relating narrative, and the unique nonlinear features of multimedia. The multimedia environment gives students the unique opportunity to simultaneously gather and explore the primary source documents, photos, and data from which the narratives are derived. Students can then trace the numerous relationships among the events, linking ideas and recording observations as they move easily among the many sources.

Perhaps most important, the project acknowledges the need to help students develop skills in historical inquiry so that they will be able to decipher narrative, interpret documents, and derive meaning from historical events.[4] If the optimistic predictions for this multimedia approach prove true, Digital Video Interactive (DVI) may revolutionize interactive courseware. DVI is a first step in digital multimedia development. It will be able to incorporate anything from text to full-motion video, and will have the potential to expand the usefulness of PCs.

DVI technology is based on a simple concept: all presentation materials are stored together on a random access device, such as a hard disk or CD-ROM, and accessed directly by the user's computer.[5] The possibilities for using DVI in military training are great. Soldiers could receive wargaming training in exportable DVI packages covering a virtually limitless array of subject areas. No additional equipment or modifications would be necessary. There would be savings both in terms of dollars and in travel time, both key considerations for NG/USAR units.

DVI obviously has applications for active-duty training as well. This powerful tool offers many military training benefits: soldiers can receive training on their own PCs or on PCs at their home stations; DVI has the advantages of Computer-Assisted Instruction and Interactive Video Disc with the added plus of full-motion video; the speed and the capacity of information storage are increased; DVI provides the variety of attributes - text, audio, stills, and motion video - needed to maintain interest when soldiers need to practice skills.

Although DVI technologies are still sorting themselves out, this multimedia technology could significantly affect future training requirements.

EMBEDDED TRAINING
Train Where You Fight

Simulations combine the best of interactive instruction with high levels of involvement, stimulation, challenge, and success. Typically, simulations are used when the cost of alternative training systems are prohibitively high, when it is impossible to study the concepts of interest in "real time," or when the risks are great enough to require demonstration of competence in a controlled, relatively risk-free environment.

The Army has made extensive use of stand-alone simulations in such devices as the Conduct of Fire Trainer and Simulation Networking (SIMNET). In the near term, we are working on fielding vehicle-appended simulators, such as the Tank Weapons Gunnery Simulation System and the Thru-Sight Video.

As good as these stand-alone and appended training devices are, Armor 2000 and future programs will push technology even further to bring the real world closer to the Armor soldier – in this case, so close that the technology is part of the tank. This is the concept behind embedded training (ET). Embedded training is intended to be a fundamental characteristic of the tank itself, designed, developed, tested, and fielded as an operational component. Embedded training is unique because it provides standardized hands-on training for the soldier in the field, on the soldier's own equipment. It will be capable of training individual, crew-functional, and force-level collective tasks, and can be tailored to a wide variety of locales and missions.

Embedded training uses simulations of realistic mission scenarios and provides "realtime" cues to which the soldier must respond, using the actual equipment. For example, if the Armor Force had been using ET capabilities during the build-up to DESERT STORM, it could have programmed its systems with the actual digitized terrain data of the future battlefield while still at home station waiting for deployment. Platoon, company, or battalion level exercises could have been trained in motor pools before deployment.

The benefits of ET are significant:

- Training occurs primarily in the soldier's field location, at crew positions using actual controls and displays
- An ET system can provide training while the vehicle is moving, as in a tactical engagement simulation
- ET can store and retrieve performance data for an immediate after-action review (AAR)

•ET standardizes training by eliminating or reducing the need for other training devices in the units, and is expected to provide training equal to, or better than, planned stand-alone or appended training devices.

The real plus of ET is that soldiers will literally "train as they will fight," using the same operational controls during training that they would use in combat. Embedded training for the Armor Force will continue to focus on gunnery, tactics, driving, and maintenance. Embedded training simulation will allow soldiers to acquire, identify, and engage targets; plan, coordinate, and employ combat power; exploit mobility capabilities of the vehicle; and perform checks and fault isolation for systems hardware.

Some current Army systems already have limited ET capabilities, including the Army's Patriot and Improved HAWK missile systems. Embedded Training is under development for other systems, such as the Forward Area Air Defense Non-line-of-Sight System (FAAD-NLOS) and the Improved 155mm Self-Propelled Howitzer.

Embedded training is also the preferred training technology to support the Armored Systems Modernization (ASM) program, which includes six new vehicles scheduled to replace existing armored systems. As envisioned, ET systems will be tailored to the needs of ASM vehicle crew operation and maintenance tasks. The Armor School is pushing the designers of our Future Main Battle Tank to include ET in their original design, and the test beds for our ASM effort and subsequent vehicle prototypes will include ET.

One major testbed, a contract effort that will provide ET capabilities, is the Extended Range Gunnery Fire Control Demonstration System. This is a state-of-the-art fire control system being designed to support the Future Main Battle Tank. It will contain computer-generated training exercises equivalent to a Tank Table VIII in difficulty.

Armored Vehicle Technologies Associated and Teledyne Continental Motors are currently under contract to design the Common Chassis Advanced Technology Training Demonstrator (CCATTD). Their designs for this testbed must be able to integrate the fire control system with the fire control simulator. If approved, the CCATTD, with its common chassis, will support all future ASM programs in the training and combat modes.

VIRTUAL REALITY
A Simulating Experience

Imagine visiting General Schwartzkopf in his headquarters in Saudi Arabia as he planned the next attack in the Gulf War; or meeting with Colonel Creighton Abrams in 1944 as he prepares to lead the 37th Tank Battalion and the 10th Armored Infantry Battalion in its counterattack to take Juvelize and break up the German advance in the Arracourt tank battles; or interacting with Patton in the battle of St. Mihiel and in the Meuse-Argonne offensive, where he proved his high competence for command. This kind of realism, called virtual reality, is what the Armor soldier can look forward to beyond the year 2000.

No development in computer technology is as exciting as virtual reality. Virtual reality is a technology that allows a user to interact with a computer-generated replica of the real world. Sensory input, provided via a visor, glove, and perhaps a treadmill, feed the senses information about the environment. The computer-generated sensory input responds both to the simulated world and to the user's movements in that world. The result is an experience approximating the real-world environment, but without the danger or expense that might be associated with gaining the same experience in the real world.

In 1978, the Department of Defense developed a 3-D display simulator as part of a project called the Visually Coupled Airborne Space Simulator for pilot training. The outgrowth of this work eventually produced the Super Cockpit, one of the earliest military applications of virtual reality. In 1984, the Human Interface Research Laboratory at NASA's Ames Research Center developed the first lightweight, stereoscopic, head-mounted display based on miniature liquid crystal display (LCD) monitors.[6]

Although no past or current systems are complete virtual realities, SIMNET is an important forerunner to a virtual reality system. SIMNET provides a multisensory (sight and sound) immersion in a synthetic environment in which soldiers interact with many other participants. But the user's windows into the virtual world are small - a shell representing an M1A1 Abrams tank helps improve the sense of presence. SIMNET falls short of virtual reality in part because the interaction in SIMNET is limited to interactions between players.[7]

The data base representing the world in which a SIMNET exercise takes place is dynamic and cannot be affected by the players. For example, the terrain data base is not affected by operator-induced actions: if an artillery round explodes, it does not leave a hole in the ground. Moreover, SIMNET is two-dimensional. To address this issue, the Army Project Manager for Training Devices (PM TRADE) has funded several research projects.[8] One involves looking at the integration of low-cost head-mounted displays with several image generators, including SIMNET.[8]

Perhaps the most obvious use of virtual reality technology in support of Armor training would be to enhance training simulations. These enhancements could provide for large-scale training exercises and training in strategy and tactics and could allow armor soldiers to take part in a combined arms training exercise.

A greater challenge for virtual reality technology may be to provide a realistic battlefield for the individual foot soldier, or to develop a virtual environment using automated

No development in computer technology is as exciting as virtual reality. Virtual reality is a technology that allows a user to interact with a computer-generated replica of the real world.

sandtables. Researchers are focusing on this challenge, along with greater realism for existing simulators. Virtual reality, when well done, should provide users a sense of having had real-life experiences, like the "holodeck" on "Star Trek: The Next Generation." Such learning occurs at an essential level. It will make fundamental changes in attitudes and behavior much more likely than with any other technology.

COMPUTER AUTOMATION FOR THE SOLDIER

The Persian Gulf War added to an existing requirement for simulators that can be deployed with troops. The Army Communications and Electronic Command Research, Development and Engineering Center and Soldier C^3 Program Offices in New Jersey are designing a "soldier's computer" that may meet this need. It is a fully portable, lightweight, hands-free computer system designed for individual soldiers.

The device will contain a helmet-mounted display, pocket-size computer, hand-held joystick, a voice and data radio, and a Global Positioning System. It will integrate other systems, such as night vision devices and numerous types of sensors.

A soldier will be able to view a map depicting information such as friendly and enemy positions or contaminated areas. Then he can input battlefield status information and transmit the data to a centralized data base so that other soldiers and units can be alerted.

Helmet-mounted displays would permit crew members to move away from fixed computer stations while maintaining access to their computer. This capability would allow a driver, for example, to maneuver his vehicle with his head out of the hatch. He could dismount and move away from the vehicle while still interacting with its computers via radio link or wire.

Coupled with the appropriate software, the "soldier's computer" could provide training to the soldier when and where he needs it. On-the-job training would be easier because soldiers could take the computer-based courseware with them into the field and could also interact with an instructor via the radio link.

Repair manuals could be stored on disk, rather than on paper, and could be kept at the squad or platoon level, making transmission to the soldier rapid and reliable. More diagnostics and repair could be conducted in the field. Soldiers could get expert guidance from remote locations. Radios would permit them to send voice or text messages through the communications networks to the subject matter experts providing the guidance. Subject matter experts could even snap pictures and transmit them back.

Although not projected for implementation until the mid- to late-1990s, the soldier's computer promises to make the best use of technology to solve problems and enhance training capabilities.

TOWARD THE FUTURE

The soldier's computer, ET, and other developments will help Armor maintain its edge. The entire Armor Force takes pride in the quality of training it provides, and in the strides it has made in melding training with technology. It also realizes that much work lies ahead in maintaining quality while forging new instructional methods.

In a time of shrinking budgets and growing demands, the key challenge for military trainers will be to find the most effective, efficient uses of technology to supplement — and in some cases, to supplant — traditional instruction. That is the driving force behind Armor 2000 and beyond as we meet the challenge of the future head-on.

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Back to 1918?

Survivability Is The Best Argument For a Two-Man Tank

by Captain Mike Newell

The recent decision to disconnect the Block III tank program from the Armored Systems Modernization program, and to scale back tank research and development efforts, has created a window of opportunity to explore new future main battle tank (FMBT) concepts that incorporate future technologies and have combat capabilities that far exceed those of the Block III tank.

Electromagnetic guns, active armor and protection, voice activated computers, automatic fire control, and head-up displays are just a few of the technologies available for exploitation in the future main battle tank. Some of these technologies could lead to reducing the number of crewmen required to operate the tank.

There are a number of significant advantages that evolve from a two-man tank design. They include: increased survivability, the possibility of decreased total combat casualties in an engaged tank unit, and, depending on the design, increased agility and deployability. My intent in this article is to show the advantages and the feasibility of a FMBT concept with a two-man crew.

Any future MBT design is likely to place a reduced crew in the tank hull, mount an external gun, have an automatic loader, and depend on indirect optics for viewing. On a conventional turreted tank, the most exposed area of the tank, the turret, contains the majority of the crew. In the future, especially with the advent of smart top-attack weapons, it will be prohibitively expensive (both in weight and cost) to continue to protect the turret of a tank. The best answer seems to be to put the crew down into the hull, the most protected part of the tank. This will require an external gun with an automatic loader. This crew position and the proliferation of blinding battlefield lasers will force us to use indirect vision optics to view the battle area. Because there isn't enough room for four crewmen in the hull of a tank, the crew will be reduced to two or three. This is the basic FMBT design used throughout my discussion.

The basic rationale for a two-man tank is brutally simple. A two-man tank is potentially more survivable than a three-man tank. Survivability is the critical issue. Two-man tanks may not be cheaper to build, operate, or man. Sliding off into these arguments dilutes the true advantages of a two-man tank — it saves lives and is more combat effective! The question hounding the two-man tank design in the minds of doubters is: can two men effectively fight the tank in sustained combat operations? The ability to fight a tank well is a component of tank survivability. If a two-man tank can't be fought effectively, all the survivability advantages in the world won't make it an effective combat system.

The increased survivability of a two-man tank is a product of reduced crew compartment size and a smaller tank silhouette. In 1991, The Rand Corporation completed a study on future tank systems designs called "An Exploration of Integrated Ground Weapons Concepts for Armor/Anti-Armor Missions." Included in this study is a two-man tank design and a number of three-man tank designs, all incorporating near term (4-5 years) technologies and equivalent capabilities. This study indicates that the crew compartment of a two-man crew, seated two-abreast, is significantly smaller than any three-man crew configuration. This should be apparent to most of us. Generally, the two-man crew compartment design is 30 percent smaller than the most workable three-man crew compartment design, two crewmen up and one crewman back. This reduction in size occurs in the length of the crew compartment, reducing the probability of an antitank weapon striking the crew compartment from frontal oblique, flank, and overhead (the most vulnerable angles) attacks.

If the probability of a round hitting the crew compartment is reduced, the probability of crew casualties is also reduced. In the Rand study, the two-man tank was 30 inches, or 10 percent shorter than a three-man tank. This presents a 10 percent smaller flank and top aspect (the most vulnerable) target to the enemy. This reduced target signature makes a two-man tank more difficult to acquire and more difficult to hit. The combination of a reduced probability of acquiring the tank, hitting the tank if it's acquired, and striking the crew compartment if the tank is hit equals greater survivability.

Another potential advantage of the two-man tank is it can be more heavily armored than a three-man tank of equal weight. In other words, a 45-ton, two-man tank can have more armor protection than a three-man tank that weighs 45 tons, and still have a smaller silhouette. This smaller silhouette allows consequently more

World War I **World War II** **DESERT STORM**

RENAULT 2-MAN CREW

SHERMAN HAD A 5-MAN CREW

WESTERN MBTs HAD 4-MAN CREWS

armor protection for a given tank weight. The weight savings incurred by reducing the length of the tank by 10 percent can be turned around and put back in the tank in the form of more armor protection. The weight savings gained enables the two-man tank to have roughly 10 percent more armor protection by weight than the three-man tank. The use of very high density armors enables the two-man tank to add additional armor protection without losing the size advantage. This obviously makes it more difficult to penetrate a two-man tank if it is acquired and hit. This additional armor protection, combined with the increased survivability brought about by the smaller tank silhouette and crew compartment, should result in potentially even greater tank survivability.

Alternatively, an advantage of the two-man tank design could be a lighter tank with the same protection levels as a larger three-man tank. In the Rand study, although all the tank designs where developed with equal armor protection levels, the two-man tank design was 10 percent lighter than the lightest three-man tank design. Given equal protection levels, the smaller, lighter tank has a number of potential advantages. The two-man tank could have increased cross-country, road, and dash speeds as well as having reduced fuel consumption. A major argument for the lighter two-man tank would be the increase in tactical mobility and strategic deployability. All these advantages are gained while still retaining the survivability advantages of a smaller crew compartment and smaller tank silhouette.

The argument that a two-man tank is capable of reducing total armor crew casualties is self-explanatory. The concept of a two-man tank crew reduces the number of tank crewmen in a tank unit by a third, versus a three-man tank. Future tank units equipped with two-man tanks would have fewer total armor crewmen exposed to enemy fire and therefore have the potential for a third less casualties than units equipped with three-man tanks.

There are two main questions about the two-man tank concept we don't have the complete answer to yet. (Two-man tank detractors would call these potential disadvantages!) Can a two-man tank crew maneuver the tank, acquire and engage targets, and exercise command and control of the tank (and tank unit for leaders)? And, can a two-man tank crew remain combat effective during sustained combat operations? Although we don't have the complete answer to these two questions, there is a body of research that strongly suggests that a two-man tank design is fully capable of executing all assigned tactical missions.

During the summer of 1990, the German Ministry of Defense conducted the first round of the VT 2x2 Experiments. These experiments, supported by some personnel from the U.S. Army, tested the concept of a two-man tank using modified Leopard 2 two-man tank demonstrators. The VT 2X2 Experiments are field trials with maneuver, gunnery, and force-on-force tests of two-man tanks from single tank level to platoon level. During the test the two-man crews successfully demonstrated the ability to maneuver, acquire and engage targets, command the tank, and control a tank platoon simultaneously in scenarios lasting up to 24 hours.

After the first round of experiments, the German Army concluded the two-man tank concept was feasible and warranted further testing. The second round of VT 2X2 Experiments are scheduled to begin in early 1993. Also in 1990, a joint PM-TRADE/NTC study was conducted at TACOM using the Vetronics Crew Display Demonstrator (VCDD). The study involved OPFOR personnel from the NTC and was designed to test the feasibility of using two-man combat vehicles in the NTC. The study concluded that two-man tanks were feasible if automated gunnery functions were incorporated in an OPFOR vehicle.

Both tests concluded that a two-man tank is feasible through at least platoon leader level and for at least 24 hours of continuous combat operations. Some existing and near-term technology improvements are required. The VT 2X2 tests found that 360-degree vision is required for both

crewmen, as well as duplicate driving, viewing, and weapons controls. These technologies exist today. The PM-TRADE/NTC study found that an automated acquisition and engagement system was required. Automatic target tracking and engagement technology is being developed for the LOSAT program and has been demonstrated in the Close Combat Test Bed (CCTB) at Fort Knox, Kentucky. The U.S. has a working autotracking program, and the Japanese have already included automatic tracking on their new Type 90 tank. The technology is here! We have the capability to build an operationally effective two-man tank prototype within five years — a tank that all of our research says is fightable for at least 24 hours of sustained operations and suitable for command and control activities through at least platoon leader.

The question we know a lot less about is how well will a two-man crew perform in continuous combat over an extended period of time. Very little has been done to study the effects of continuous operations greater than 24 hours on two-man crews. The 1979 British ENDURA 2 test (UK CONFIDENTIAL) is the only test that has taken a hard look at reduced crew capability in continuous operations. They determined that there were no tasks required of a tank crew that can't be executed by a two-man tank crew; the smaller the crew is, the more time it takes the crew to complete all the required tasks. In a 96-hour tactical mission profile, used to test M1A2 performance, a three-man tank crew with current tank technology would expect to get less than three hours a day to eat, sleep, and do personal hygiene. A two-man tank crew would get even less. We all realize this is unacceptable. The most time consuming tasks that a tank crew must perform are:

- Maintain air, ground, and NBC security
- Maintain communications
- Perform vehicle maintenance
- Rearm the tank
- Refuel the tank

There are near-term technology improvements that can increase the free time of tank crewmen to a desired level. For example, automating the air, ground, and NBC security requirement increases the free time for a tank crew member to slightly more than six hours a day. Active vehicle defense systems are being developed that include these automated security capabilities. An enhanced M1A2 style Intervehicular Information System (IVIS) can give the crew an automated radio watch capability. An active vehicle defense system and IVIS, in conjunction with the new "cordless" Combat Vehicle Crewmen helmet technology, may do away with security and radio watch as we know it now. In the future, tank crewmen will have the capability to monitor an automated security and commo system while they perform other crew tasks.

Vehicle maintenance tasks will be reduced through the use of maintenance prognostic and diagnostic modules. These are not exotic new technology, they are current systems that are included on the M1A2. These modules warn the crew of impending component failures, so the component can be replaced before it fails. This saves the crew time performing unscheduled maintenance on the tank.

A two-man crew would require some type of on-board power tools to accomplish **quickly** difficult crew maintenance tasks (changing track!). Automated rearm and refuel systems are a reality today. (If the Air Force can do automated refueling at 300 mph at 10,000 feet, we can certainly do it stationary on the ground.) Extra crews and maintenance crew chiefs may not be necessary. With basic, near-term technology improvements, we give the crewmen of a two-man tank over eight hours of free time a day. That's more than a crewman on a four-man tank gets now!

Arguments against a two-man/high tech tank most often revolve around the perceived inability of a two-man crew to perform all the tasks required of the crew in combat or the reliability of all the "high tech gadgets" on the tank. These shouldn't be the most important issues. The issues we need to focus on are the potential survivability, mobility, and deployability advantages of a two-man tank design! High technology, which has some risk, is necessary to enable a two-man crew to fight the tank as effectively as a more robust three-man crew could. Every indication says they'll do just that. If technology is critical to realizing the tremendous potential advantages of the two-man tank, then we have to make it reliable. And we can! Remember when laser rangefinders, digital fire control computers, and turbine engines were "unreliable" high tech "gadgets"? In each of these cases, high technology has demonstrated that the real benefits gained are worth the potential risks. It's time to quit fighting a good idea just because we're uncomfortable with the technology involved. If we don't accept some technological risk, and push the outside of the tank performance envelope, we will never capture the tremendous future combat capabilities of this thing we call a tank!

Captain Mike Newell was commissioned from the United States Military Academy in 1980. He served as a platoon leader, troop XO, and squadron maintenance officer at Fort Hood, Texas; as a tank company commander and HHC commander in Germany; and as a small group instructor at the Armor School. He is currently an ORSA project officer in the Directorate of Combat Developments at Fort Knox.

Do We Really

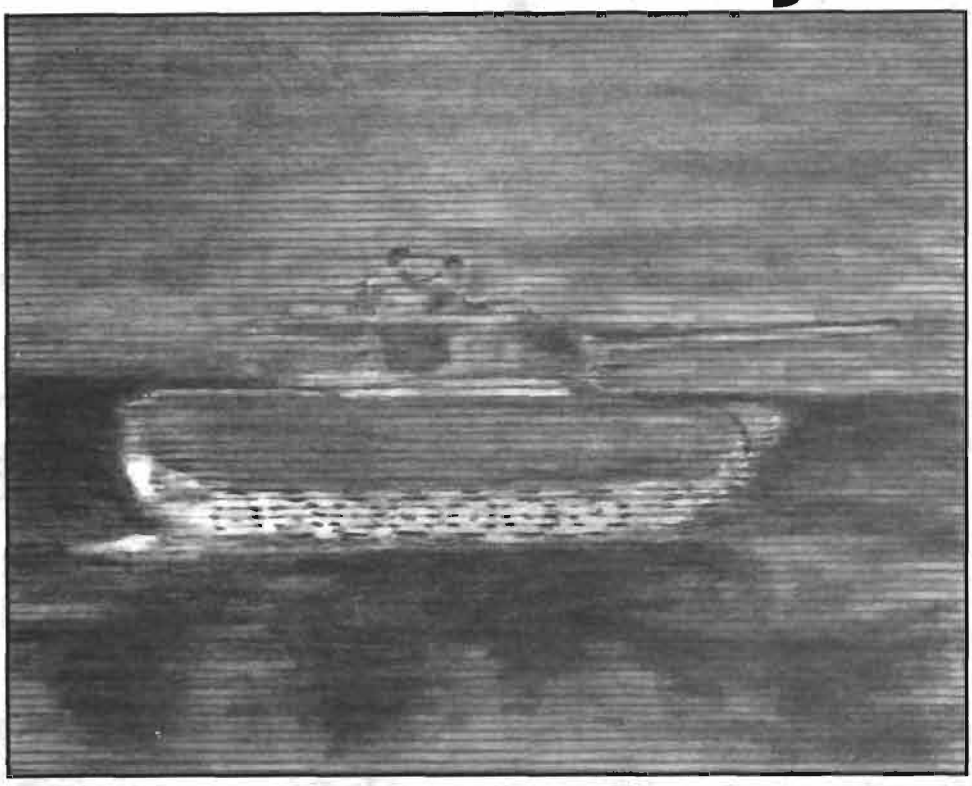

Illustration by
SPC Jody Harmon

Own The Night?

by Josef Schroeder

From the swamps of Vietnam to the sands of Iraq, the Army has learned the importance of seeing effectively at night.

We developed and fielded the first generation of starlight scopes and image intensifier (I^2) systems in Southeast Asia. These systems added a new dimension to land warfare, allowing us to fight the North Vietnamese and Viet Cong forces on our own terms. Operation DESERT STORM reaffirmed the importance of conducting ground campaigns on a 24-hour basis.

Army Chief of Staff GEN Gordon R. Sullivan recently voiced his concern with our night vision capabilities in a pointed question: "Do we really own the night?"

To discover the answer, the Armor School examined an armor battalion/task force through a warfighting lens (the battalion commander's combat perspective). The study focused on the task force structure in terms of tanks, scouts, and support elements.

The Threat

The first step in the study was a comparison of our capabilities and vulnerabilities and those of a variety of threats, Commonwealth of Independent States (CIS) "Soviet/Russian" and regional. That comparison showed that the countries employing the doctrine of the former Soviet Union turn night into day through extensive use of flares and reliance on infrared sights and devices. However, the CIS is beginning to install thermal equipment on tanks, attack helicopters, and some reconnaissance elements. In addition, the CIS seem to have reduced the thermal and radar signatures on its tanks (T-72s and T-80s) by making simple changes such as adding rubber skirts around the hull and turret. By insulating and reducing the hot spots on a tank, opposing gunners have fewer visual cues for target identification.

Most regional threats primarily use CIS equipment, with U.S. night vision goggles (NVGs) and some U.S. thermal-equipped weapon systems. In DESERT STORM for example, Iraq had Dutch-manufactured NVGs. Friendly nations such as the Egyptians, through the M60A3 buy, now have its thermal technology. It is becoming obvious that not only is the CIS selling its best equipment, but the

If we do not have a long-range identification capability, crews will fire when they detect a target; if the target is friendly, the result could be fratricide.

Chinese and others are also willing to sell their best equipment. As a result, we can expect a worldwide proliferation of thermal and I^2 devices. They will be available to any country or terrorist organization that can afford them.

Current U.S. Capability

In the U.S. armor battalion/task force, night vision capability ranges from the unaided human eye to thermal devices. Most crew-served weapons in the task force have thermal sights, but their capability ranges from poor (TOW, scouts) to adequate (the tank fleet). NVGs and driver viewers for combat vehicles primarily use I^2 technology, which provides some additional capability, but has the same range limitations first noted in the Vietnam conflict. Essentially, little new capability has been fielded since the mid-1980s.

Current U.S. thermal technology consists of first-generation common-module forward looking infrared systems (FLIRS), with detector arrays ranging from 60 channels (M-3 CFV) to 120 channels (M60A3, M1) to 180 channels (AH64). Modules with fewer detectors provide less information and detail and have reduced range to identify. Second-generation FLIRS, which could be available in the mid-1990s, could increase the number of detectors to 1,000. A 1,000-detector array will greatly enhance image definition, to about the same as future high definition television sets, and will increase the range at which targets can be identified.

All U.S. tanks — M60A3, M1A1, and M1A2 with commander's independent thermal viewer (CITV) — use the same 120-channel thermal sight. Most tankers recognize that the Tank Thermal Sight (TTS) on the M60A3 is better than the Thermal Imaging System (TIS) on the M1A1. The M60A3 sight, when compared to the M1A1 presents a more detailed image to the gunner. Even though both have a 120-channel detector, the signal to noise ratio of the TTS is better. The TIS uses a small TV tube whose curvature results in part of the image always being slightly out of focus. This image passes through beam splitters and lenses which reduce the total amount of light from the image. Consequently, the gunner increases the image contrast causing low resolution targets to disappear. The TTS does not have this handicap since its image is displayed directly onto an image intensifier tube screen, rather than through a monocular sight. The screen is easier to view for long periods of time. The sight on the CITV of the M1A2 also features improved image presentation, providing more detail than the gunner's TIS.

The future does not look bright for the Armor Force. We expect only limited improvement in the armor and cavalry fleet. A key development would have been the introduction of the CITV, the position location/navigation (POSNAV), and intravehicular information system (IVIS) on the M1A2, but it appears that only 62 of these tanks will be produced. (POSNAV and IVIS would allow the crew to easily navigate and know their position at night.) The only other programmed improvement for our tanks and scouts will be the addition of global positioning systems (GPS), which also will improve our night navigation.

U.S. Tank Force vs Threat

A comparison of our current capabilities with those of various threats shows that we currently have an edge in night vision. Only a concerted effort, however, will allow us to keep that advantage. This will be particularly true against regional threats, who could very quickly have a capability equal or superior to our current equipment. We could fall behind if we fail to program funds to field new technology while threat countries and organizations take advantage of the proliferation of Western technology, including thermal equipment, available on the open market.

The crucial area, in which we need a decisive edge, is in identifying targets beyond the maximum effective range of our weapons. That range is generally considered to be 3,000 meters for the M1A1 and 3,750 meters for the CFV. If we do not have a long-range identification capability, crews will fire when they detect a target; if the target is friendly, the result could be fratricide. Historical data indicates that fratricide occurs mainly at night or during limited visibility.

We also need an edge in our ability to maneuver quickly, accurately, and confidently at night. This means we must know precisely our unit's position and our own vehicle's position in relation to the unit; anything less accurate increases the chance of fratricide or vehicular accident.

In addition to the major concerns of target identification, fratricide, and night navigation discussed above, we also face vulnerabilities related to thermal and radar signature, chemical operations, and task force support. Tanks and scout vehicles have incorporated very little thermal or radar signature reduction technology. Both the M1A1 and the CFV have an especially distinct and bright thermal signature. Flat surfaces on tanks and CFVs further increase their radar signatures. Those who have used NVGs during chemical operations know that chemical operations cannot be conducted effectively at night because NVGs are not compatible with the protective mask. Task force support operations are only rarely trained and conducted under blackout conditions.

Few support units are given enough NVGs or navigation devices (GPS).

What Can Be The Future?

The Armor School has recommended several immediate actions to correct these vulnerabilities.

For tanks, the following actions can be taken:

•Field more than the 62 M1A2s currently programmed.

•Implement the M1A1 TIS tuneup. Night Vision Labs believes that the performance of the gunner's TIS can be improved by tuning up the electronics so they are operating at peak efficiency, producing a sight that is as good as the TTS on the M60A3. This would be done by an Night Vision Electro Optical Lab (NVEOL) team deployed worldwide to work on every tank.

•Field a second-generation FLIR with increased magnification and a 480-channel detector array, possibly with a 16-power narrow field of view. This would allow the gunner to identify targets out to the maximum range of the main gun.

•Replace the driver's I^2 viewer with a thermal viewer, thus allowing the driver to drive nearly as fast at night as in the day. His capability would not be limited to clear weather and available illumination. He would also be able to select routes that would provide cover and concealment.

•Employ a combat identification device (CID). This would allow gunners to shoot with confidence at targets that can currently be detected but not identified. Without a CID, the gunner has to wait until the enemy closes to within identification range.

•Reduce thermal signature and radar cross section. The thermal signature could be reduced by cooling the engine exhaust with shielding similar to that used on a helicopter.

For Scouts:

•Field GPSs with compass, POSNAV, and IVIS on all scout vehicles, to allow them to readily navigate at night and also know where the rest of their unit is at any one time.

•Upgrade all CFVs and HMMWVs with second-generation FLIRS with very high magnification (20-power, for example) and a Combat Identification Device.

For Combat Support:

•Ensure that NVGs are completely compatible with the protective mask and that they are adaptable to equipment in all types of units (for example, the tinting of some truck windshields prevents the driver from seeing out while wearing NVGs).

•Ensure that more support units have GPS.

Training Fixes:

•Implement more extensive target identification training. Tank Crew Gunnery Skills Test (TCGST) should/must include thermal vehicle identification. NVEOL conducted four to five hours of target ID training during a test at Yuma Proving Grounds. The result was the crews were able to detect targets by their exhaust gas signatures.

•Thermal camouflage can be created by simple methods, such as using wet burlap to produce a black/cold area or oil that looks like a hot spot.

•Teach crews how to set up thermal sights/devices for low-contrast targets, improving both acquisition range and detection range.

•Improve training devices and simulators, so that they include enhanced thermal target training capability. This could be accomplished by showing low-contrast targets under battlefield haze. For example, the thermal targets on the Unit Conduct of Fire Trainer (UCOFT) today are very clear and distinct.

The proposals outlined here can help the armor battalion/task force maintain its superiority in night-vision capability.

But not forever. Advancing technology, much of it available to potential threats around the world, will some day — perhaps soon — render our current equipment second-rate. We must pursue new programs and field new and improved equipment, with emphasis on POSNAV, second-generation thermal sights, signature reduction, and training to enhance our proficiency in night operations.

And we must begin now to guard against the day when we no longer "own the night."

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R. Paul Orentas, Ferdinand H. Zegel, Jaime Gonzalez, **Desert Shield IR Guide II**, January 1991

Mr. Josef Schroeder is an Operations Research Analyst for the Directorate of Combat Developments, Armor Center, Fort Knox, Ky. As a Reservist, LTC Schroeder is the commander of the 3rd Bn, 399th Armored Regt., 2nd Bde, 100th Division, Ft. Campbell and Hopkinsville, Ky. He was commissioned in Armor as a Distinguished Military Graduate from the University of Minnesota in 1970. He has served as an armor and recon platoon leader with 2-32 Armor, 3rd AD, Germany; company commander, 15th Bn, 4th Training Bde, Ft. Knox, Ky.; and Armor Test Officer with the Armor Engineer Board, also at Ft. Knox. He is 1986 graduate of the Command and General Staff College. His reserve assignments include battalion S3 and XO; and brigade S4 and S3, 2nd Bde, 100th Div.

The Future Is Now

A Profile of the M1A2 Abrams

by Captain Timothy Garth

No one can argue the effectiveness of the M1A1 Abrams tank during Operation DESERT STORM. The level of firepower, mobility, survivability, and ease of operation of the M1A1 ensured a quick, decisive victory in Southwest Asia. This tank is the latest and greatest, right?

Not quite, young trooper. Waiting for its debut with the soldiers of the 1990s is a tank more advanced than the M1A1 — the M1A2 Abrams Main Battle Tank.

The M1A2 Abrams Tank looks like just another Abrams variant, an evolutionary step in U.S. tank production. However, it is more a giant leap forward in tank technology. Nothing like the M1A2 has ever reached the soldier. In the age of electronics and data management, the M1A2 gives the tanker more lethality, fightability, and ease of use. Let's look at its components.

Intervehicular Information System (IVIS)

IVIS allows the tank crew to communicate with other tanks, including higher and lower echelons, using digital data burst communications. Operations orders, overlays, reports, calls for fire, and other information can be sent by digital data burst through the SINCGARS radios.

Position/Navigation System (POS/NAV)

The Position/Navigation System (POS/NAV) is a totally autonomous system that gives the crew its position in a military grid reference system format. This system does not depend on satellites or any other external devices for maintaining location. Input from the POS/NAV is used for own vehicle location and, when combined with the laser rangefinder (LRF) and IVIS, enemy and other far target locations are known. IVIS sends friendly tank positions to other tanks every 15 minutes, or 100 meters of movement. With this information, tankers will always know the position of other vehicles in their unit, even without visual contact.

Commander's Independent Thermal Viewer (CITV)

The CITV allows the tank commander to search for and engage targets independently of the gunner. The tank commander can use auto scan and search a sector he has chosen, or scan manually with the Commander's Control Handle Assembly (CCHA). Once the commander identifies a target, he merely presses the designate button, and the main gun is aligned with the CITV and the target.

The gunner can engage this target while the commander searches for the next target. This "Hunter-Killer" capability greatly enhances the abilities of the M1A2 crew to destroy multiple enemy targets.

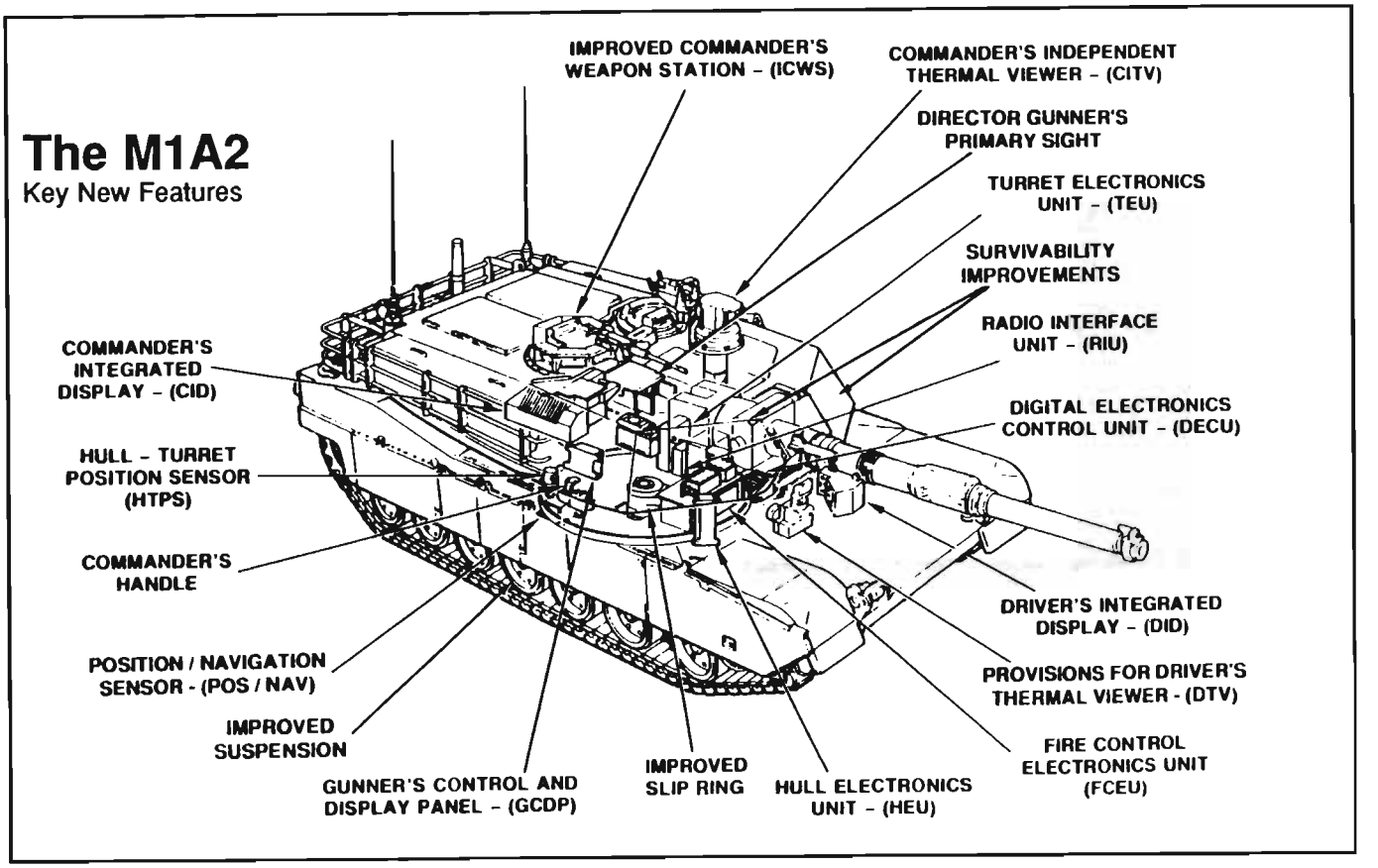
With the CITV's stadia reticle, the commander can estimate range and engage a target even if the laser rangefinder is inoperative.

Improved Commander's Weapon Station (ICWS)

The ICWS has improved vision blocks that give the tank commander a full 360-degree view outside the tank. Each vision block has overlapping view and directed energy weapons protection.

The Core Tank

The internal and external structure of the M1A2 hull and turret are the same as the M1A1. Inside this battle-proven, highly survivable structure is a totally new concept in tank systems. The basic wiring of the tank is an all-new digital system. The 1553 data bus of the M1A2 allows each Line Replaceable Unit (LRU)/component to share a communication link and operate as a system. The 1553 data bus allows enormous amounts of data to



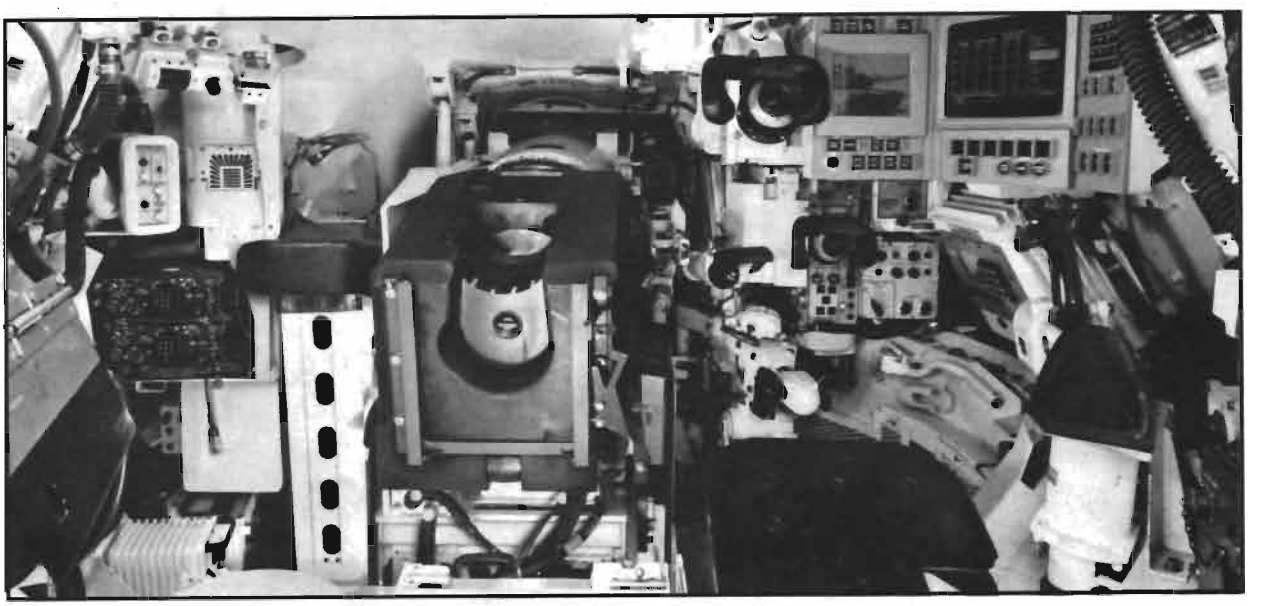
flow through the tank, providing the tank and its crew information not previously available.

This electronic wonder provides a degree of redundancy, and, therefore, improved survivability.

All display panels in the M1A2 are new. The Commander's Integrated Display (CID) contains screens for IVIS and CITV functions. The tank commander can look on the CID to view operations orders, reports, or map overlays. He can also draw overlays and send them through IVIS. Radio setup and control is another feature done through the CID. The CID can provide backup for both the gunner's and driver's panels.

The Gunner's Control and Display Panel (GCDP) contains readouts of all data the gunner needs. All ballistic inputs, both automatic and manual, can be accessed on the GCDP. The GCDP can also back up CID functions.

The Driver's Integrated Display (DID) is a single panel that replaces the three driver's panels on the M1A1. The driver can use the steer-to indicator to follow the course set by the tank commander through IVIS and



Interior of the M1A2

CITV dome on left turret front identifies the M1A2 version.

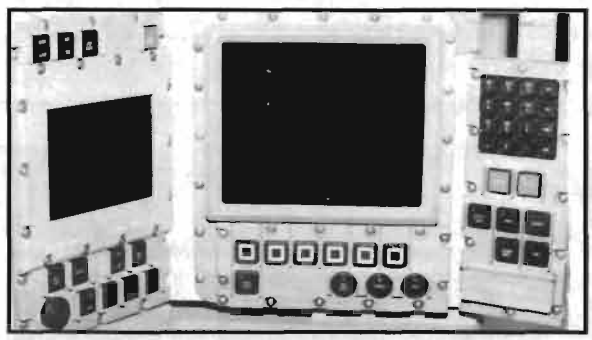
the POS/NAV. He can use the backup function to accomplish limited tank commander (CID) functions if required.

The Dual Axis Head Assembly (DAHA) in the GPS enables the M1A2 to more accurately track and engage evasive targets, both on the ground and in the air. When used with planned ammunition improvements, the M1A2 becomes a more lethal component of the future battlefield.

The M1A2 Abrams will greatly enhance the warfighting capability of the Armor Force of the future. Greater command and control realized by this system will increase our ability to mass and commit decisive combat power on the battlefield. A side benefit of increased command and control is better identification of friend or foe. Real time information will be provided through a display screen instead of long radio transmissions. The M1A2's increased engagement and target destruction capabilities put it head and shoulders above the current tanks — THE FUTURE IS NOW!

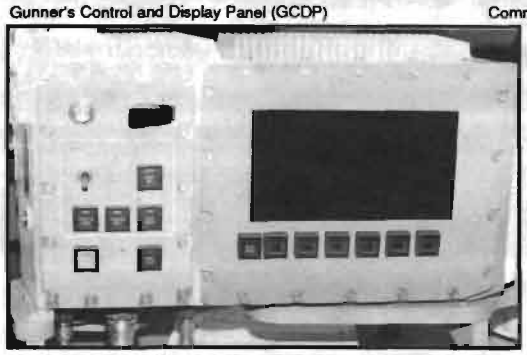
Captain Timothy Garth was commissioned in 1982 from ROTC at Old Dominion University, Norfolk, Va. A graduate of AOB, AOAC, CAS^3 and the Materiel Acquisition Management Course, he has served as a platoon leader, company XO, and support platoon leader in 2-8 Cav, 1st Cav Division, Ft. Hood, Texas; as battalion S4 and company commander in 3-64 Armor, 3d ID, FRG; and as a test officer at TEXCOM Armor and Engineer Board at Ft. Knox. He is currently the logistics officer in the TRADOC System Manager for Armored Gun System (TSM-AGS) at Ft. Knox.

Gunner's Control and Display Panel (GCDP)

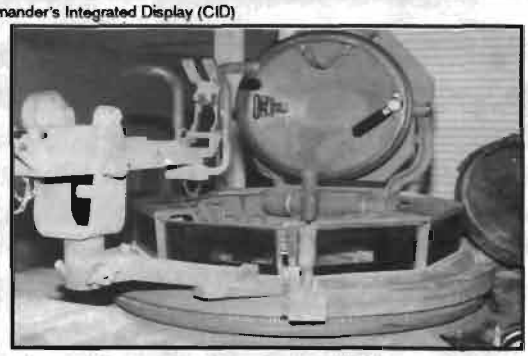


Commander's Integrated Display (CID)

Improved Commander's Control Handle



Driver's Integrated Display Panel



Improved Commander's Weapon Station (ICWS)

Should we not focus on developing these technologies, and then formulate our doctrine to take advantage of them? Should we shift to a "Technology Based Requirements System?"

Doctrine vs. Technology A Blueprint for the Future

by Captain (P) Tom Arielly

"We cannot expect the enemy to oblige by planning his wars to suit our weapons; we must plan our weapons to fight war where, when, and how the enemy chooses."
Vice Admiral Charles Turner Joy
USN, 1895-1956

This issue of *ARMOR* focuses on technological advances we expect to see over the next 20 years. What changes will these innovations cause in our doctrine? For that matter, what is the relationship between technology and doctrine? Volumes have been written on this subject, and this short article won't answer these questions. Change is the natural order of things — technology will always evolve, and doctrine is not immutable. However, we must remain focused on the fundamental principles of warfare in shaping our doctrine to apply new technologies in a way that allows us to execute that doctrine better.

The relationship between technological advances and doctrine is dynamic. The two are so intertwined it is sometimes difficult to determine which one drives the other. Rapidly evolving weapons technology often drives initial countermeasures into the tactics, techniques, and procedures area, while the engineers work frantically to come up with technological countermeasures. This in turn drives the development of further doctrinal and technological counter-countermeasures, and the cycle begins anew. The Cold War years were defined by this type of weapons competition between East and West.

This relationship between technology and doctrine will be even more dynamic in the future. Rapid technological change will provide revolutionary weapons systems having a significant impact on the "how" of warfare. But will they radically change the "what" of warfare?

The Concept Based Requirements System — CBRS — is the cornerstone of the current Army acquisition system. Simply put, CBRS postulates that requirements (hardware development) should be driven by the way we expect to fight (doctrine/concepts). Is CBRS valid in today's world? Technology advances at a pace almost defying comprehension. The lethargic DOD acquisition system virtually insures that "emerging" technologies will be obsolete before incorporated into a fielded weapons system. Stealth, directed energy weapons, composites, advanced acquisition systems, and precision, long-range munitions are reshaping the dynamics of battle. Should we not focus on developing these technologies, and then formulate our doctrine to take advantage of them? Should we shift to a "Technology Based Requirements System?"

The future Army and Armor Force must be capable of strategic response to crises through power projection — we must rapidly generate overwhelming force to defeat threats to our national interests globally, or in Admiral Joy's words, "to fight where, when and how the enemy chooses."

At the same time, we are entering an era of severely constrained resources. Our forces will be smaller, based largely in CONUS, and have limited funds for research, development, and procurement. It is absolutely essential to focus the acquisition process on those essential systems critical to the execution of the Army's warfighting doctrine. CBRS provides that focus of effort. If anything, we must insure we make the "C" in CBRS work.

Of course, the critical assumption in CBRS is sound doctrine, which supports the "concept" portion of CBRS. Current AirLand Battle doctrine is sound. The ongoing revisions of FM 100-5 will be evolutionary, not revolutionary in nature, providing a true azimuth for requirements development.

The bottom line is the need to focus our technological efforts on providing us with capabilities that give us the ability to apply combat power more efficiently and

If we develop a technologically advanced system that requires more people to operate or maintain, and/or only operates within well defined parameters, then we have wasted precious resources with no tangible increase in capability (remember the SGT York?).

effectively. If we develop a technologically advanced system that requires more people to operate or maintain, and/or only operates within well defined parameters, then we have wasted precious resources with no tangible increase in capability (remember the SGT York?).

The single constant in this doctrine/technology relationship is the principles of war. These nine principles are immutable; they will always be applicable to warfare, regardless of other variables. There are those who say that technology may drive changes to the principles of war — that on the modern battlefield, some of thse principles are no longer valid. I personally disagree with this point of view, but it is one that needs exploration. Certainly, technology will impact the application of the principles of war and their interrelationships, but they will remain fundamentally valid.

These principles are the bedrock upon which we must base requirements development. We cannot afford to become enamored with "systems" and lose sight of the fundamental essence of the application of military power. The principles of war guided Alexander and will continue to shape future warfare. We must strive to develop and acquire technologies that enhance our ability to apply these principles more effectively.

So, as weapons technologies continue to advance, will our doctrine be forced to evolve? Certainly, but the effect depends on where you sit. Armor platoon leaders and company commanders will remain focused on the violent application of combat power to destroy the enemy. The fundamental character of their fight will not radically change, although it will occur more rapidly and violently than ever before. To be an armor leader will be more challenging and more demanding.

So what? If you are a tank or cavalry platoon leader or a company or troop commander, focus on learning your trade. Having your "head in the game" when it comes to the business of warfighting is far more critical to the future missions of our Army than a detailed technical understanding of a weapons system capability. Ends, not means — or in the words of Ardant du Picq, "(t)he instruments of battle are valuable only if one knows how to use them."

As armor leaders, our responsibility is to ensure that we remain focused on the fundamental principles of warfare shaping our doctrine and tactics and that we apply new technologies in a way that allows us to better execute that doctrine — in other words, to ensure we don't become enamored with "systems" and lose sight of the fundamental essence of mobile armored combat.

Captain (P) Tom Arielly was commissioned in Armor from the U.S. Military Academy in 1980. He was assigned to the 2/1 Cavalry, 2d AD, and served as a cavalry platoon leader, troop XO, support platoon leader, and S1. After attending AOAC, he served as the regimental maintenance officer in 2d ACR and as H Company commander in the 2/2 ACR. He is currently chief, Cavalry Doctrine and Literature, Armor/Cavalry Tactics Division, Command and Staff Department, USAARMS.

Future Army Combat Forces

by Captain Michael L. Howe

Introduction

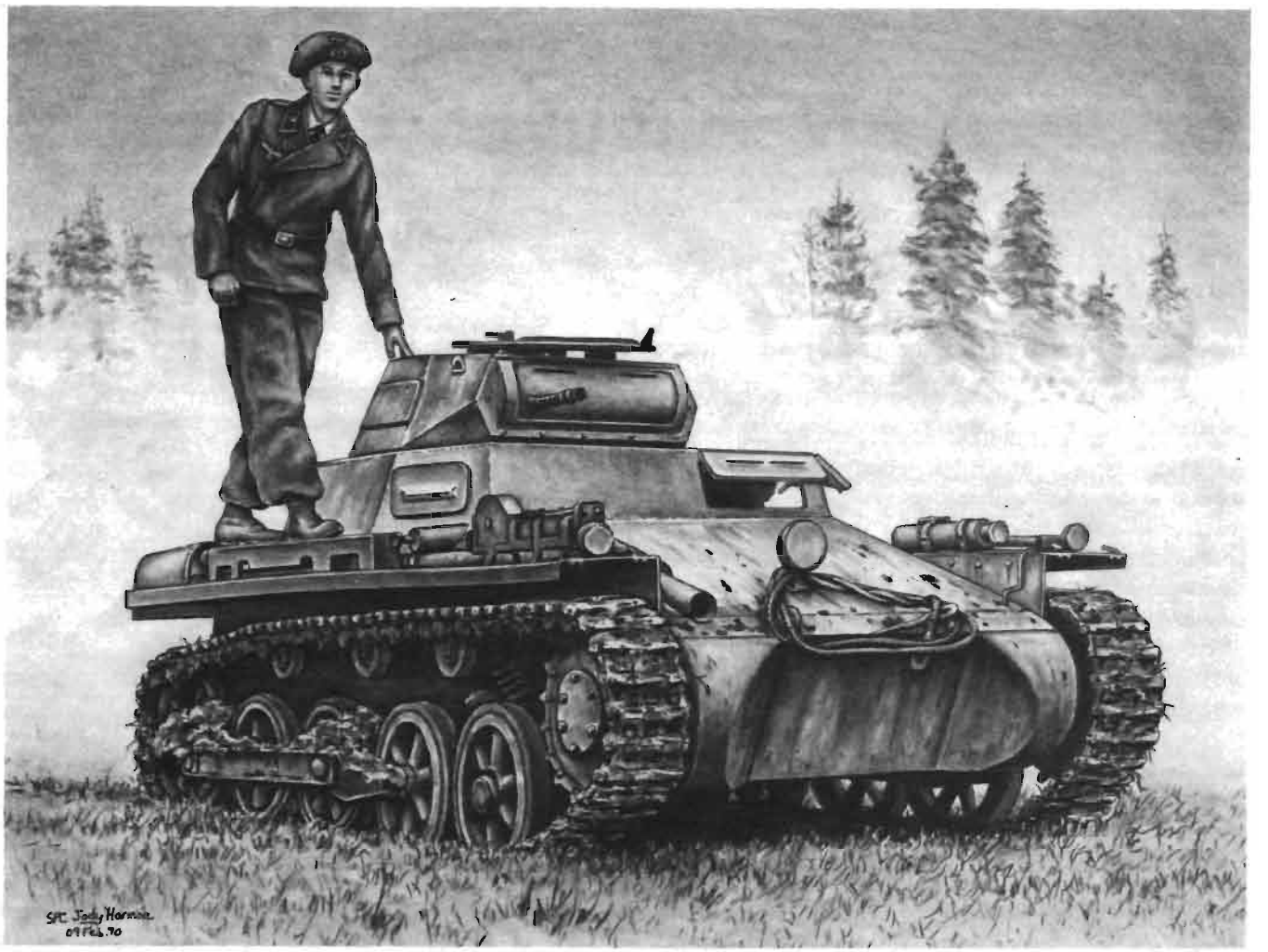
United States military forces are approaching a crossroad in development. Operation DESERT STORM was one of the few wars that did not produce forced development of new weapons, logistic systems, communication systems, or industrial processes; rather it confirmed the process of research and development in accordance with a perceived threat. However, the existence of an on-line, readily identifiable military threat upon which to base military force development may not be a determinant for the foreseeable future. With development and fielding lead-times of up to 15 years for some of the most advanced military hardware, it will become increasingly difficult, if not impossible, to make prudent decisions based on traditional quantifiable factors associated with the enemies of the past. Entering the 21st century, a small military force must not become a national security vulnerability. The future United States' military forces must have the capability to deploy, then fight and secure victory while using reduced resources. Inherently, armor/mechanized forces must remain the fighting base of the United States Army.

German General Heinz Guderian argued in the 1930s that armored forces should be at the core of the new army his nation was developing.

Fighting Theory

Between World War I and 1939, the United States faced a period similar to the decision crossroad the military is facing today. For the United States, national policy, the public mood, and budget constraints brought about war planning based on the concept of limited war in terms of numbers of participants, areas and forces. However, no fighting doctrine was developed to support the strategic theory.[1] Many nations faced similar decisions about the focus of their armed forces. The choice for most became one of developing the weapons invented through necessity during World War I and thereby building an army based on mechanized forces of armored vehicles or maintaining an infantry force based on wheel transportation or foot marching. Perhaps no nation faced a rebuilding task as great as Germany during that period. Following a near total disarmament as a consequence of World War I, Germany had to decide on a fighting concept for its army and then build a force capable of executing that concept. One of Germany's main proponents of armored warfare was General Heinz Guderian. Many of Guderian's arguments, used to convince the German military to adopt the tank as its decisive ground combat weapon, remain applicable to the decisions facing the U.S. Army today. Borrowing heavily from the writings and theories of B.H. Liddell Hart and

Blitzkreig in Practice: The panzers roll into Poland, 1939.



Mid-1930s trooper of the Panzerwaffe — the early German armored force — stands on the deck of a Pzkw I in the distinctive uniform of that force, which included a padded beret, later discarded. The Krupp-built light tank was essentially a lightly armored machine gun carrier. Although it was obsolete for combat as early as 1940, it was used for training and — with later modifications — as a command tank.

J.F.C. Fuller, Guderian formed his concepts of the armor force around the principles of protection, fire and movement. These are very similar to Fuller's functions of battle as described in the following passage:

When two men fight, whatever the stake may be, they have got to guard, to hit, and to move. Whether they are armed or unarmed, or whether they are fighting on foot, on horseback or from within a machine, these three functions remain constant. Multiply the two men to any number and the result is exactly the same. Therefore, it follows that all organization to be tactically efficient, must express these three functions, and the more readily, rapidly and effectively it does so, the more perfect it is in itself. The things which enable the soldier to give effect to functions of guarding, hitting and moving — namely means of protection, weapons and means of movement — I have generally called the physical elements of war, and out of their combined use, tactics, or the art of fighting is evolved.[2]

As described, these functions are unchanging principles of war. The basic concepts remain unchanged even today, providing a means to examine the capabilities of military forces with common considerations. A review of Guderian's principal concepts affirms the primacy of armored forces in the Army's ground combat role.[3]

Armor Attacks

Guderian felt those outside the membership in the mechanized ground combat forces of the army tended to imagine an armor/mechanized attack as massive numbers of tanks speeding across the battlefield, crushing wire barriers, smashing machine guns and spewing weapons fire. To Guderian, such tactics were one use for armor forces, however, they were not the true function of those forces. He felt the events of past wars as well as fic-

Guderian felt that until a new and better method of making a successful ground attack, other than a mass infantry assault, was developed, Germany had to continue to maintain the belief that armor/mechanized forces — properly employed — would become the best means available for ground combat.

titious depictions of armor combat were so impressed on the minds of the critics of armored forces that they pictured an armor attack as tanks steadily rolling forward to crush the enemy beneath their tracks whenever and wherever the commander ordered, regardless of the tactical or operational situation. Guderian insisted that the versatility and effectiveness of an armored force was often underestimated. He felt that most military personnel considered armor forces to be blind and deaf, incapable of holding ground they had captured, and completely vulnerable to antiarmor defenses. Guderian's critics insisted that antiarmor defenses were no longer susceptible to surprise, and that the modern weapons and artillery of the period were always thought to maintain perfect accuracy and reliability. To them, defenses were impervious to the degrading effects of casualties, smoke, fog, trees or other obstacles, and ground contours. Guderian's critics believed that state of the art detection systems, combined with faultless optical systems, seemed to make the defense of the period all-seeing and all-knowing. This scenario presented a picture in which armor systems had no future. If that had been so, Guderian would have faced a situation where all new tactics for old weapons should have been scrapped, while at the same time allowing the world to continue with the consequences of positional warfare as practiced during World War I. However, Guderian felt that until a new and better method of making a successful ground attack, other than a mass infantry assault, was developed, Germany had to continue to maintain the belief that armor/mechanized forces — properly employed — would become the best means available for ground combat. Guderian ignored the contention that the older a weapon became the less effective it was because of newly developed countermeasures. He stated, "Pity the artillery! It is already hundreds of years old. Pity the air force! Age is creeping up on it."[4] Guderian insisted that weapon effectiveness was relative to the effectiveness of the countermeasures employed against it. He felt that any weapon was effective only so long as the military was willing to make maximum use of the latest technological developments and thus remain at the peak of performance. His point of view was that the tank had not been surpassed by other weapon technology and therefore would become the "architect for victory."

Protection

One of the primary advantages Guderian stressed was the protection gained from armored vehicles against enemy weapons fire. He felt the struggle of men to overcome the effects of enemy weapons fire had existed throughout military history; insisting the contest between armor and missile had and would result in advantages and disadvantages for each contender, Guderian felt that for each type of armor developed a missile had been developed in order to defeat that armor. The constant struggle between armor and missile did not detract from the value of armor forces. He believed that if it did, armies could do no better than to send soldiers into battle with no other protection than their cloth uniforms. Guderian held that in armored warfare, if an army could equip a force with reasonably protective armor, then commit that force against an enemy defense in an area avoiding the mass of the enemy antiarmor weapons, then that force would inevitably be successful. He further contended that if an army could equip a force with armor invulnerable to enemy fire, success was almost guaranteed. Guderian emphasized that once an attacking force passed the enemy main defensive belt, the armor forces would fight and destroy the enemy's unarmored forces in unprotected rear areas resulting in decisive victory.

Movement

To Guderian, only movement brought victory. He felt armor forces provided the best means to bring troops into contact with the enemy. Guderian stressed that the ability to move faster than the enemy was the key to military success. For him, armor forces had that capability. Movement established the conditions for combat and enabled an army to achieve decisive results. Guderian realized armor forces could not successfully attack in all situations. They could not storm fortifications, nor could they operate well in obstruction-filled terrain. However, Guderian insisted armor forces could only be looked upon as having even more attacking power than other arms of the military and was not considered to be the answer for all operational situa-

tions. He stressed that the ability to fire and move, as opposed to firing from fixed positions, would enable armor forces to prevent an enemy from reestablishing a defensive position and finally to overcome the enemy defense.

Fire

Guderian felt the main advantage of armor forces was the ability to bring firepower to bear while actually advancing against and through the enemy. He saw armor's weapons fire as intended to destroy specific enemy vehicles, personnel, and equipment, not merely to suppress or pound an enemy into submission. For Guderian, the ability to actually advance against an enemy while bringing firepower to bear was a quality unique to the armor force. He felt that armor forces were the finest weapon for the attack. Basing his beliefs in opposition to proponents of infantry, who felt that tanks were created in order to enable the infantry to attack, Guderian concluded that it followed that a weapon that allowed others to advance had to be the primary weapon of the army.

Armor Today

Today, many of those same advantages stressed by Guderian remain characteristics of modern armor forces. Most significant, armor forces continue to fulfill the primary elements of war as described by Fuller — protection, fire, and movement — and are therefore best suited to constitute the basis for a fighting doctrine for the future. The armor/mechanized forces provide more protection against direct and indirect fire weapons than any other weapon capable of movement and attack. Armor/mechanized forces provide superior firepower, with capability to destroy all land based conventional weapons as well as equipment and personnel. Armor/mechanized forces provide unmatched crosscountry, all-weather mobility while maintaining excellent on-road movement capability. By examining the other branches of the Army using the same considerations one comes to the same conclusions.

MG J.F.C. Fuller, British military theoretician, inspired the German doctrine of mobile warfare.

Conclusions

As J.F.C. Fuller stated in his lectures on armored warfare:[5]

As the present age is largely a mechanical one so will the wars of this age take on a similar complexion, because military organization follows civil organization... as industry is the base of mechanization, it logically follows that in the future only industrialized countries will be able to wage organized warfare with success. When war depended on horseflesh, as it did during the Middle Ages, a country which possessed few good horses stood a poor chance against a country possessing a plentiful supply. Similarly in those distant days, a country which could produce armour was all powerful when compared to a country which could not. So also today, a country which possesses few industries and manufactures few will be virtually impotent to resist invasion.

Armor forces of today incorporate the computer, as well as advanced electronics, as basic equipment. As stressed by Guderian, the effectiveness of armor/mechanized forces will only decline when the military no longer invests in maintaining up-to-date equipment.

Notes

[1]Maurice Matloff, "The American Approach to War, 1919-1945," in *The Theory and Practice of War*, ed. Michael Howard, (Bloomington, Ind.: Indiana University Press, 1975), p. 219)

[2] J.F.C. Fuller, *Machine Warfare*, (Washington D.C.: Infantry Journal Inc., 1943), p. 55.

[3]Closely adapted from, General Heinz Guderian, *Panzer Leader*, (Washington D.C.: Zenger Publishing Co., 1952), p. 39.

[4]Ibid. p. 42.

[5]J.F.C. Fuller, *Armored Warfare*, (Westport, Conn.: Greenwood Press, 1983), p. 5.

Captain Michael L. Howe was commissioned in Armor from OCS, Ft. Benning, Ga., in 1984. He served as a tank platoon leader in 4th ID, Ft. Carson, Colo.; support platoon leader and S4 in 2-68 Armor, Baumholder, Germany; and company commander of Troop F, 1-12 Cav, and as a force design officer at Ft. Knox, Ky. He is currently attending Georgetown University in graduate studies in national security. He will be assigned as an ROTC instructor at Georgetown in September 1992. He is a graduate of the Armor Officer Basic and Advanced Courses and CAS[3].

Creeping Overwatch

by Captain Robert L. Jones

During a recent rotation to the National Training Center, National Guard units practiced a variation of the platoon movement by successive bounds technique. The variation, frequently called "creeping overwatch," was a solution to the tactical problem of advancing over open terrain.

Creeping overwatch is simply the logical extension of movement by successive bounds. The current doctrine teaches two methods for a platoon conducting bounding overwatch: alternating bounds and successive bounds. Both techniques use the section as the basic unit for movement. Creeping overwatch adds a third movement technique to the traditional two methods described in the manual, extending the technique of successive bounds to a one-tank bounding element.

In creeping overwatch, the platoon leader orders the lead section to bound one tank at a time. As the bounding tank maneuvers forward, the platoon leader retains 75 percent of his combat power in overwatch. This is better than the normal 50 percent available when bounding a platoon by section. The lead tank bounds forward about 500 meters (see Figure 1).

When the lead tank is set, the platoon leader orders the second vehicle in the section to bound. As the second vehicle bounds, the platoon leader still has 75 percent of his combat power in overwatch, one tank forward and two tanks back (Figure 2). Once the lead section is established forward, the platoon leader bounds the trail section. The platoon leader bounds both tanks in the trail section together if the enemy has not fired on either of the lead tanks (Figure 3).

If the enemy intends to contest the platoon's forward movement, he will most likely open fire when the first tank enters his engagement area. If the enemy has not fired by the time the second tank enters the engagement area, it is probably safe to bound the trail element as a section.

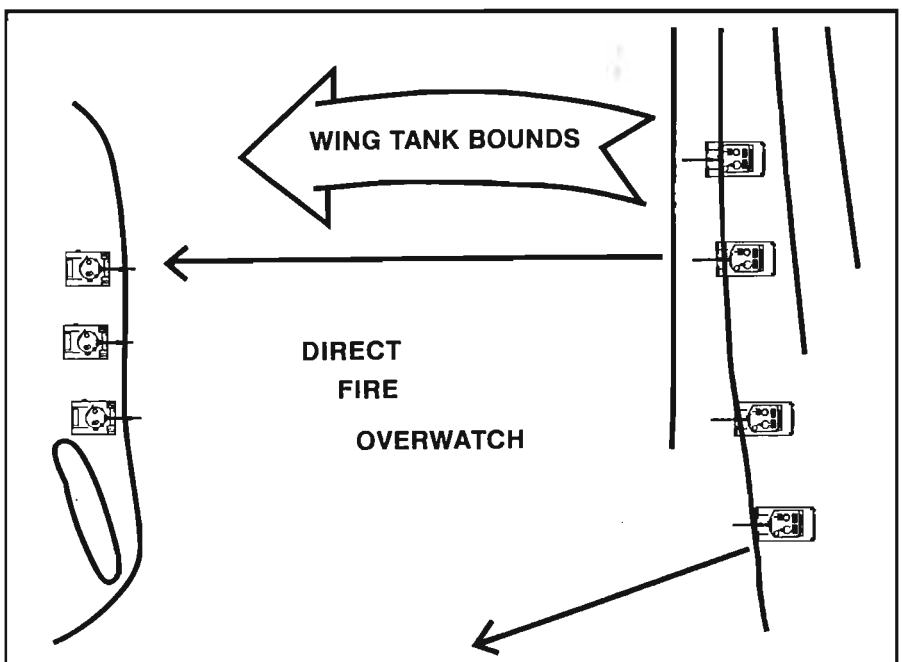


Figure 1.

There are several tradeoffs in the selection of any particular movement technique. The first and most obvious disadvantage to this technique is that it is slow. The bounding tanks should only bound 500 meters, and it takes the platoon three internal bounds to move the whole platoon forward 500 meters. The 500-meter guideline allows the tanks in overwatch to cover the lead tank with machinegun fires to repel a close infantry ambush. It also allows the overwatching tanks to provide accurate main gun fires 2000 meter forward of the bounding tank. Even more time is involved if the bounding tank must evade an ATGM, the "Sagger Dance" adding time to each bound. And finally, the time that the overwatch element spends in one position increases the overwatch element's vulnerability to enemy artillery fires.

On the positive side, creeping overwatch is the most secure movement technique to maneuver a tank platoon forward. The technique risks the smallest element forward prior to contact. It provides the platoon leader with the maximum firepower to deal with anticipated enemy action. The technique also allows the platoon leader to maintain forward momentum under fire. By using direct fires to destroy or at least suppress enemy AT weapons, the platoon can maneuver even when very little cover is available.

This technique does not ignore the importance of the wingman concept to each tank's survival. The wingman must have a clear view of his partner at all times in order to even consider using this technique. The original concept of this technique practically dictates that the whole platoon will have an almost identical sight picture. As with any overwatch technique, the platoon leader

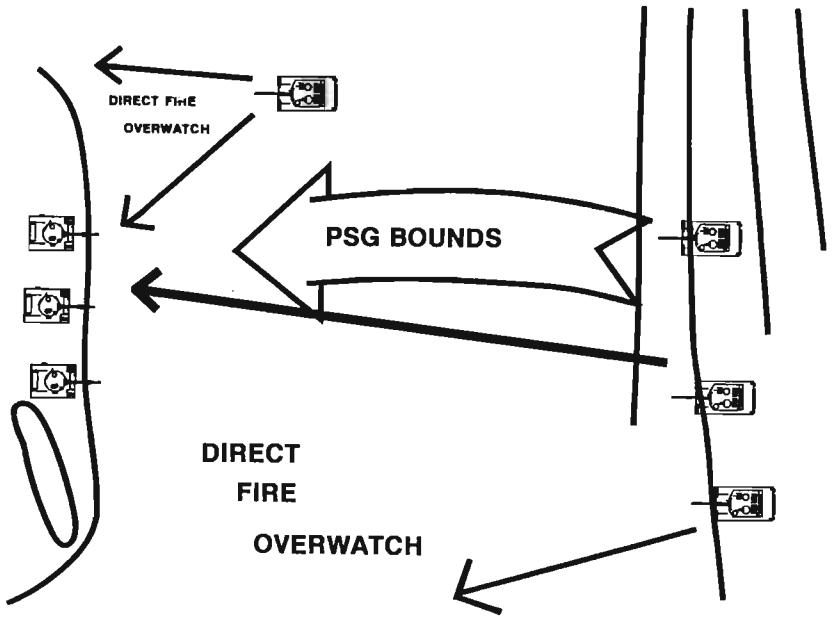


Figure 2.

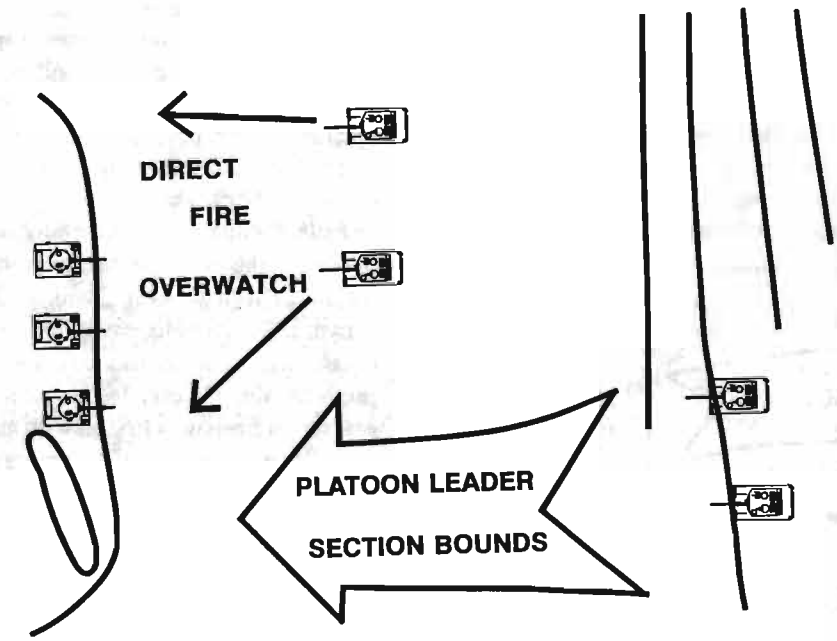


Figure 3.

must avoid masking the overwatching element's fires as the first two bounding vehicles move forward. This means a wingman will normally bound first, followed by the second vehicle in the section.

The platoon leader can initiate creeping overwatch from any formation and end the bound back in that formation. For example, if the platoon is moving in echelon left, and the platoon leader initiates creeping overwatch, the platoon should end its bound back in an echelon left formation. I have drawn the platoon in a line formation because this technique, with its very slow and secure movement, implies that enemy contact is very likely and that the platoon leader should know the direction from which he expects attack. The platoon leader, when he decides to initiate this technique, should move the platoon into a firing line and give an orientation. The platoon leader's choice of this movement technique dictates against moving forward by alternate bounds because alternate bounds are inherently less secure than successive bounds.

The company commander can use creeping overwatch to gain ground under fire by designating the bounding platoon and maintaining 13 of his 14 tanks in overwatch. This leaves the commander with 93 percent of his combat power to kill the enemy. The withering firepower available from a tank company or tank team will go a long way toward helping the bounding vehicle complete his bound.

Creeping overwatch deserves a place in our professional toolbag as the third method of movement under the heading of bounding overwatch. Although this technique is technically bounding overwatch with movement by successive bounds, the specifics of the technique make it an important variation from the method prescribed in FM 17-15. Creeping overwatch is an excellent movement technique when the security of the force is threatened, bypass is not possible, and the unit must continue to gain ground.

Captain Robert L. Jones was commissioned in Armor from USMA in 1983. He has served as a tank platoon leader and a tank (COHORT) company XO with 2-66 Armor. He commanded Charlie Company, 4-69 Armor in Kitzingen, Germany, and is currently assigned as an armor company combat trainer at the National Training Center.

The Impact of German Reunification On the Future of the German Armor Forces

by Lieutenant Colonel Wolfgang Hahne, German Army

What will happen after unification? What will German unity mean for peace and security in the heart of Europe? Will Germany revert to old patterns of behavior, or has it learned the lesson of history?

Germany will remain linked to the United States in close friendship and partnership, which is of vital importance for Germany, and this means we will remain in NATO. Germany will be a free democratic country, with sovereignty based on our constitution and basic law.

Germany will also remain a Federal State, now with five more eastern states. (See shaded area on map below.)

Reunification has created great hope and a new perspective for Germany, but it is clear now that we have underestimated some of the difficulties. Unemployment has risen, the budget deficit has increased, interest rates are up, and taxes are up, too.

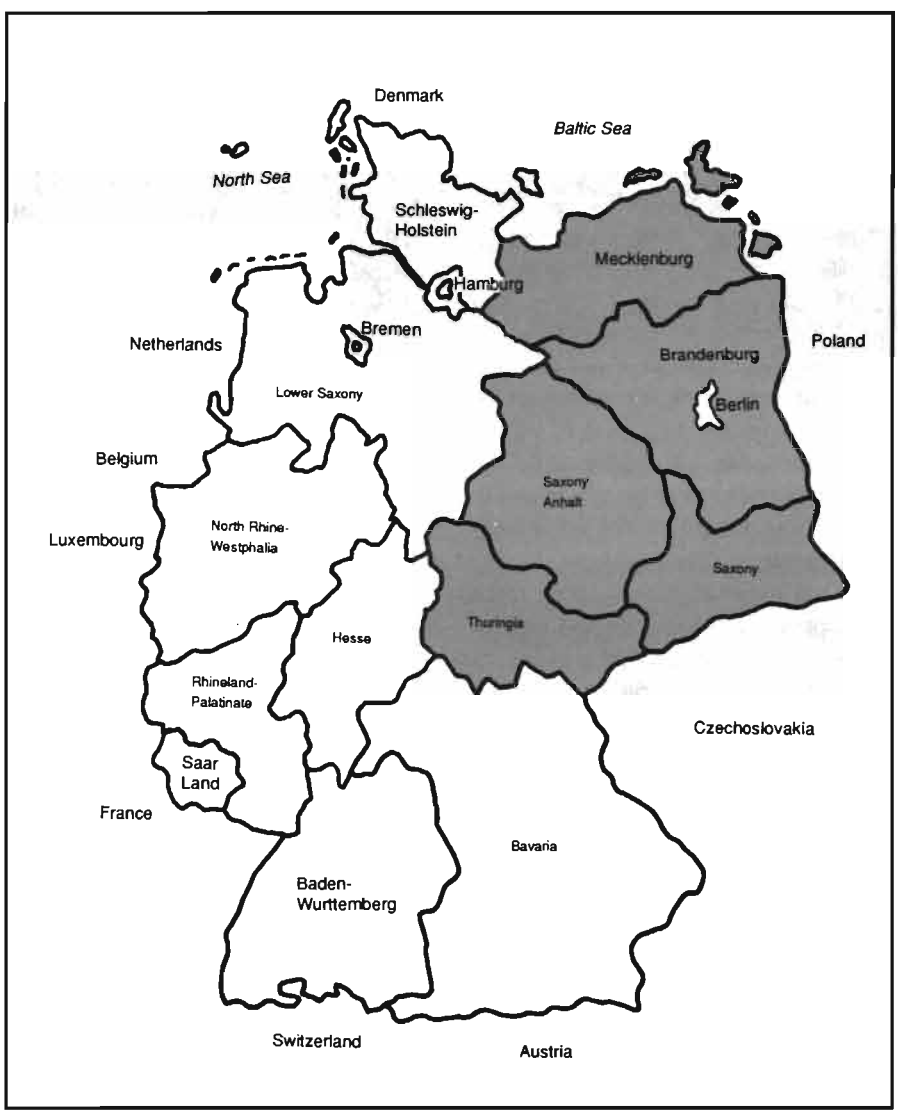
The basic idea for unification is, that the people in the former German Democratic Republic are the real losers of World War II because they suffered 47 years under the repression of the Soviets and never had a chance to leave their country. Therefore, these people need our help and confidence, and we decided to take all of them — in any kind of job, including soldiers — without looking at what they had been doing in the past.

As we integrate the states of the old GDR, replacing a communist command economy with a democratic system and a free market economy — we are also facing the problem of uniting two armies that radically differ in organization, tactics, equipment, and training.

Uniting Two Armies

Before unification, the Nationale Volksarmee (NVA) of the GDR had a strength of about 170,000 men. The unification treaty fixed very unfavorable conditions on the adoption of soldiers from the east, and 40,000 members of the NVA left that service before reunification, which took place on 3 October 1990. This left 130,000 to be integrated into the 470,000-member Bundeswehr.

So far, the integration process has revealed a tremendous number of



The New Germany

With unification, Germany added the five eastern states (shaded area), which include about 16 million additional people and a 70,000 square mile area. The nation now includes about 80 million people and an area of 225,000 square miles.

problems that had not been foreseen:

•Equipment and weapons of the NVA were less efficient than we had thought.

•Barracks were in a desolate state, compared to Western standards.

•The style of command more closely resembled the Russian, rather than West German, command tradition.

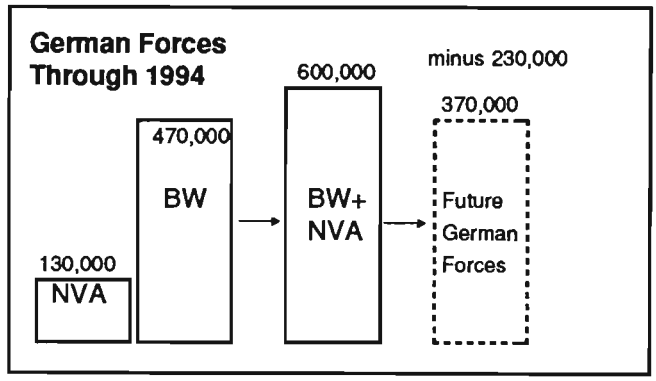


Figure 1

•Many of the Bundeswehr officers and noncommissioned officers took a decidedly negative attitude toward their counterparts in the East German Army.

•The Bundeswehr West had to assume the cost of the Bundeswehr East from its annual budget.

•Some of the missions of the old NVA had no counterpart in the Bundeswehr — the operation of power plants and day nurseries, for example.

Added to these problems of reunification were the requirements of the "2-Plus-4 Treaty" which will restrict the size of the unified German Army to 370,000 men by 1994. Given that the Bundeswehr had 470,000 members and added 130,000 from the east, this will mean a force reduction of 230,000 from the Bundeswehr by the compliance date. The plan calls for the Bundeswehr to reduce its strength to 370,000, including 50,000 former NVA members (See Fig. 1).

Beyond the matter of numbers, there is the problem of structure and organization. A third of the NVA members were officers; in contrast, only seven percent of the Bundeswehr are officers. (An NCO corps, as we know it, did not exist. In the NVA, NCOs were specialists — bus drivers and cooks, for example — not subordinate leaders. Officers were responsible for many of the duties our NCOs assume.)

Applying the Bundeswehr's seven percent guideline to the remaining 50,000 members of the NVA results in a requirement for only 3,500 officers, not the 40,000 to 50,000 who were members of the old NVA. Of this 3,500-officer requirement, half will come from the Bundeswehr West, so only about 2,000 of the former NVA officers will be needed. You can imagine the kind of social problems, acceptance problems, and organizational problems we have inherited by dismissing more than 40,000 officers representing almost the entire officer corps of the East German Army.

The history and traditions of the NVA officer corps reflect a long period of Soviet domination. In 1957, all NVA officers who were Wehrmacht officers during WWII were dismissed. Officers were sent to the Soviet Union for training and indoctrination. The officers were recruited from German soldiers who had deserted to the Russians during WWII and younger men who had already been influenced by Soviet thinking. As a result, we are faced with integrating an officer corps of almost Russian character.

These differences are broad and significant, affecting tactical doctrine, style of command, and the relationships between officers, NCOs, and enlisted men. The Bundeswehr West was influenced by the traditions of the former Wehrmacht and our NATO allies. By the tradition of the Wehrmacht, I mean tactical doctrine, style of command, and relations among officers, NCOs, and enlisted men. In contrast, the NVA institutionalized some of the worst characteristics of Soviet organization:

•The style of command in the NVA involved detailed orders from higher to lower levels of command, with junior leaders having only a very narrow range of decisionmaking. In contrast, the Bundeswehr delegates much more authority to lower ranks, reflecting German military tradition since the middle of the last century. Every leader has to decide independently on the activities being carried out on his level. He gets only broad directives explaining his objective or the desired result and has latitude to decide how that result is achieved. This is the heart of the concept of "auftragstaktik," or mission orders.

•As we adopt these new officers from the NVA, we also inherit an ideological problem. All the officers of the East German Army were members of the Socialist Unity Party of Germany (SED). They were all communists. However, since the end of the 1970s, the population of the GDR had realized that their theory of the state clashed more and more with social and economic reality, and their communist beliefs had become a hollow ritual. When you talk to these former NVA officers today, they recognize and admit that history proved the superiority of the Western conception of the world and its way of life. But in their own justification, they also say that socialism or communism was a good and noble utopia. The younger officers of the former NVA will free themselves more quickly from their ideology than the older ones, and the majority of the officers of the former East German Army who will finally integrate during the next year will not be older than 35.

Weapons and Equipment

Along with many former members of the NVA, we have inherited their equipment and weapons (see Fig. 2). Some of it can very well be used by us, but there are considerable problems with heavy weapons. Tracked

Weapons and Equipment Absorbed from the East German Army

(Major Equipment Types - Approximate Totals)

2,000 Main Battle Tanks
2,400 Infantry Fighting Vehicles
320 Self-propelled Howitzers
400 Towed Howitzers
270 Rocket Launchers
300 Mortars
900 Twin AA Guns
1,500 Recon Vehicles
50 Cargo Helicopters
26,000 RPGs
163,000 Submachine Guns
450 Antitank Missiles
350 Recovery Tanks

Figure 2.

vehicles have steel tracks, rather than rubber tracks, as the NVA did not move tracked vehicles on public roads. However, this is very often the case in the West, and the steel-tracked equipment will ruin blacktop roads.

Safety standards are very different, too. For example, all of our vehicles must have dual braking systems; theirs do not have this. Their ammunition propellants have considerable mercury content, which produces hazardous vapors. To use these weapons, we would have to develop new ammunition with safer propellants. Most combat vehicles cannot exceed 7 km/hr in reverse, a fatal weakness when changing positions and unacceptable for any kind of reconnaissance use. Many of the Soviet-designed vehicles depend on large amounts of asbestos in their construction. We are taking this out of the vehicles we plan to continue using.

In addition, we would have to add thermal sighting equipment to vehicles and, of course, replace all the radio systems for compatibility. All in all, the cost of many of these changes would be too prohibitive, and moreover, the Bundeswehr would become dependent on spare parts from the Soviets.

Finally, with the downsizing of forces in Europe under the CFE Treaty, a treaty which reduces levels of conventional forces in Europe, we will not need this additional equipment, except in a few cases. The Bundeswehr plans, for example, to adopt 764 of the NVA's BMP infantry fighting vehicles until enough Marder 2 Improved IFVs become available in 1994.

The Bundeswehr plans, for example, to adopt 764 of the NVA's BMP infantry fighting vehicles until enough Marder 2 Improved IFVs become available in 1994.

We will also be able to use former NVA rifles, NBC protective clothing and equipment, shoulder-fired surface-to-air missiles, water treatment plants, maintenance vehicles, and some other equipment.

Barracks facilities were in a desolate state. Little had been spent to keep up the buildings — there had always been a shortage of building materials in the GDR — and barracks blocks appear a gloomy gray, with falling plaster and poorly functioning toilets and shower rooms. In 1991, the Bundeswehr spent 550 million marks for renovation of barracks in the five states of the former GDR. Unfortunately, this money was obtained from the building funds of the Bundeswehr.

Now, what will become of what used to be the East German Army?

The new Federal Armed Forces Eastern Command will have 50,000 men, including the remaining personnel of the East German Army and 1,500 officers and NCOs of the Bundeswehr. The Corps East will include territorial troops, in order to save staff and personnel. We will also combine Army and territorial troops in the West by 1994. This will be part of our reduction to 370,000 men.

In spite of all these problems, we are optimistic and hopeful that, in a few years, we will have overcome the differences between East and West and emerged with a united, intact Bundeswehr.

Missions: Then and Now

Under the 1949 constitution, which allowed the reestablishment of armed forces in 1956, the Germans and their allies agreed that the new German forces would be used only in defense of German and NATO territory, in the event of an attack by the Warsaw Pact. Now that the threat from the old Soviet Union has changed, we need a new strategic concept. The army's future missions will focus on three areas:

- Defense of Germany's frontiers, mostly as an integral part of the alliance, but on occasions under national command.
- Participation in actions at the periphery of alliance territory.
- Participation in UN and possibly even WEU missions, once the appropriate legal foundations have been established.

The army's main task, however, will remain that of directly protecting the people and state of Germany.

Future Tactics and Strategy

To be successful in defending Germany, our forces will have to maintain strong operational reserves so that we can concentrate to prevent a successful attack. Along extended sectors, this will mean that a relatively small part of the force will perform reconnaissance, guard, and cover missions, maintaining surveillance over wide areas and being prepared to react immediately to border violations. This force must be strong enough to shape the battlefield for decisive operations, but will have to accept high risks in those sectors. We cannot deploy strong forces along our entire border as we did in the past. Once the weaker covering forces can identify the enemy's main effort, we will have strong reserves sufficient to sustain decisive operations.

For situations at the periphery of Europe, we will need specially organized and trained military forces at a higher state of readiness than those poised to

defend Central Europe. These forces will need to be mobile and sustainable at long distances.

Although the future NATO structure and the multinational corps are not decided yet, there is no doubt we will take part in the NATO multinational force structure.

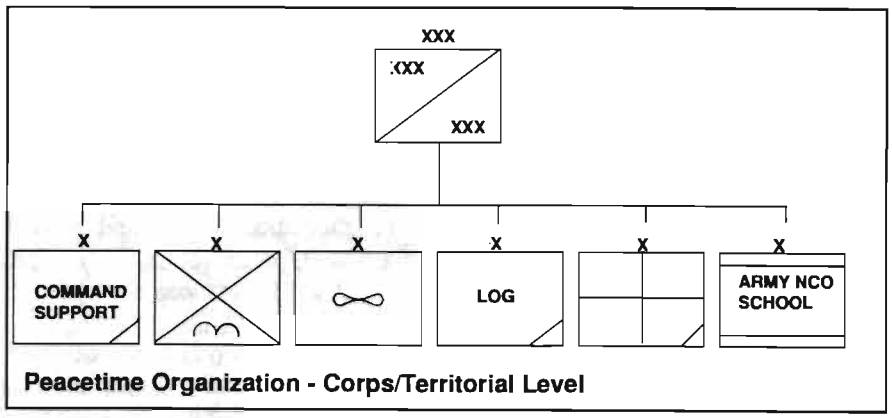


Figure 3

Future German Army Force Structure

We are faced with a reduction in the size of the army and a tremendous increase in the territory it has to cover. Yet we want to retain an adequate number of major combat formations, which will increase demands on the command and control system. This problem could only be solved by adopting a new command structure, called Army Structure 5. The idea behind Army Structure 5 is to merge the Army Field Forces with the Territorial Army, a merger made possible by changes in the overall security setting and driven by the need to reduce the number and size of commands. This fusion is reflected in the Army's streamlined peacetime organization.

Corps headquarters organizations will merge with territorial commands to form one command in peacetime. Division headquarters organizations will do the same with military district commands (WBKs). However, they will remain in a position to split up into two separate commands to discharge their own particular functions in time of war.

Once oriented primarily toward implementing the German Defense Plan, the Bundeswehr is undergoing a transformation, gradually becoming more oriented toward training and reconstitution. Applying the so-called principle of dividing, most maneuver brigades will be at around 60 percent of their authorized peacetime standing strengths. A limited number of the standing maneuver brigades, combined with appropriate combat support, logistical, and medical troops will form the backbone of a force for action on short warning.

Reservists will play a much greater role in the new German Army. Although there will be fewer reservists, there will be a need for higher quality reservists, as they will man about 50 percent of the primary weapon systems. The reservist will now be at the heart of the new German Army, rather than on the periphery.

Figure 3 shows the peacetime organization of corps/territorial commands, and Figure 4 the organization of division/WBKs. Each division/WBK has command of 2-3 mechanized brigades, one light infantry regiment with training capacity for reservists, and a varying number of VBKs.

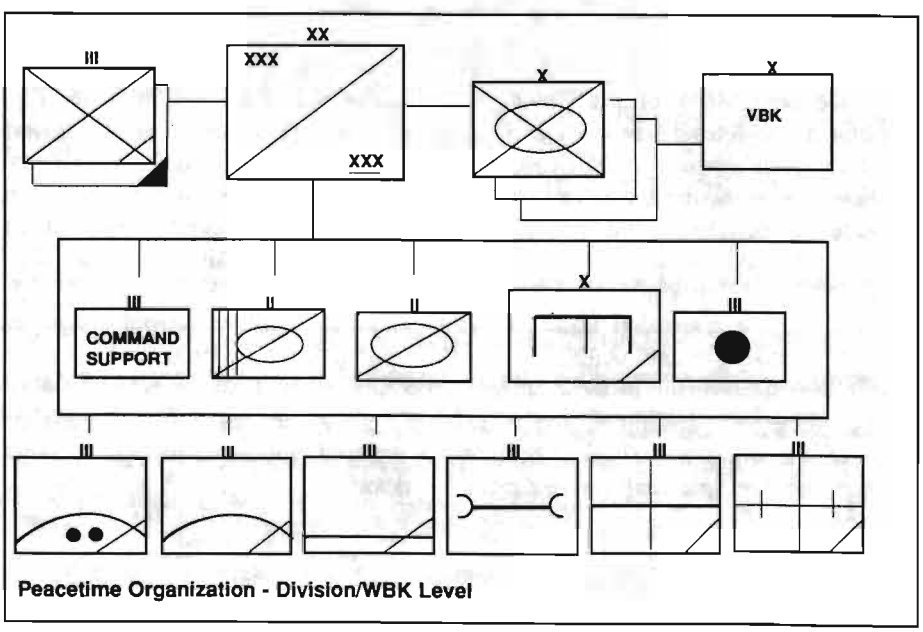
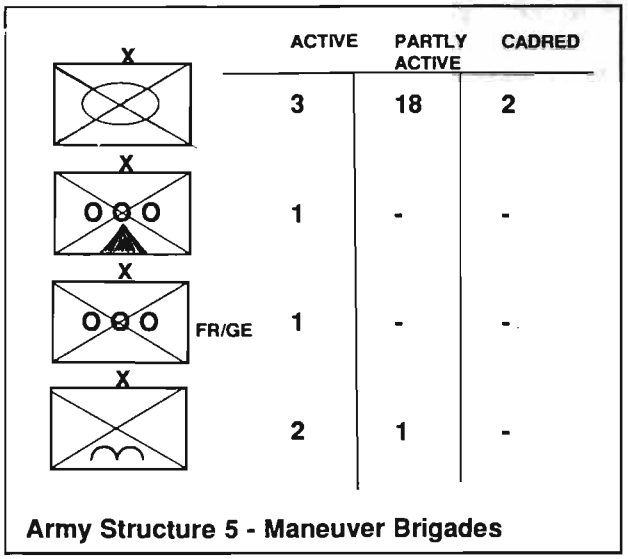


Figure 4



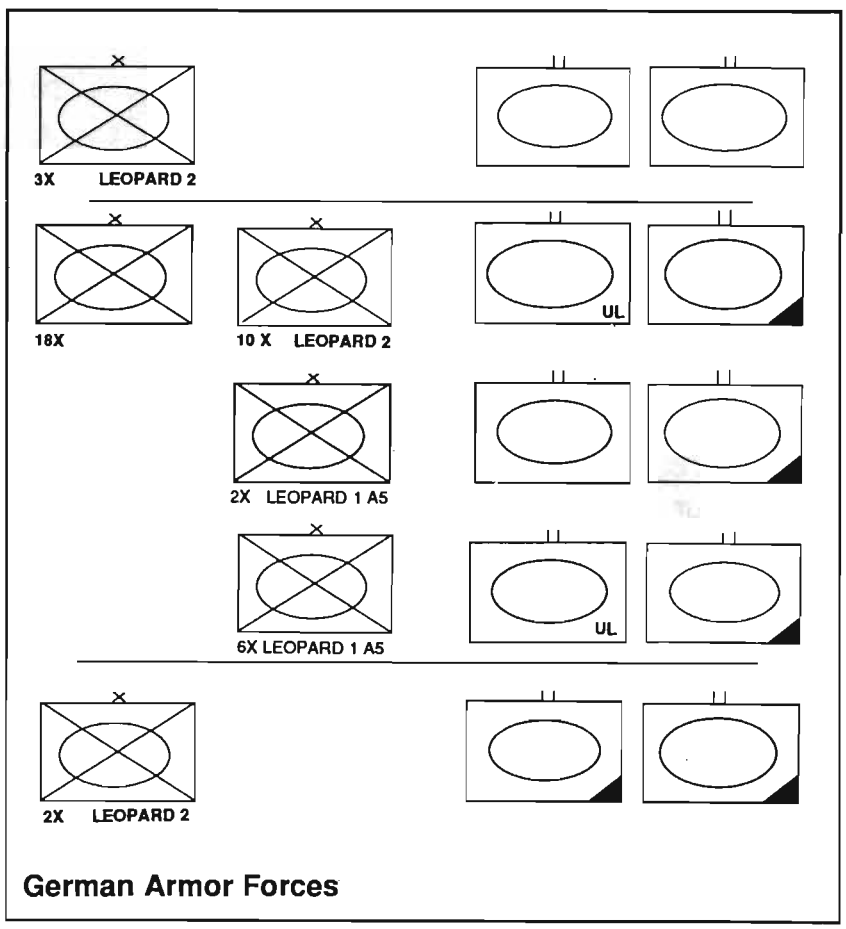
Army Structure 5 - Maneuver Brigades

Figure 5

Army Structure 5 calls for 28 maneuver brigades, three of them standing, two fully cadred, one standing mountain infantry brigade, the standing Franco-German brigade, and three airborne brigades, two of them standing (Fig. 5)

The German Armor Forces will be affected most by the reductions in the German Army. Two active (parent) tank battalions will belong to each of the three active mechanized infantry brigades. Two more tank battalions, one an active unit and one a partly active build-up unit, will belong to each of the 18 partly active mechanized infantry brigades. Two cadre tank battalions will belong to the two cadre mechanized infantry brigades. Overall, under Army Structure 5, the Armor Forces will go from the current 74 tank battalions to 46 — 24 active, 18 partly active, and four cadre (Fig. 6).

The structure of armored reconnaissance forces in Army Structure 5 is not firm yet, but there are indications this branch will retain at least the same strength as it had under the previous army organization because of the greater need for reconnaissance to protect flanks and overwatch areas. We will also need a stronger air-transportable component given the future potential missions of German forces.



German Armor Forces

Figure 6

In summary, Structure 5 leaves the army with:

- The same number of corps and territorial commands.
- Eight divisions and WBKs, rather the current 12 divisions and five WBKs.
- A total of 28 maneuver brigades instead of the current 48.
- The elimination of 115 fully or partly active battalions.
- The elimination of 166 cadre battalions. (Fig. 7)

Under Army Structure 5, there is sufficient flexibility to task-organize on short notice, combining standing airmobile and mechanized units and necessary combat support and combat service support elements.

Integrating Active and Build-up Battalions

Field trials helped us decide how to integrate parent and cadre battalions in the armor forces and mechanized infantry. In peacetime, the "build-up battalion" remains under the control of the active battalion, which is responsible for mobilizing its non-active counterpart when needed (Figs. 8 & 9). The active battalion's commander is responsible for both units, and his active unit includes the cadre for the build-up unit. On mobilization, the active battalion commander moves to command the build-up battalion, while his subordinate takes over the active unit.

Conclusion

Faced with the problem of a substantially smaller German Army and fewer Allied forces stationed in Germany, we must be able to accomplish much more difficult missions over a larger area. Planning is clearly determined by the intention to ensure full integration into the Alliance. With the reorganization, the German Army will have adequate standing forces to enable participation in IRF/RRF and UN missions.

Within the Bundeswehr, our major challenges are downsizing, building up II Corps in the East, and integrating the NVA forces into the Bundeswehr. The basic features are one army, a streamlined command structure, and greater importance of reservists. We know that neither the Germans alone nor the West Europeans together can manage these challenges. Only with close cooperation from our allies, particularly our American friends, we can meet these challenges.

We can only hope to have the kind of success you have had in your 200 years of history. In my opinion, our greatest advantage is that we all want a united Germany as soon as possible.

Army Structure	4	5
Corps	3	3
Territorial Command	3	
WBK	5	8
Div	12	
Maneuver Brigades	48	28
Battalions (Active/Partly Active)	385	270
Battalions (Cadred)	515	349

Figure 7

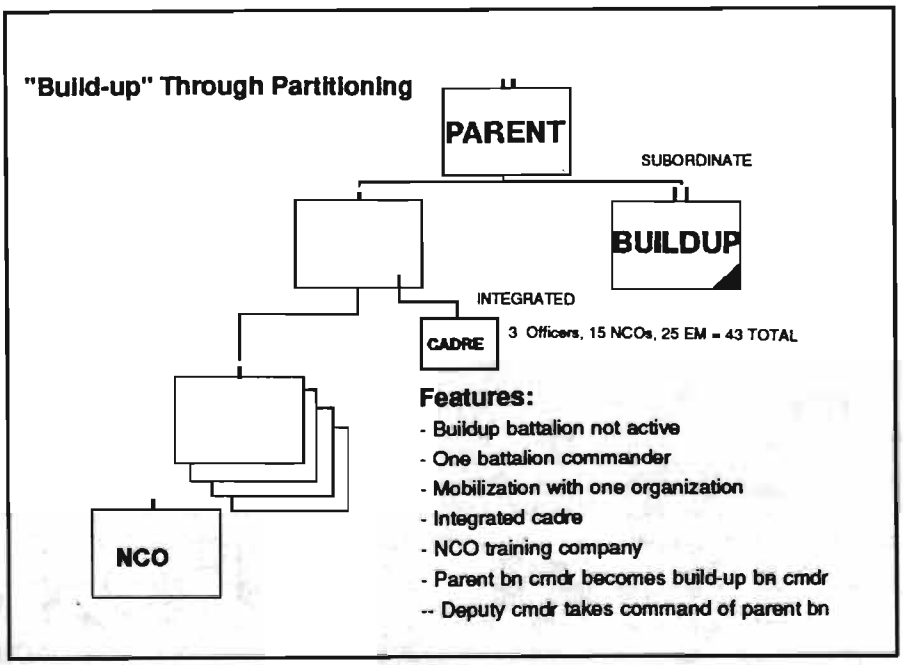


Figure 8

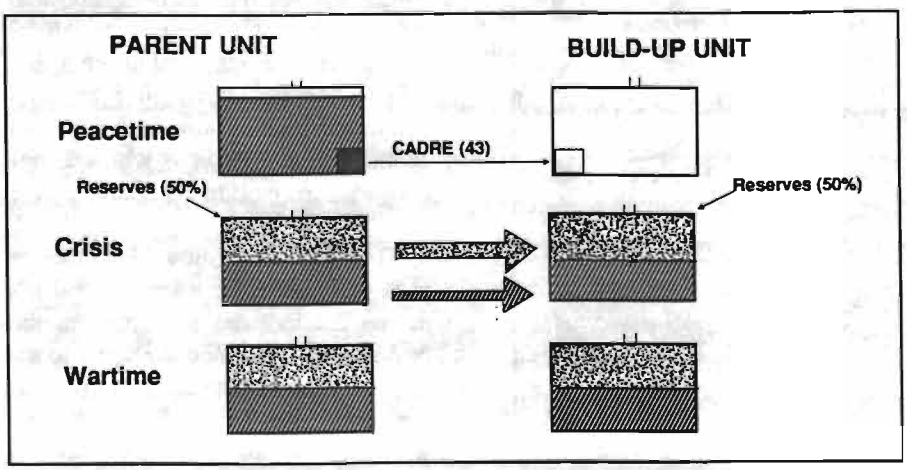


Figure 9

Lieutenant Colonel Wolfgang Hahne, German liaison officer to the Armor School, has over 30 years of active commissioned service, beginning as a tank platoon leader of a Leopard I unit. He has served as tank battalion commo officer, company commander, battalion XO and S3, and tank battalion commander. At various times in his career, he has also served as an instructor at the officer school and the Combat Arms School.

50th Anniversary
7th Armored Division

Armored cars and halftracks of the 7th AD return enemy fire near Epernay, France, August 1944.

The "Lucky Seventh": Assigned to Three Armies, Seven Different Corps During Its WWII Campaign From Normandy to the Baltic

With headquarters in a tent and a good deal of borrowed equipment, the 7th Armored Division started life at Camp Polk, Louisiana, on 7 March 1942. Led by MG Lindsay McDonald Silvester, the "Lucky Seventh" whipped itself into fighting trim with maneuvers in Louisiana and Texas.

World War II Campaigns

Northern France
Rhineland
Ardennes-Alsace
Central Europe

The division arrived at California's Desert Training Center No. 2. for maneuver training on 11 March 1943, followed by assignment to Fort Benning, Ga., on 12 August.

By April 1944, the division was at Camp Myles Standish, Mass., in preparation for debarkation. Staged at Camp Shanks, N.Y., the division departed New York on 7 June 1944, arrived in England a week later, and landed in France on 11 August 1944.

At times assigned to the First, Third, and Ninth Armies and seven different corps, the "Lucky Seventh" fought in the battle of Chartres within a week after crossing the Normandy beachhead, then attacked toward the Seine River, securing a bridgehead at Melun on 24 August 1944. Driving rapidly, the division crossed the Marne River

World War II Commanders:

MG Lindsay McD. Silvester
March 1942-November 1944

MG Robert W. Hasbrouck
November 1944-Sept. 1945

BG Truman E. Boudinot
September 1945

Battlefields Of the "Lucky Seventh"

The 7th AD's campaign in Europe during 1944 ranged across extremes of terrain and temperature. In September, it moved into Holland's flat canal country, above. And in one of the worst winters in European history, it took part in the reduction of the "Bulge" before having a chance to rest and refit in February 1945. At left, a street scene in Bastogne during the Ardennes fighting.

at Chateau-Thierry on 27 August, then the Meuse at Verdun on the 31st.

Short of fuel, the division rested on its arms until 6 September when it attacked to force the Moselle, crossing units under heavy fire on 8 September, which had to be subsequently withdrawn. The remainder of September saw the division's CCA, CCB, and CCR heavily engaged in attempts to force the river against tough German defenders.

Relieved by the 5th Infantry Division on 24 September, the Seventh sidestepped to Holland and attacked from Oploo four days later against heavy opposition to force a corridor west of the Maas River. October was characterized by tough fighting, gains and reversals as the division tried to gain ground and take canal crossings in Holland.

The German Ardennes offensive caught the division preparing to drive from Linnich, Germany, on the Roer River. Elements were committed to the defense of St. Vith on 16 December. German attacks forced a withdrawal on 21 December and the loss of Manhay on Christmas Eve. The division retook Manhay on 27 December then turned its sector over to the 75th Infantry Division on the 29th.

Attacking through mines and deep snow toward St. Vith on 20 January 1945, the division captured Born in house-to-house fighting the next day. CCB attacked through CCA to clear St. Vith on 23 January. The campaign ended by 6 February, and the "Bulge" was reduced. The division spent the rest of the month on a badly-needed rehabilitation.

On 7 March, the division started clearing the zone west of the Rhine River between Bonn and Remagen, crossing the Rhine on 25 March and attacking the next day. It captured the Edersee Dam intact and secured crossings over the Eder River on 30 March.

The Seventh helped reduce the Ruhr Pocket over the next two weeks against determined opposition. The division assembled at Gottingen on 18 April, and on the 30th, began the drive from the Elbe to the Baltic, which it reached on 3 May.

There, the division made contact with advancing Soviet Army forces and was in that region when hostilities ended on 7 May 1945 (see "Your Mission is to Contact the Russians...", *ARMOR*, March-April 1989).

In four campaigns, the "Lucky Seventh" had suffered 898 killed in action, and 3,811 wounded in action, 200 of whom later died of their wounds.

The "Lucky Seventh" returned home at Hampton Roads on 9 October 1945 and inactivated at Camp Patrick Henry, Va., on the same day.

Prepared by the ARMOR Staff.

50th Anniversary
8th Armored Division

"Tornado" Trained Cadre, Then Raced Across Europe Like a Thundering Herd

The "Thundering Herd" played a crucial role in World War II. It provided soldiers for the expansion of the Armored Force, and it later distinguished itself in battle as the "Tornado."

In 1942, the United States Army was trying rapidly and efficiently to expand its armored forces. High level military planners realized the need for an armored unit to train cadre personnel, who would then form the core of other armored divisions. General Orders Number 19, Headquarters, The Armored Force, officially activated the 8th Armored Division on 1 April 1942, at Fort Knox, Kentucky, as this training division.

On 18 April 1942, BG Grimes, the 8th's commanding general outlined its mission to the division's officers:

" ...to provide complete cadres, officers and enlisted men, for new divisions. The primary purpose is to train, organize and prepare these divisional cadres. We are a training division as distinguished from an active division."

Throughout April, May, and June, new personnel arrived. Units reached full strength, and instructors trained. On 13 and 14 June, the individual units received their standards at retreat ceremonies. The "Thundering Herd" remained at Fort Knox until January 1943. During that time, incoming personnel fresh from civilian life rigorously trained in the new concepts of armored warfare. More than 10,000 cadre personnel learned their business with the 8th and moved on to form cadre of the 9th through the 14th Armored Divisions.

Shermans of the 8th AD fire on German positions near Kirchellen, Germany, March 1945

In January 1943, the division moved to Camp Campbell, Kentucky. Almost immediately, the 8th sent more than 4,000 men directly to Tunisia to replace losses suffered by U.S. tankers. The division continued its training mission until February 1943. Then, War Department Training Memorandum Number 2, 1943, directed the 8th

to cease training cadre. Officers of the 20th Armored Division assumed responsibility for their own unit's training, and the 8th began to train filler replacements for existing units.

Early in March 1943, the "Thundering Herd" moved to Fort Polk, Louisiana, and joined the Third Army. Its training mission complete, the 8th began the Mobilization Training Program. By September 1943, it had completed transition to the new "light" armored division. During the next months, the division prepared for combat by participating in field exercises and full scale manuevers in Texas and Louisiana. March 1944 brought 1200 replacements straight from civilian universities; they were members of the Army Specialized Training Program. However, a War Department levy tasked the 8th to once again provide replacement fillers. Almost all of the privates and privates first class departed for overseas assignments. That April, the division was reinforced by an influx of former aviation cadets. The 8th spent the rest of spring and summer honing its skills for combat.

On Election Day, 7 November 1944, the "Thundering Herd" sailed out of New York harbor aboard the ships *HMT Samaria, USAT George W. Goethals, USAT Marine Devil,* and the *SS St. Cecelia.* During the convoy to England, the men of the 8th practiced lifeboat drill, exercised, and studied French or German. On 19 November, the division disembarked at Plymouth and Southampton and quickly moved to Tidworth Barracks. The preparations for war increased intensity. Humorously, the "Thundering Herd" celebrated Thanksgiving Day on the fourth Friday of November. The frozen turkeys drawn from quartermaster stocks did not thaw in time for the more traditional Thursday holiday. The Division hosted British orphans for Christmas Day 1944, and received reports of the "Battle of the Bulge." Finally, on New Year's Day, the division received orders to move quickly to the continent.

8th AD "Hellcat" tank destroyers line a street in Rheinberg, Germany, March 1945.

On 13 January 1945, the 8th Armored Division joined the XX Corps, Third Army, at Pont-a Mousson, France, and received the code name "Tornado." Combat Command A assisted the 94th Infantry Division in reducing the German salient between the Moselle and Saar Rivers. After fierce fighting against crack enemy units, the "Thundering Herd" won high praise from MG Walton Walker, XX Corps commander.

On 19 February, the 8th joined the XVI Corps, Ninth Army, and relieved the 7th British Armored Division in the vicinity of Brackterbeek, Holland. Soon after, the division took part in "Operation Grenade" to eliminate enemy resistance west of the Roer River. Once the XVI Corps gained a crossing site, the "Thundering Herd" drove on to the Rhine River. Combat Command B assisted the 35th Infantry Division in seizing the Wesel Bridge and Rheinberg. This cut off enemy resistance west of the Rhine. The 8th was the first Ninth Army armored unit to cross the Rhine. On 28 March, it attacked east to penetrate German defense along the Rhine-Herne Canal. By 3 April, it had reached Paderborn, Germany. The division then turned southwest and helped reduce enemy resistance in the Ruhr Pocket. There, the division distinguished itself in desperate fighting. On 11 April, the 8th joined the XIX Corps and conducted offensive operations to destroy any resistance in the Harz Mountains. SHAEF announced V-E Day on 8 May 1945 and brought the war in Europe to an official end.

With hostilities concluded, the "Thundering Herd" moved to occupation duty in Czechoslovakia. There the 8th began a metamorphosis. An Army points system designated men to return to the states or remain in occupation. Men left for other units, and replacements arrived. On 19 September, the 8th began the long trip home. The *USS West Point, USS LaJeune, USS Vulcania Victory, USS Excelsior Victory, USS Norway Victory,* and the *USS Victory Hood* carried the division home.

The 8th Armored Division was deactivated at Camp Patrick Henry, Virginia, on 13 November 1945.

This unit history was researched and prepared by CPT John Buckheit during his temporary assignment to ARMOR Magazine in Summer 1990.

The Spirit of the Cavalry

selected and translated by Lieutenant Colonel Donald C. Snedeker

Quotations from Combat Formation and Combat Operations of the Cavalry by Baron von Malzahn, Rittmeister and Company Comander, Ulan Regiment von Schmidt (1st Pomeranians) No. 4, Berlin, 1913.

Training

"A unit is properly trained if it can accomplish what is required in war and if it does not have to rid itself of bad habits on the field of battle learned on the field of training."

"From start to finish, it must be emphasized that all training must be calculated in terms of war. Since, in war, only what is simple promises success, only simple formations are to be taught and used."

"Following the regulations of the Great King (Frederick the Great), it is emphasized that the entire training of Cavalry is founded on the conscientious and meticulous training of the individual man and horse; and that only upon this basis alone is built the training of all larger formations up to the Cavalry Division."

"Unit training exercises can never completely make up for failures in individual training. This must be reinforced during every period of instruction."

"Only after all prescribed formations have been practiced to perfection by the platoons and every man knows what he has to do, can training on the company level begin."

"Essential for all training in the use of firearms is the principle that what one does is more important than how. The good of all training exercises is to develop a soldier who thinks for himself and acts conscientiously. The set determination to hit the target, and the faithful effort to do one's best, even when not being observed or under supervision, these are the essentials for superiority in a firefight."

Combined Arms Warfare

"The effective combination of all elements in accomplishing the mission in combat is secured through thorough schooling in peacetime."

"Mounted artillery frequently supports reconnaissance; artillery fire will often force an enemy to give away its presence and strength."

Leadership

"Higher level leaders must not be distracted from their overall mission through the arrangement of details."

"Lower level leaders must be trained in responsibility and in the ability to make decisions such that they can independently go beyond their own level of command when the battle situation requires."

"Especially important for all leaders is the appropriate selection of his own location during the fight. The leader's impact on soldiers in battle can first be gained through effective leadership and giving of orders, through personal attention to their execution, and timely intervention, but especially by the skillful use of terrain."

"Leadership in battle with the Cavalry is more personal, more a factor of the leader's personality than in any other branch of service. The special character of cavalry combat with its rapid pace and its unexpected changes of direction requires special qualities from the mounted leader."

"Nowhere does 'average' leadership have an effect to the same degree as it does in the Cavalry. In the Cavalry, mistakes can almost never be made good again. The short time available, the rapidity of all actions, the inability to call back a

mounted attack once it has begun, are decisive. No matter how good a unit is, it can't make up for a failure in leadership."

"The commander is not bound to a fixed position. It is a grave mistake to be glued (too close) to the unit... (I)n all cases where the regiment (battalion) is employed independently, the commander must be far forward. Only thus can he gain the personal appreciation of the enemy and the terrain which is imperative for rapid decision-making. It is nonetheless to be considered that he must, through appropriate means, (be) in contact with the regiment and be able to deliver his orders as quickly as possible."

"Every platoon should be led by an officer if possible. Noncommissioned officers will replace missing officers. Just as senior lieutenants should be capable of commanding the company, so too should noncommissioned officers be trained as platoon leaders and soldiers as noncommissioned officers. Units should frequently practice the loss and temporary replacement of individual leaders."

"The essential prerequisite for executing such surprise moves (such as rapid change of direction), other than well schooled men and horses, is attentiveness, self-confidence, and skillfulness of all leaders from platoon leader upwards."

Tactics

"Actions against the enemy's flank and rear are especially effective in all Cavalry operations. Included in this sense are the so-called 'raids' as practiced in an exemplary manner by the American Cavalry general Stuart."

"Even after a long approach march, hours of combat, and bloody losses, while the sister services camp on the hard won objective, the Cavalry knows neither rest nor relaxation. Well into the night, the Cavalry rushes forward, always attempting to overtake the enemy in headlong flight and turn its flank."

"The Cavalry must constantly be aware that the defense is only effective and only achieves its purpose if it is executed boldly and with an offensive spirit."

"More than any other branch of service, the Cavalry is dependent on the effects of terrain — during the approach march, changing formations, in the attack, or in the defense. Only the personal appreciation of the commander himself or of someone he trusts is decisive. Maps do not generally provide the desired level of detail."

"Just as surprising the enemy is the true element of Cavalry, so too must the Cavalry never, under any circumstances, be surprised by the enemy."

"Just as important as obtaining timely information about the enemy is hiding from him our own organization and actions. Disguising (covering) can be required to the front as well as on the flanks and can be achieved offensively or defensively."

Taking Care of Man and Beast

"Leaders' concern for keeping their horses in good condition up to the start of the battle is an important contributor to success. Even in the middle of the battlefield, opportunities to feed and water must be taken advantage of."

The Spirit of the Cav

"When in doubt, leaders must act according to the principle: a bold decision is usually best."

"Nothing could be worse than to wait for (more) information rather than acting. Insufficient information about the enemy should never be a reason for giving up the initiative. The Cavalryman who waits for enemy intelligence and orders will always arrive too late!"

"Thanks to the mobility resulting from the speed of its horses, the Cavalry is more capable of surprising the enemy than any other branch of service. This spirit (of mobility) is embodied in the Cavalry and the chances of success are thus increased, as the effectiveness of its weapons is enhanced by its spirit."

"The Cavalry should always attempt to fulfill its mission offensively, and this principle is reinforced by the words of Frederick the Great: 'No squadron should wait until it is attacked, rather attack the enemy first every time.' "

Lieutenant Colonel Donald C. Snedeker is the chief, Inspector and Escort Branch, On-Site Inspection Agency-Europe.

GEN JAMES H. POLK

General James H. Polk, Former Commander Of USAREUR and CENTAG, Dies at 80

The Armor community lost one of its patriarchs with the passage to Fiddler's Green of General James Hilliard Polk, 80, on February 18, 1992. He died at the William Beaumont Medical Center, Fort Bliss, Texas. General Polk's distinguished career spanned more than 37 years, culminating in his assignment as Commander in Chief, U.S Army Europe and Seventh Army, and NATO's Central Army Group commander.

He was born on December 13, 1911, at Camp McGrath, Philippine Islands, the son of Col. and Mrs. Harding Polk. Lt. Polk was commissioned in the Cavalry upon his graduation from the United States Military Academy in 1933. He attended the Cavalry School, Regular Course, and had served in two cavalry regiments by the time of World War II.

Leaving his instructorship at West Point, he attended the Command and General Staff School before assuming command of the 6th Cavalry Reconnaissance Squadron (Mech) of the 106th Mechanized Cavalry group. Later, as group XO, he participated in the Normandy invasion, the St. Lo breakout, and Third Army drive across France. Assuming command of the 3rd Cavalry in September 1944, he led it with distinction until December 1945, consistently spearheading General Walton H. Walker's XX Corps of the Third Army. Polk was decorated three times for gallantry while in command.

After the war, General Polk served as chief of tactics at the Ground General School at Fort Riley, attended the Armor Force Staff College, and served a tour in the G2 Section, General Headquarters, Far East Command. He served as X Corps G2 through three campaigns in the Korean War.

General Polk graduated from the National War College in 1952, then served as an Army War College instructor until 1955. The next two years found him with the 3rd Armored Division at Fort Knox and then in Europe as commander of two combat commands, chief of staff, and assistant division commander.

In July 1957, General Polk began a two-year tour as assistant chief of staff for Plans and Operations, Land Forces Central Europe, NATO. In 1959, he returned to the Office of the Assistant Secretary of Defense for International Security Affairs as director of the Policy Planning Office.

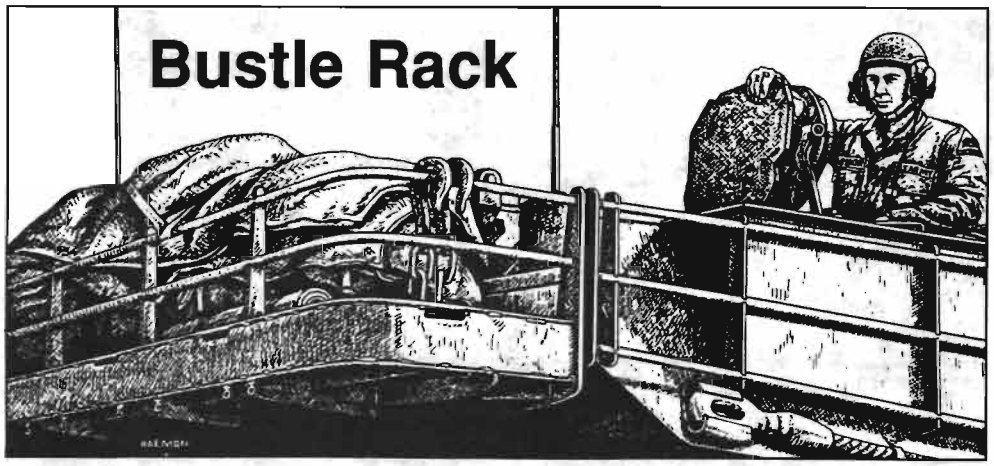
August 1961 marked the beginning of a series of key command assignments in Europe — CG, 4th Armored Division (Aug '61-Nov '62); U.S. Commander in Berlin (Dec '62-Aug '64); CG, V Corps (Sep '64-Feb '66); Deputy Commander-in-Chief, U.S. Army Europe and Seventh Army (Dec '66-May '67); and Commander-in-Chief, U.S. Army Europe and Seventh Army, also, Commander, Central Army Group, NATO (Jun '67-Mar'71).

General Polk was placed on the U.S. Army retired list on April 1, 1971. A member of the U.S. Armor Association since 1933, he was President of the Association from May 1972 to May 1974, and received the Gold Medallion, Order of St. George in 1986. He was also the honorary colonel of the 3d ACR.

Among General Polk's awards and decorations are the Distinguished Service Medal w/OLC, Silver Star w/OLC, Legion of Merit w/2OLC, Bronze Star Medal, and Air Medal.

General Polk is survived by his wife, the former Josephine Leavell, whom he married in 1936; a son, James H. Polk III; a daughter, Josephine Schwartz; two brothers, Col. John F. Polk, USA-retired; and Captain Thomas H. Polk, USN-retired; and five grandchildren.

Interment was at Arlington National Cemetery, Va.



Delayed Desert Damage

An important new program to identify and assess hidden damage to Army equipment resulting from harsh environmental extremes during the Gulf conflict is underway at TACOM.

Called DELAYED DESERT DAMAGE, or 3D, the program is designed to assess the extent of the damage and use the information as a base for engineering analysis, to revise short- and long-term maintenance policies and determine funding needs. The Maintenance Directorate at TACOM has the responsibility for 3D.

"By learning how our equipment performed in the relentless heat and blowing sand, we can improve Army readiness," said LTC Al Lopez, maintenance director.

"TACOM equipment was tested for this type of environment and performed exceptionally well. But the unrelenting heat and sand may have accelerated normal wear," according to Ralph Janus, 3D action officer.

As a result of Operations DESERT SHIELD/STORM, TACOM has found evidence of unique and premature wear caused by sand ingestion and other environmentally-induced factors on equipment returned to units and depots, he said. The extent of latent or hidden damage and long-term effects is being evaluated by using field experts and through a complete inspection and disassembly process of examining numerous vehicle systems.

Major systems being assessed in the 3D program include the M1A1 Abrams Tank, M2A1 Bradley Fighting Vehicle, High Mobility Multipurpose Wheeled Vehicle, Heavy Equipment Transport, M939 5-Ton Cargo Truck, and Heavy Expanded Mobility Tactical Truck.

The results should lead to a high-tech version of the old Army program known as FITCALS. The FITCALS acronym stands for: Feel, Inspect, Tighten, Clean, Adjust, Lube, and Smell," Lopez explained.

The 3D program has already produced enough information to use in revising Defense Business Operating Fund projections and to publish new maintenance procedures and advisories. The final result will enhance equipment life with a balanced Army-wide maintenance program.

TACOM will be publishing a special technical bulletin outlining maintenance procedures which will help units to sustain equipment.

"The 3D program actually goes beyond the systems mentioned. And though we are only one-third of the way through, we've already seen high dividends from our work," he continued.

The combined input of field data and special depot inspections at Anniston, Ala., Red River, Texas, and Tooele, Utah, is being evaluated by a matrix team of engineers, technicians, specialists and other MSC representatives. So far, the data has provided enough information for the team to make certain insightful assumptions.

"For example, 3D analysis of tactical vehicles showed that sand and other environment-induced factors caused premature wear on brake drums, steering knuckles and internal gears. Sand penetration of the seals was the most significant cause of premature wear. Brake shoes exhibited scoring and cuts caused by sand," Janus noted.

"We found evidence that sand entered many of the seals and caused abnormal wear. Internal gears also showed signs of heat stress and unusual wear," Janus added.

Changes to AR 220-1 (Unit Status Report)

On 3-5 December 1991, FORSCOM J5 conducted a Unit Status Report (USR) conference to provide an update on changes to AR 220-1. The revised AR 220-1 pertains to both the Active and Reserve Components and becomes effective 16 April 1992.

Some of the primary changes are: Change reports are now required whenever there is a change in the status of a resource area versus a change in the overall rating. All equipment reportable on DA Form 2406 will be considered in determining Equipment Readiness (ER). Previously only Equipment Readiness Code (ERC) "A" equipment was considered. C-4 ERC "B" Line Identification Numbers (LINs), considered war stoppers, will be listed on Equipment Shortage (ESRAT) card. Units alerted for deployment in support of contingency operations will submit a USR 24 hours prior to deployment date. A Mission Accomplishment Estimate (MAE) will be determined for all units. USAR units will submit a USR quarterly, and roundout units will also submit an "Assessment Memorandum" to their Active Component (AC) unit each quarter. AC commanders with an assigned roundout unit will comment monthly on the impact of having a roundout unit.

For information concerning this article, write or call the Directorate of Total Armor Force Readiness, ATTN: ATZK-TFR (CPT Reilly or Mr. Wolff), Ft. Knox, Ky. 40121-5000, phone: DSN 464-1961 or 464-TANK, commercial (502)624-TANK.

Branch Immaterial OCS

The Branch Immaterial Officer Candidate School (OCS) is conducted at Fort Benning, Ga., by the 3d Battalion (OCS), 11th Infantry Regiment. This is the Active Component's only OCS, and annually commissions about 450 officers into 16 different branches.

This intense 14-week program offers selected soldiers and warrant officers an excellent opportunity to secure a commission. Throughout the program, officer candidates undergo rigorous physical training and extensive leader and ethical development. Candidates are challenged and assessed in numerous leadership positions, both in garrison and in tactical training environments.

Commanders at all appropriate levels are encouraged to identify and assist interested applicants prepare selection administration, as well as submit endorsements to application packets. AR 351-5, *(U.S. Army Officer*

Candidate School) contains program information and application instructions.

Functional Area (FA) 53 Update

The Computer Science School at the U.S. Army Signal Center, Fort Gordon, Ga., is developing a new course to support FA 53 (systems automation) officers. The Systems Automation Course (SAC) II is being developed to prepare FA 53 officers, currently serving in branch related assignments for upcoming FA 53 assignments. This course will quickly bring an officer up-to-date with current automation technology and Army automation issues. It will also provide him with the critical skills that will be required in his next assignment.

SAC II is four weeks, four days long and should be scheduled enroute to an officer's next FA 53 assignment. The first scheduled course date is January 1993, with courses being conducted on a quarterly basis thereafter. The requirements to attend the course are: (1) be on orders to a FA 53 assignment, (2) be in the grade of MAJ-COL, and (3) have served outside of FA 53 for at least the last three years.

For further information on this new course, please contact CPT Prantl at DSN 780-3236 or through DDN as "prantl@gordon-emh2.army.mil". To request seats in this course or other FA 53 assignment information, please contact MAJ Welch at DSN 221-2759 or through DDN as "welchd0@hoffman-emh1.army.mil".

Army Awards $1.2 Billion Truck Contract

TACOM recently awarded a five-year, $1.2 billion contract to the Texas-based Stewart and Stevenson Services, Inc., to build a new family of 2-1/2- and 5-ton tactical trucks.

Known as the new Family of Medium Tactical Vehicles (FMTV), they are planned for introduction to troops in October 1993. The trucks will replace the M44-series 2-1/2-ton trucks and M39- and M809-series 5-ton trucks now in use by the Army, Marine Corps, and Air Force, and will supplement the newer M939-series 5-ton trucks.

The company will build 11,000 trucks — approximately 60 percent will be 2-1/2-ton, and 40 percent 5-ton versions — over the next five years.

The trucks will have full-time all-wheel drive and an improved suspension system offering better off-road mobility than the existing vehicles.

The 2-1/2-ton version will have four-wheel design and will come in only a van and a cargo-truck variant.

The 5-ton version will use six wheels and will include two cargo models — one of which will have a materiel-handling crane — a dump truck, a wrecker, and a tractor.

Several add-on kits will be available to make the vehicles suitable for special roles, such as deep-water fording and operation in Arctic regions.

All cargo models and 5-ton dump configurations will be air-droppable and deployable by a Low-Altitude Parachute Extraction System (LAPES). In a LAPES deployment, a parachute pulls the pallet-mounted truck from the rear of a cargo plane flying about 20 feet above the ground. The trucks will also be helicopter transportable.

Significant FMTV performance improvement features include:

- new axle design by Rockwell International, in which some of the drive-reduction gears are contained within each wheel hub. This change reduces the size of the differential housing, thereby improving cross-country mobility by providing more vehicle ground clearance, increasing wheel travel and reducing the weight of the axle.
- extra-wide Michelin steel-belted radial-ply tires (called the Supersingle), which will provide improved traction and longer tire life, and will eliminate the need for dual wheels.
- central tire inflation system by Eaton Corporation, which will allow the driver to change tire pressure from inside the cab, making it possible to maximize traction on paved highways, sand, cross-country terrain, and when immobilized in mud or snow.
- new, lightweight six-cylinder turbocharged diesel engine by Caterpillar (lighter than current engines, yet delivers more horsepower). The 2-1/2-ton will use a 225-hp version of the engine; the 5-ton truck will use a 290-hp version.
- an Allison-built, electronically controlled, seven-speed automatic transmission that is lighter, smaller, easier to maintain, and has fewer parts.

Other improvements will result in a dramatic reduction in FMTV life-cycle costs.

The trucks will use the same instrumentation and controls, a common three-man cab and many of the same mechanical and electrical components.

A built-in diagnostic system will allow the driver to monitor vehicle operations from a dash-mounted display and know at a glance if a mechanical or electrical problem occurs.

The transmission will have its own diagnostic computer that will alert the driver to problems by displaying a code. That code will save the mechanic time by identifying what needs to be fixed.

Mechanics will be able to repair the new trucks easier and faster because of their cab-over-engine design in which the cab tilts forward to faciliate quick engine and transmission removal and installation.

According to COL Larry Day, FMTV project manager, current plans call for the Army to buy 102,000 trucks over the next 30 years. "The program over its life is estimated to be about a $20 billion acquisition," Day said. "In operation and support costs alone, we will save $40 billion. So for every buck we invest, we will get two back in O&S cost savings."

Reunions

The **11th Armored Cavalry Regiment** (Blackhorse) will hold its 23rd annual reunion at Fort Knox, Ky., June 19-20, 1992. This reunion is open to all Blackhorse Troopers, commissioned, noncommissioned, warrant, or enlisted from any period of service. For additional information write: The Secretary, Blackhorse Association, P.O. Box 11, Fort Knox, Ky. 40121, or call Bill Squires, (502) 351-5738.

The **1st Infantry Division** 75th Anniversary Commemoration and Reunion will be held June 7 and 8 at Ft. Riley. Former members of the division interested in participating may contact Major William B. McCormick, Public Affairs Officer, Bldg. 405, 1st Infantry Division (Mech) and Ft. Riley, Ft. Riley, Kan. 66442-5000, phone DSN 856-3032, commercial (913) 239-3032.

The **11th Armored Cavalry's** veterans of Vietnam and Cambodia will host its seventh reunion, 14-16 Aug 1992 in San Antonio, Texas, at the Holiday Inn Riverwalk, North. Contact: Ollie Pickral, 1602 Lorrie, Richardson, Texas 75080-3406, phone: (214) 235-6542.

The **11th Armored Division** will hold its reunion 19-23 August 1992 In Louisville, Ky. For more information, contact Alfred Pfeiffer, 2328 Admiral St., Aliquippa, Penn. 15001.

The **740th Tank Battalion** will hold it annual reunion September 3-6 in Dallas, Texas. Contact Harry F. Miller, 2150 6th Avenue N. #102, Seattle, Wash. 98109, phone (206) 283-8591.

If your son or daughter attended **Fort Knox High School**, please help us locate them. In particular, we are looking for the classes of '58, '59, '60, and '61 to join us in a reunion to be held at Ft. Knox July 24-25, 1992. For more information contact Dick Thorton, High School Public Relations Office, 7501 Missouri St., Ft. Knox, Ky. 40121 or phone (502) 624-5621.

BOOKS

Marine AMTRAC firing on a town from the Han River beach, September 1950

A Korean War Memoir By a Journalist-Soldier Offers a New Perspective On the Present Force

The Coldest War: A Memoir of Korea by Jim Brady. Pocket Books, Simon and Schuster Inc., 1991. New York, New York. 294 pages. $5.50.

Jim Brady's book on his tour of duty during the Korean War offers us an uncommon view of a forgotten soldier. Our nation's journalists have written little about this war. Jim Brady, a Marine rifle platoon leader turned journalist, offers us a glimpse of the life of a combat soldier in Korea.

Jim Brady was born in New York City in 1928. When he was 19 years old and a sophomore in college, Brady enlisted in the Marine Corps Reserve Platoon Leaders Class to avoid being drafted into the Army. Three weeks after his graduation from college and his commission as a Marine Reserve lieutenant, on 25 June 1950, the North Koreans launched a major attack across the 38th parallel. By Thanksgiving of 1951, LT Brady found himself as a rifle platoon leader on the front lines of the Korean War. Following his eight months of duty as a rifle platoon leader, a rifle company executive officer, and a battalion intelligence officer, LT Brady returned home, left the service, and pursued a career in print journalism. His credentials include being the publisher of *Women's Wear Daily* and *Harpers Bazaar*, editor in chief of *New York* magazine, and associate publisher of the *New York Post* newspaper. His combat experience, combined with his journalistic experience, provide for an extraordinary view of the combat soldier in Korea.

In this book, Brady attempts to honestly assess and come to grips with his performance from the day he gets off the replacement plane in Korea, to the day he boards the ocean liner to return home, eight months later. Brady describes both his heroic actions while on several combat patrols and his relief from fear each time another patrol was canceled.

For those who have the privilege of serving as a platoon leader in today's service, Brady's book is especially useful. I found myself making constant comparisons between myself and Brady, and also between the Marine Corps of 1951 and the Army of 1991. In the forty years that separates these comparisons, I came away realizing that not much has changed in the way the individual feels or performs. I was struck, however, at the major difference between the organizations. This major difference is professionalism. Brady, without meaning to do so, gives us the reason for this difference in the professional caliber of the two organizations. Simply put, it is the rotation system employed by the services during the Korean War. Brady, despite being in Korea for only eight months, is constantly describing how "green" soldiers arrive, and how seasoned veterans leave. The Marines of 1951, unlike their counterparts of the past and present, were only able to reach a certain level of competence, which they never exceed.

Brady did not attempt to make any political statements about the war. However, like all soldiers, he wondered aloud:

"We never fight a real battle, we don't win or lose, yet guys get killed, we wrap them, and send them south somewhere. We eat some more, we sleep some more, more of us get killed or lose a leg or go blind, and there's never a real battle and still the war goes on. Wouldn't you think one of us, them or us, would get tired of it and just pack up and go home?"

This book is a well written, fast paced account of one man's coming to grips with himself during an eight-month period of his life. His journalistic training allows him to dispassionately describe in detail life in the trenches of Korea. It makes excellent reading for all those who either participated in the Korean War or wish to compare their feelings and experiences with someone else's.

JOHN G. FERRARI
Captain, Armor
Radcliff, Ky.

Lieutenant Ramsey's War by Edwin Price Ramsey and Stephen J. Rivele. Knightsbridge Publishing Company, New York, 1990. 333 pages. $19.95.

It is quite appropriate as we begin observing the 50th anniversary of America's entry into World War II, that Colonel Edwin Ramsey's story is finally told. *Lieutenant Ramsey's War* recounts the private, and sometimes lonely, war waged by Ed Ramsey from December 1941 until his collapse from exhaustion and disease in mid-1945. This riveting, first person account of courage and leadership, provides a heart-rending look at the little known war of the Filipino guerrilla forces.

While easy to read, this book, based on Colonel Ramsey's frank personal recollections, moves along like a novel with excitement, action, and emotional encounters. Written some 50 years after the events occurred, Colonel Ramsey has had the opportunity to reflect on the impact of his actions and that of his command. It is an excellent example of small unit leadership impacting on higher level strategy.

Colonel Ramsey begins with a candid and forthright account of his early years in Wichita, Kansas. These experiences, and his years at the Oklahoma Military Academy shaped the character and courage of the man who would later lead over 40,000 guerrillas against the cruel and brutal occupation of the Philippines by the Japanese Imperial Army.

After enjoying, as Ramsey states, "the life of a colonial army officer," the rigors of war become apparent during the initial air and ground action of mid-December 1941. While executing a screen for the left flank of the Allied Army, Ramsey participated in the final cavalry charge in American history by the 26th Cavalry Regiment (Filipino Scouts) at Morong, 16 January 1942. Despite heroic efforts, the Allies fall back, and Ramsey and the 26th are trapped behind enemy lines. Choosing to fight rather than surrender and become a POW, Ramsey joins the fledgling resistance.

Initially, the guerrillas were somewhat scattered and uncoordinated, but through the efforts of Ramsey, Captain Joe Barker, Colonel Thorpe, and many other brave men and women of the resistance who chose to fight, the guerrillas become a force to be reckoned with. Ramsey brings to life the contributions of the resistance toward the liberation of the Philippines in exciting detail. Colonel Ramsey lays out all his fears and feelings. Further, it is fascinating reading to see how an officer trained to be a cavalryman became a guerrilla, "I was going to be a guerrilla, and I did not even know what that meant."

The U.S. Army Field Manual (FM) 22-100, Military Leadership, states: "All men are frightened. The more intelligent they are, the more they are frightened. The couragous man is the man who forces himself, in spite of the fear, to carry on." (GEN George S. Patton). Despite self-doubt, malaria, dysentry, hunger, injury, a typhoon, fatigue, and constant pressure from Japanese forces, including spies, Colonel Ramsey persevered. Through this terrible struggle, he came to understand the Filipinos and their courageous desire for freedom. Though these conditions were all but impossible, Ramsey continued to believe in his mission. Moreover, he states: "Indeed, guerrilla work had now become second nature to me. I no longer felt strange slipping through the countryside at night, hiding out in the hills, and carrying on secret induction ceremonies in the barrios..." His will was sustained by the belief that GEN MacArthur would return. Colonel Ramsey's courage and dedication were rewarded in October 1944 when MacArthur did return to the Philippines. In June 1945, then LTC Ramsey received the Distinguished Service Cross from GEN MacArthur.

This superb work presents lessons from 50 years ago that are relevant today, as the military works through low intensity conflict and joint doctrine, and reexamines its role in the Philippines. I enjoyed this book immensely. I recommend it to all leaders of soldiers and those interested in little known military history.

DOUGLAS J. MORRISON
CPT, Armor
Battle Command Trng. Program, CAC-T
Ft. Leavenworth, Kan.

Maple Leaf Route: Caen (Vol. 1); Falaise (Vol. 2); Antwerp (Vol. 3); Scheldt (Vol. 4); Victory (Vol. 5), by Terry Copp and Robert Vogel, published by Maple Leaf Route, Alma, Ontario, Canada, 1983-1988.

A five-volume series, averaging about 140 pages per book, *Maple Leaf Route* covers the combat history of the Canadian forces in Northern Europe as part of Montgomery's 21st Army Group, from the landings in France through the end of the war in Europe. That is, the period of June 1944-May 1945. The title derives from the symbol marking the difficult road they traveled. The authors, both distinguished professors of history, write from a unique viewpoint, describing the historical role of a very significant national military force played as an inlayed element in the overall drama of two major allied powers which controlled the historic actions involved.

The authors, using primary sources, have proved equal to their sometimes difficult task of sorting out the fog of war from their own side of the battle lines, and, as necessary, that on the other side as well. The historical work they have produced is very readable, straightforward, and unadorned with superfluous and errant explanation of the many complex and questionable decisions necessary in this period of World War II. They have done the Canadians proud. This is not to imply they have failed to dig deeply into the pros and cons of this period of military history, but they have done so with an analytical artistry that reduces the complex to the simple for the reader. The uniquely Canadian viewpoint adds illumination on facets of the events that took place in Northern Europe in this era not seen before.

Although the actions of the air and naval forces are treated where necessary as part of the operations, this is a saga of the land forces, specifically, the First Canadian Army with its 1st and 2nd Corps, three infantry and two armored divisions, and supporting units. Also included is the 1st Polish Armored Division, which spent most of the combat period with the Canadians. Equal time is given to the two British corps and eight British divisions, which at one time or another fought under Canadian control. The brigades, regiments, and battalions involved are too numerous to mention here, but it is their battles that fill the books, and they certainly are mentioned there.

The Canadian forces actions are painted against a continuing "larger picture" background of both enemy and higher echelon deliberations and operations. Such background sketches are covered in separate chapters and in relatively small bites so as not to lose the Canadians in the larger whole. An outstanding example is found in the *Antwerp* volume covering the choice of focusing effort on Antwerp or Arnhem. Tactical and strategic errors of the Canadians, British, Americans, and Germans are pointed out with equal impartiality.

However, most of the content of the five volumes is not devoted to higher level decisions and non-decisions, but to the real heroes being written about - the troops at battalion and lower level who fought the war on a personal basis. Quotes from unit war diaries and personal experiences, well selected photographs, and excellent maps depict the battles involved from the corps to the regimental level, with emphasis on the brigade and lower echelons. The use of regimental war diaries is particulary effective. Compressed as the volumes must be to reflect the broad sweep of the campaign they cover, *Maple Leaf Route* is laid out in memorable and realistic fashion. It is the story of Canadians on the route to victory, and of the price they paid — perhaps more than their fair share — for "the sweetest of Springs, the Spring of Liberation."

Canadians of all persuasions should study well this period in their history, and I doubt there is a better source than in this series of books for the Canadian Northern Europe land combat experiences. Discovered late by this American, the five volumes have given me a fresh look at the war in that area. An enlarged look, which has revealed some previously missing pieces of the real story of the campaign. For all Americans, these volumes served to provide a most impressive picture of Canada's significant part in the "Crusade in Europe." I can highly recommend them all.

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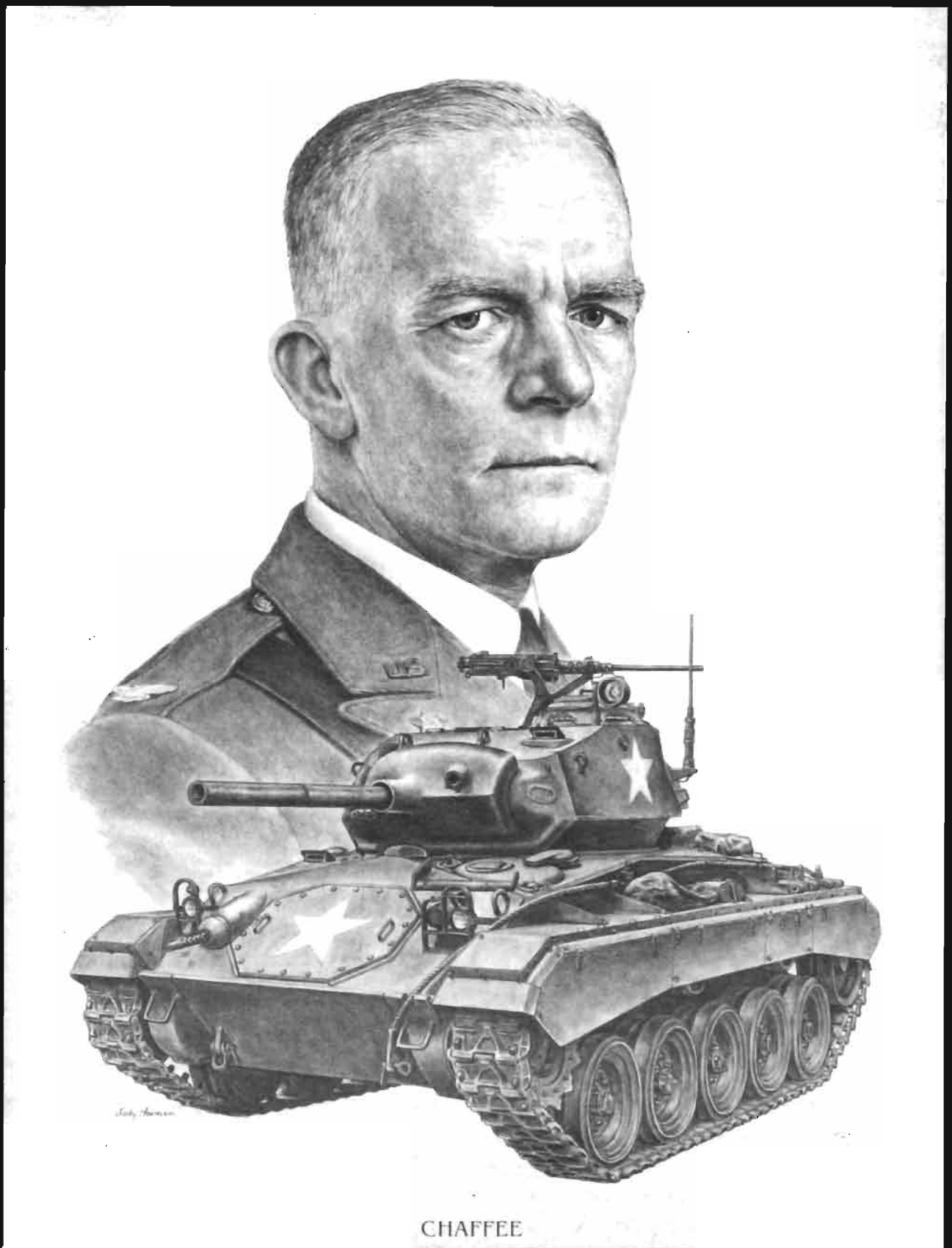

"The Namesake Series"

This portrait of General Adna Chaffee and the M-24 light tank that later bore his name is the first in a new series by ARMOR Contributing Artist SPC Jody Harmon. The portraits are in color and will be available through the U.S. Armor Association.