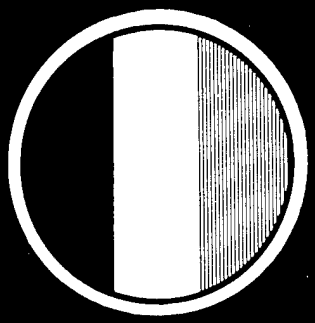
UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

TRADOC BULLETIN 8



- WEAPONS
- TACTICS
- TRAINING

MODERN WEAPONS ON THE MODERN BATTLEFIELD

31 DECEMBER 1975

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	31 December 1975	FINAL

4. TITLE AND SUBTITLE
TRADOC BULLETIN 8. MODERN WEAPONS ON THE MODERN BATTLEFIELD

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
HQ U.S. ARMY TRAINING AND DOCTRINE COMMAND
ATTN: ATTNG-CON
FORT MONROE VIRGINIA 23651

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
See TRADOC Bulletin 7 dated 30 June 1977

12a. DISTRIBUTION / AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

14. SUBJECT TERMS

15. NUMBER OF PAGES
48

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

This TRADOC BULLETIN is intended to provide to commanders, and others concerned with military training, timely information on weapons, tactics, and training. It is not intended to supplant doctrinal publications, but to supplement material on "how to fight" with data derived from tests, recent intelligence, or other sources.

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COMMANDER
US ARMY TRAINING AND DOCTRINE COMMAND
ATTN: ATTNG-CON (TEL: AUTOVON 680-2972/3153)
FORT MONROE, VIRGINIA 23651

UNITED STATES ARMY
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BULLETIN NO. 8

Modern Weapons on the Modern Battlefield

OVERVIEW: NEW LETHALITY

DURING the past several decades, the nature of battle has changed–not abruptly but nonetheless significantly. ***Today's battlefield presents challenges beyond any the US has ever faced.*** Great numbers of weapons of advanced destructiveness have been provided by major powers to client states; arms purchased by minor but affluent nations have further spread the latest military technology throughout the world. Recent wars between small nations have developed intensities formerly considered within the capabilities of large states only.

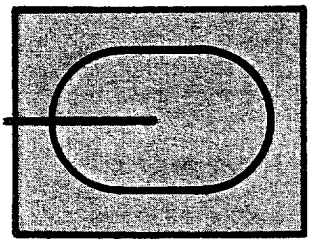
CONTENTS

THE POTENTIAL FOR VIOLENCE IS AT AN ALL-TIME HIGH

Nuclear weapons have not been used since 1945, the use of chemical weapons has been relatively insignificant, and biological weapons have not been used at all. Even so, the inventories of such arms and the number of nations holding them have grown year by year. The potential for violence is at an all-time high.

The war in the Middle East in 1973 might well portend the nature of modern battle. Arabs and Israelis were armed with the latest weapons, and the conflict approached a destructiveness once attributed only to nuclear arms. Use of aircraft for close support of advancing armor, in the fashion generally practiced since 1940, was greatly reduced by advanced surface-to-air missiles and air defense guns. In clashes of massed armor such as the world had not witnessed for 30 years, both sides sustained devastating losses, *approaching 50 percent in less than two weeks of combat.* The magnitude of these battles can be estimated from the fact that the Israelis destroyed a number of Arab tanks about equal to the total the US Army had deployed in Europe at the time. These statistics are of serious import for US Army commanders.

TRENDS: TANKS



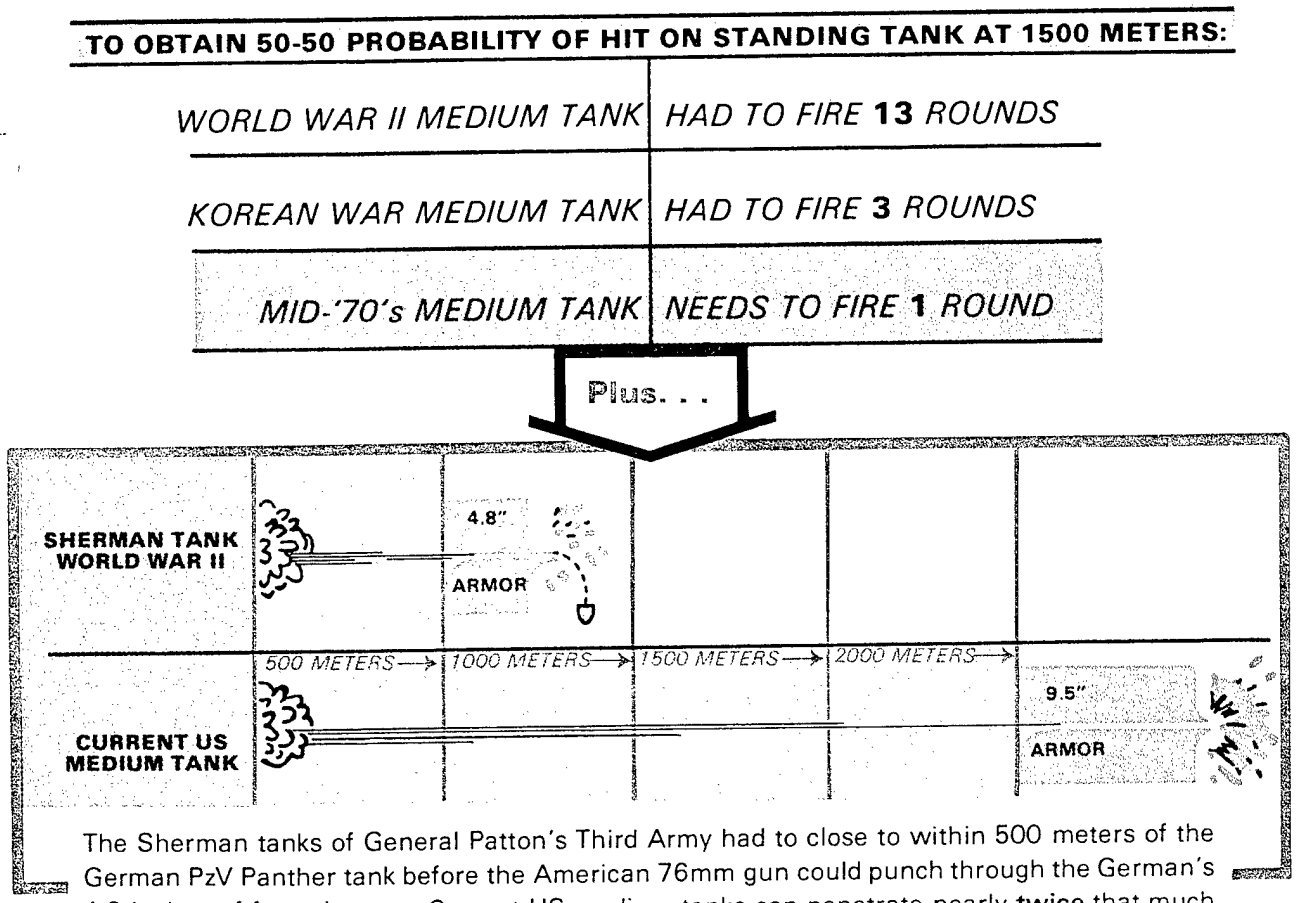
ALL GREAT ARMIES REST THEIR LAND COMBAT POWER UPON THE TANK

All great armies of the world rest their land combat power upon the tank. The armies of the Warsaw Pact, fashioned on the Soviet model, incorporate masses of tanks, backed by an impressive industrial base producing large numbers of quality armored fighting vehicles. Warsar Pact doctrine anticipates use of nuclear weapons in the future war, but teaches preparedness to fight without them. For both conditions, it *emphasizes heavy concentrations of armor.* In 1945, tanks comprised less than 6 percent of USSR ground forces. By the mid-'70's, tanks were more than 25 percent. Each Soviet-type motorized rifle division of the mid-'70's has 16 times the number of tanks of its World War II counterpart.

Similarly, tank strength is the foundation of NATO defense: the armies of the Federal Republic of Germany, the United States, Great Britain, and their Allies maintain strong tank forces in Central Europe, France, Sweden, Japan, the Chinese People's Republic, and nations of the Middle East and South Asia have all made significant investments in tank design, or procurement or both. Few states, even among the poorer nations, are without armored forces.

In the Arab-Israeli War of 1973, both sides relied heavily upon the tank for both defense and offense. Notwithstanding the fact that unparalleled numbers of infantry antiarmor weapons of advanced designs were used on both sides, and caused high attrition, *the tank was the crucial factor on the battlefield.* The tank was both the backbone of the defense and the key to successful attack. **The tank, however, could not operate effectively outside the combined arms team of tanks, infantry, artillery, and air defense.**

Firepower. Modern tanks are significantly more lethal than the armored vehicles which fought in World War II. Trying to hit another stationary tank at a range of 1500 meters, the US Army medium tank of World War II could fire 13 rounds, and would still have only a 50-50 chance of hitting. The standard US medium tank of the mid-'70's commanded the same hit probability with a single shot.



The Sherman tanks of General Patton's Third Army had to close to within 500 meters of the German PzV Panther tank before the American 76mm gun could punch through the German's 4.8 inches of frontal armor. Current US medium tanks can penetrate nearly **twice** that much armor at **four** times the range.

These charts plot characteristics of the main battle tanks of the major tank-producing nations over three decades. Each point records the year in which a significant improvement was introduced.

TANK GUN SIZE

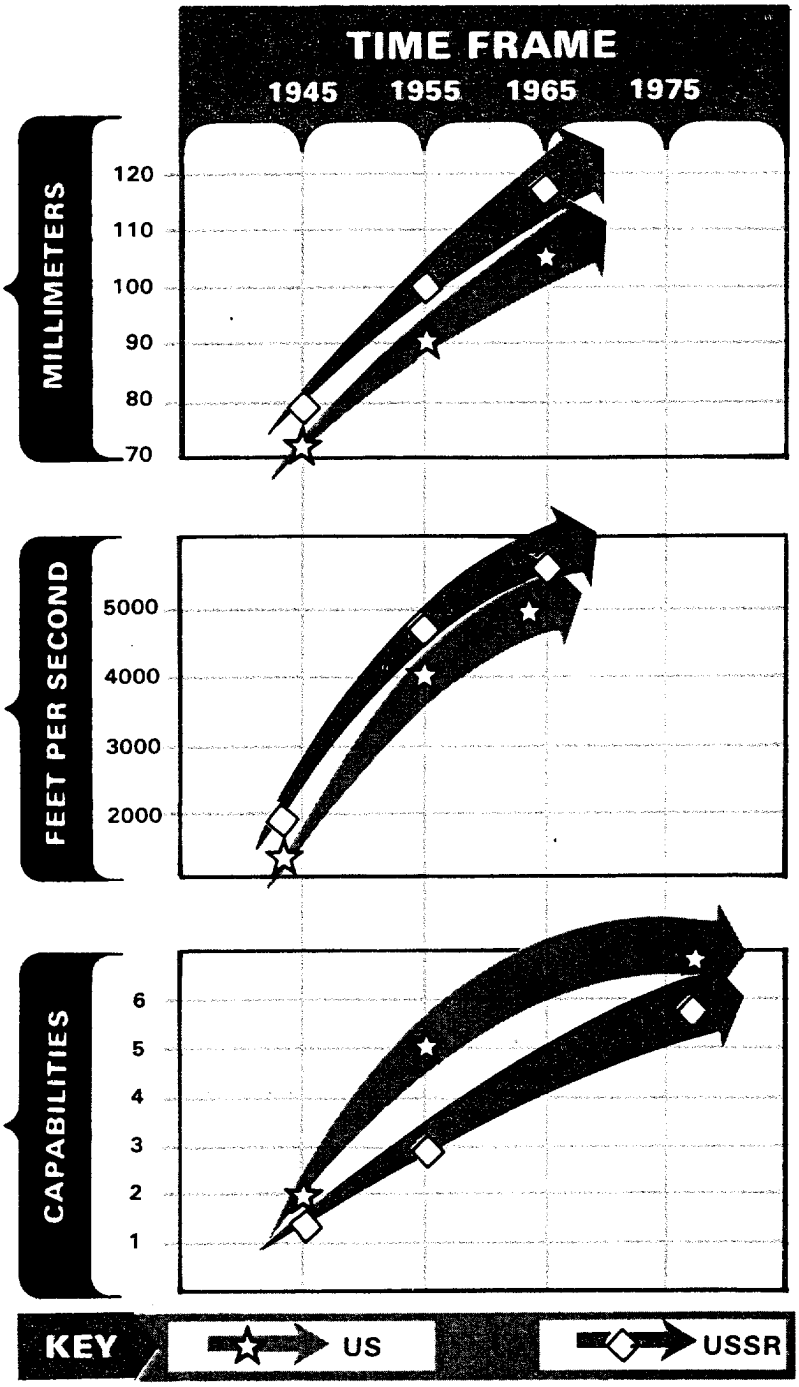
Modern tank guns are larger by one-third than the guns of 1945.

MUZZLE VELOCITY

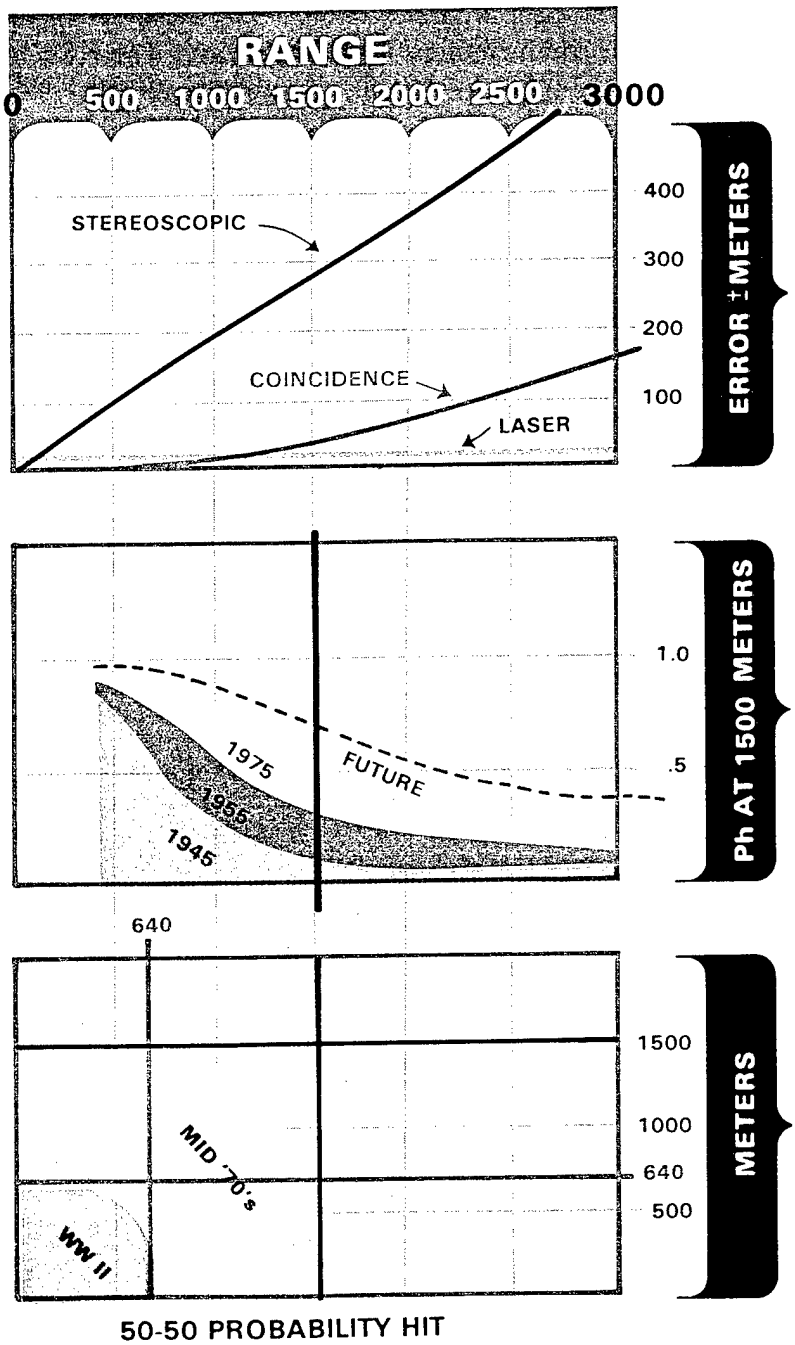
The muzzle velocity of tank projectiles has more than doubled. Rounds travel nearly one mile per second.

FIRE CONTROL INSTRUMENTS

Range finders, computers of superelevation and lead, sights and other aiming aids have improved by a factor of 4.



Improvements in gun accuracy and range have increased the area a single tank can command with its weapon.



ACCURACY OF RANGE FINDERS

Since most tank misses are caused by inaccurate range estimation, the unaided optical sights of WW II were replaced first by stereoscopic range finders, then by coincidence range finders, and finally, in the mid-'70's, by laser range finders.

ADVANCE IN TANK CANNON TECHNOLOGY

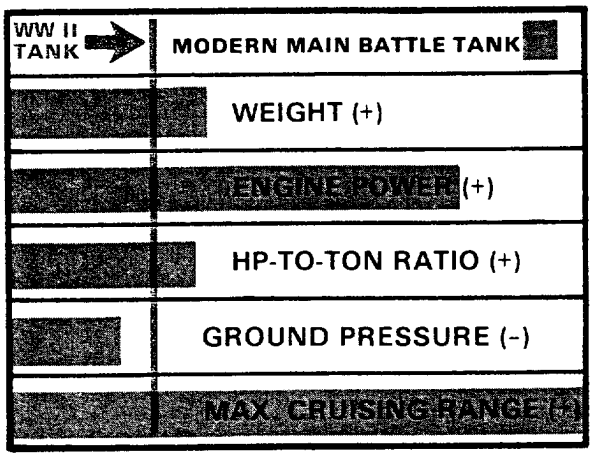
Taken together, these advances have increased hit probabilities ten-fold--and future tanks will mount guns of even greater range and accuracy.

COMMAND OF GROUND

One implication of this increase in range and hitting power is that the tank influences much more terrain than formerly. The tactical reach of the modern tanker extends over 7 times as much ground.

Armor Protection and Mobility. Modern tanks have not only bigger guns, improved ammunition, and more sophisticated fire control apparatus, but armor protection roughly double that of World War II tanks. Nonetheless, the chief tank-producing nations have designed their main battle tanks to constrain bulk, and to balance increases in engines, track and suspension systems.

For example, while the modern US main battle tank is one-third heavier than its World War II predecessor, it's equipped with an engine more than 2 times as powerful. Its agility has actually increased: its horsepower-to-ton ratio has *increased* by one-fourth, its ground pressure has *decreased* by one-fourth, and its maximum cruising range has increased by three times. Both the US



and the USSR have fielded amphibious light tanks, and many nations have developed various snorkeling devices for underwater fording. Tanks of the United Kingdom have tended to be somewhat heavier than US designs over the period; Soviet and German designs have tended to be lighter. But virtually all new designs have added armor protection and firepower.

At the same time, mechanical reliability has advanced. During the fighting in France in 1940, more than half the tanks participating went out of action due to mechanical failures. Modern main battle tanks are expected to average 300-400 km between mechanical failures.

MISSILE-TANKS CAN SCORE HITS 9 OUT OF 10 TIMES AT 3000 METERS

Tank development accelerated in the '70's with emphasis on increasing firepower and improving armor protection. Tanks appeared which can fire antitank guided missiles as well as cannon rounds. The missiles have much higher accuracy and greater range than cannons -- 50-100 percent greater. Such missile-tanks can hit tank-size targets 9 out of 10 times at a range of 3000 meters.

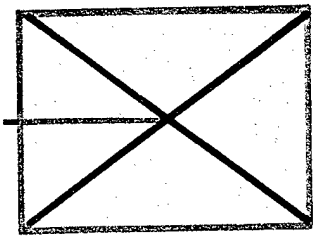
Also, most modern tanks have been equipped with night vision devices. Active sights let soldiers see targets illuminated with invisible infrared beams out to ranges of 1500 meters. More significant, there are passive sights with comparable range capability, which let the operator see targets by natural light (e.g., starlight), or by detecting the heat emitted by the target (thermal imagery sights). Thermal sights are effective out to 4 to 6 thousand meters.

Not the least of modern developments are tanks with stabilized turrets which materially aid gunners acquiring a target, and facilitate firing on the move.

In sum, the capabilities of modern tanks have been extended to as far as the tanker can see. What he can see, he can hit. What he can hit, he can kill. The tank, with its cross-country mobility, its protective armor, its formidable firepower, has been and is likely to remain the single most important weapon for fighting the land battle. Armored or mechanized forces (organized around tanks, infantry, artillery, air defense and tactical air) have demonstrated on the modern battlefield the capability to mass and maneuver rapidly, to break through defenses, to strike deep into the enemy's rear, to encircle his flank, *and to win decisive battles.*

THE TANK, WITH ITS CROSS-COUNTRY MOBILITY, ITS PROTECTIVE ARMOR, ITS FORMIDABLE FIREPOWER, HAS BEEN AND IS LIKELY TO REMAIN THE SINGLE MOST IMPORTANT WEAPON FOR FIGHTING THE LAND BATTLE

TRENDS: INFANTRY



Modern infantry is significantly more capable than its World War II counterparts, but especially so in three main respects -- **antiarmor weapons, mobility,** and **night vision.**

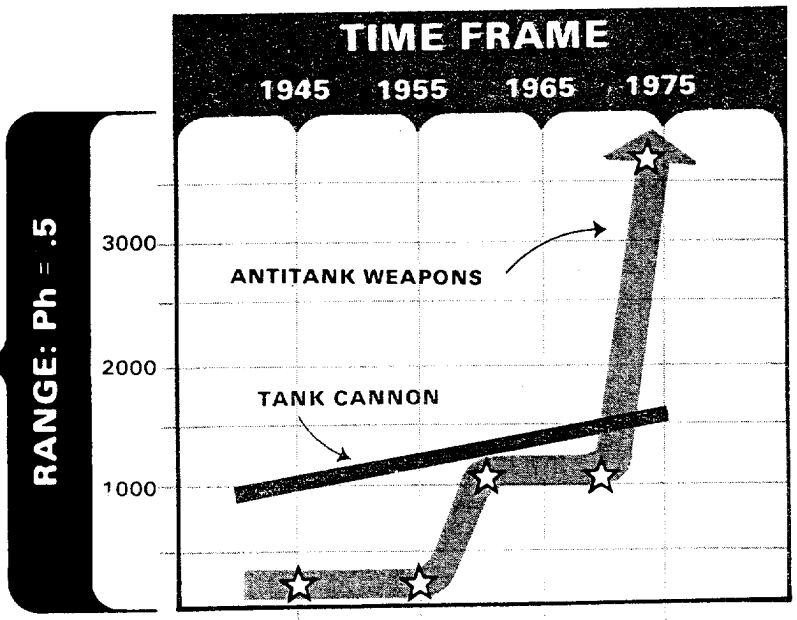
INFANTRY CAN INFLICT HEAVY LOSSES ON ARMORED FORCES AT LONG AND SHORT RANGES

Antiarmor Weapons. Tanks were invented to defeat the infantry defenses of World War I, and remained, for nearly 50 years, the nemesis of infantry. During World War II, shoulder-launched rockets with shape-charge explosives (e.g., bazooka, panzerfaust) began to erode the tank's invincibility. But rockets and the related recoilless rifles which followed soon thereafter, called for infantrymen courageous enough to duel a tank well within the lethal range of the tank's cannons and machineguns. Now, *well-trained infantry can inflict heavy losses on armored forces at both long and short ranges.* Mechanized infantry equipped with TOW and DRAGON can support tanks in both the offense and the defense against tank-heavy enemy forces.

US infantry antitank weapons have not only increased in range beyond that of tank cannon, their ability to penetrate armor has outpaced armor development.

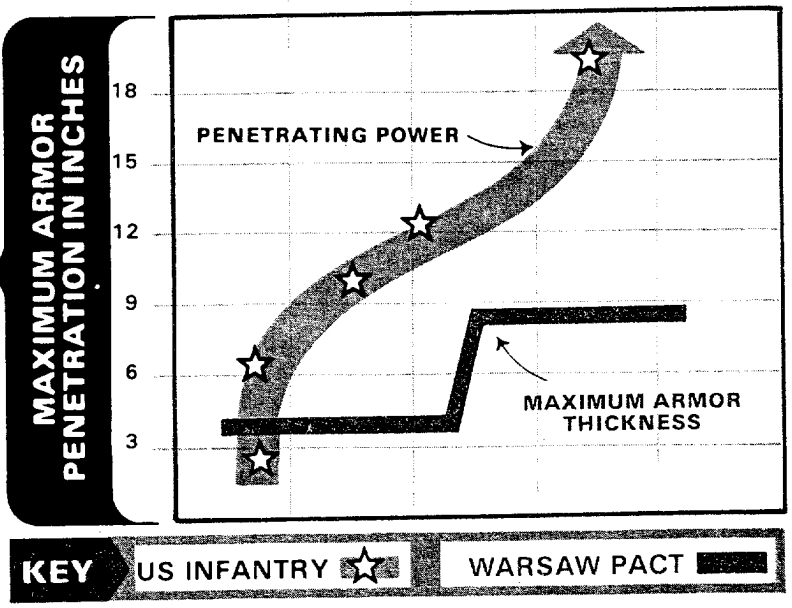
ANTITANK VS. TANK RANGES

The line across the middle of the chart shows the trend for the principal Warsaw Pact medium tanks. The other line shows the trend in range capability for the antitank weapon of the US Army Infantry in the same time frame. The leaping crossover was the result of introducing the tube-launched, optically-tracked, wire-guided (TOW) missile in the early '70's.

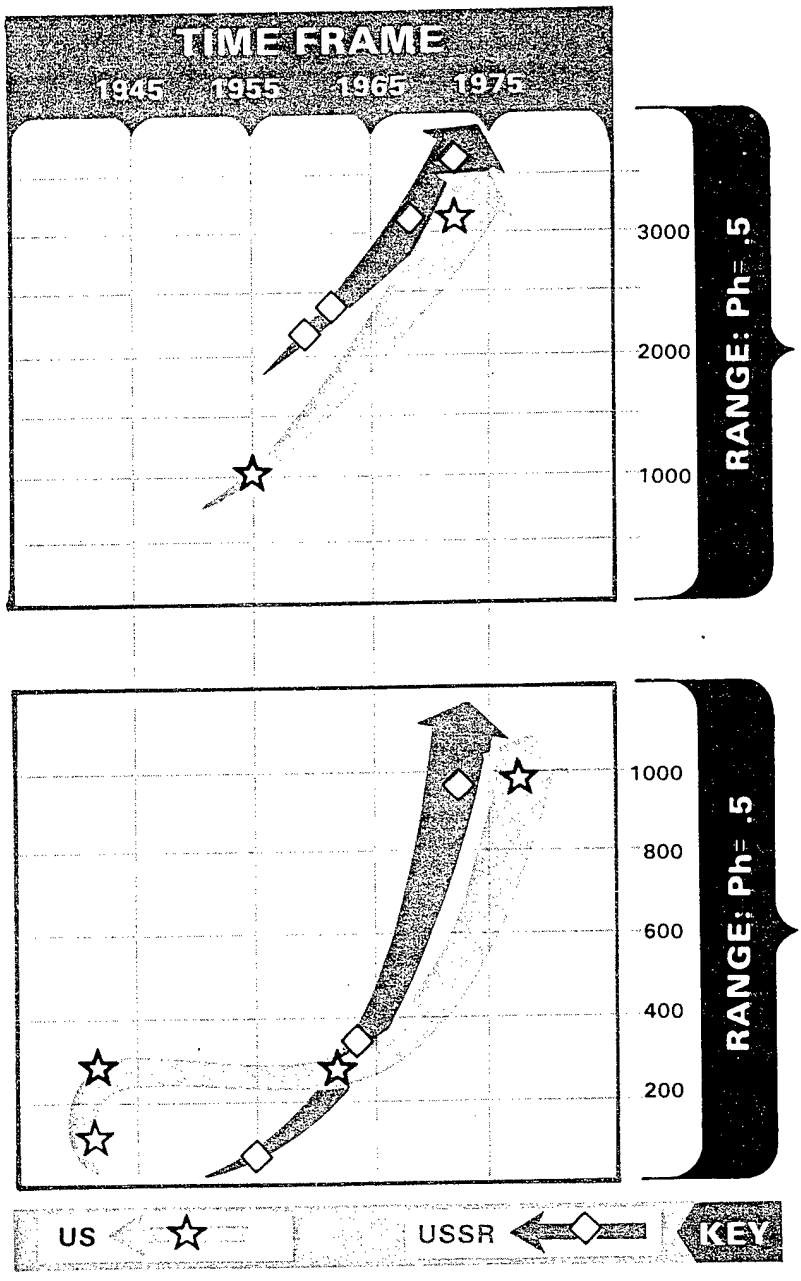


PENETRATION VS. ARMOR THICKNESS

Increases in armor penetrating capability kept pace with the increases in range and accuracy. This chart shows the trend in penetrating power of US weapons compared with the growth in the maximum thickness of armor of the Warsaw Pact tanks.



Other nations, notably the USSR, have progressively fielded infantry weapons of comparable range and accuracy and hitting power. Additionally, both the US and the USSR have improved shorter range weapons, so as to achieve high accuracy with light, man-packed, hand-held weapons within a range of 1,000 meters.



Ph* FOR CREW-SERVED WEAPONS

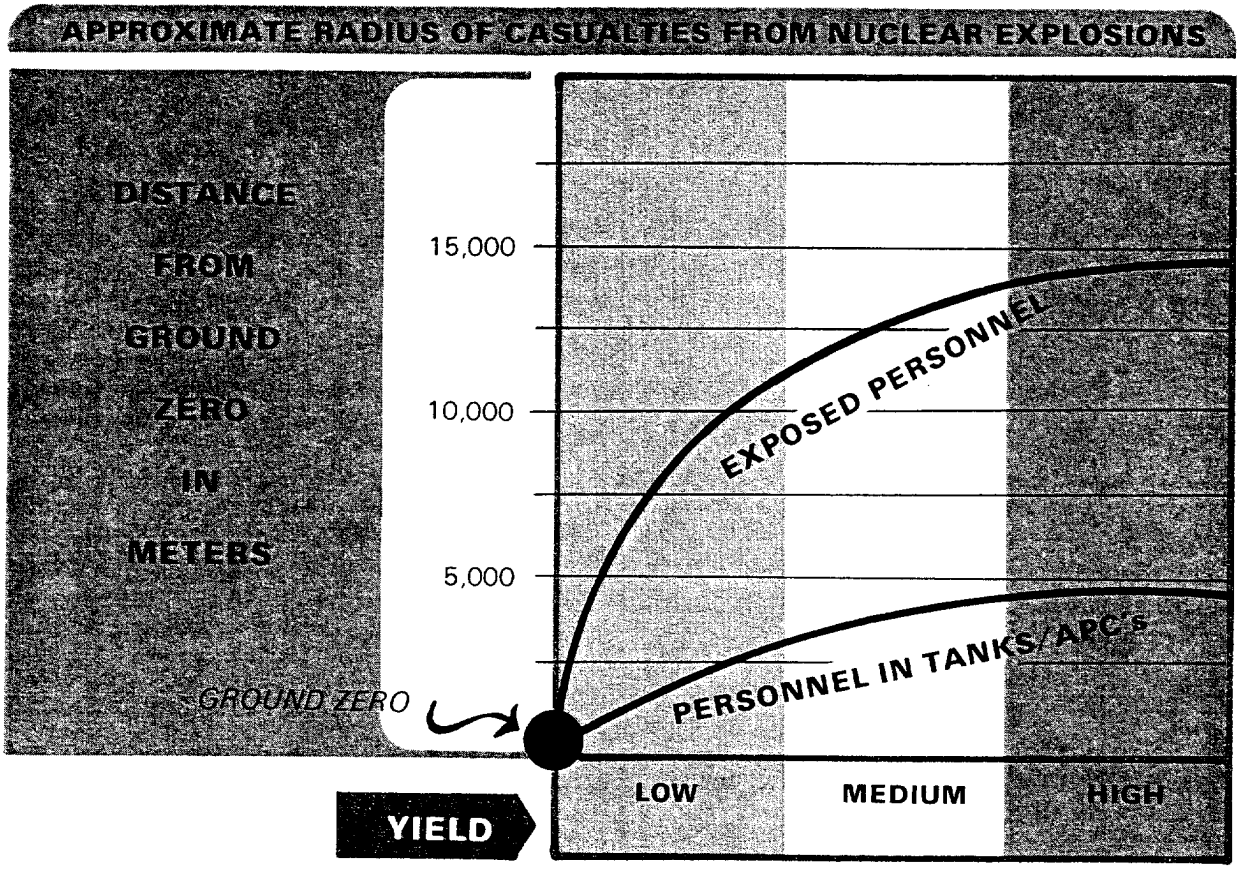
US and USSR crew-served infantry antitank weapons have tripled their range in less than 20 years.

Ph* FOR INDIVIDUAL WEAPONS

US and USSR individual antitank weapons have increased their ranges by four times in the past decade.

**Probability of hit*

Mobility. By the end of WW II, most armies had concluded that armored vehicles for carrying infantry into battle had limited utility on the battlefield. The Soviet Army, for example, taught that when infantry was required for the support of tanks, the infantry should ride the tanks to the assault position, and then fight on foot through the objective. However, as the tank increased its mobility — its operating range, its agility, its ability to cross soft ground — the inability of infantry on foot (or even in trucks) to keep up with tanks, began to inhibit exploitation of the full combat power of the tank. Moreover, as armies considered the use of nuclear weapons on the battlefield, it became apparent that infantry on foot or in trucks were much more vulnerable than those in armored vehicles.



Additionally, advances in conventional artillery munitions, particularly those which cause casualties among unprotected personnel from air-burst weapons, indicated a need for overhead armor protection for advancing infantry. In the '50's, a pronounced trend developed toward "mechanization" -- armored vehicles especially designed for carrying infantry. After some experimentation with full-tracked, fully-enclosed troop carriers pooled at division level for the purpose of providing armored mobility to infantry units as required, the major armies made such vehicles organic to the infantry squad or section.

By the early '70's, these vehicles were equipped with both the new antitank guided missiles, and large automatic weapons capable of suppressing enemy infantry at ranges of 1,000 meters and beyond. Doctrinally, emphasis shifted from armored vehicles for taxiing troops into battle, to an

infantry combat vehicle which fights as part of the mechanized infantry squad throughout its operations.

MECHANIZATION OF INFANTRY

By the mid-'70's, one out of every two infantrymen in the US Army active forces was a member of an armored personnel carrier mounted force.

● ● ●

In Soviet-equipped forces, armored personnel carriers were 37 times more numerous than in the 1945 Red Army.

Mechanization provides infantry units advantages in tactical mobility over foot or truck-borne units. But the greatest advances in infantry mobility have been brought about by the introduction into combat of the helicopter. As the helicopter has advanced in speed, operating range, air-worthiness, and maintainability, it has emerged as a fully capable member of the combined arms team.

GREATEST ADVANCES IN INFANTRY MOBILITY DUE TO COMBAT USE OF THE HELICOPTER

The US Army, which has had more experience with helicopters in battle than any other army in the world, has exploited the helicopter in its organizations, weapons system design, tactics and techniques. Provided helicopters, the infantry commander on the modern battlefield possesses tactical flexibility, command means, and logistics markedly better than those at the disposal of his predecessors in WW II or Korea.

HELICOPTER IMPACT

INFANTRY SQUAD	TIME TO COVER 30 Km	DISTANCE COVERED IN 1 HOUR
WALKING	5 HOURS	6 Km
APC	2 HOURS	15 Km
AIRMOBILE	15 MINUTES	120 Km

Today heliborne infantry can move about the battlefield 20 times as fast as foot-mobile troops, and 8 times as fast as mechanized forces.

Night Vision. Thirty years ago, the most advanced aids to infantry vision at night were **infrared** detectors which required an infrared light source to illuminate the target area. Such devices were employed for pointing infantry weapons (and for driving at night as an aid to mobility), but their range was limited. They also suffered the disadvantage that an enemy equipped with infrared detectors could see the light source.

In the mid-'60's, **image intensifiers** became available which operated with existing light--starlight, moonlight, sky glow from cities, or battlefield fires. The first of these devices in the US Army, packaged as a telescope for aiming a rifle, weighed only 20 per cent as much as the earlier infrared device. At about the same time, the US Army fielded larger crew-served weapon sights using image intensifiers with capabilities of 1200 meters under starlight, and 2,000 meters under moonlight. And for the same weight, this device had over 4 times the range of earlier infrared equipment.

Image intensifiers are completely passive; that is, *it is impossible for the enemy to detect them in use.* By the mid-'70's, this technology had led to small, night vision aids permitting an infantryman or a helicopter pilot to see effectively at night.

Also emerging in the mid-'70's were **thermal sights,** entirely passive like the image intensifiers, but which detect heat radiation and construct images based thereon. These sights are particularly useful in penetrating atmospheric haze, fog, snow or rain clutters, light foliage, and camouflage. These devices are small, relatively lightweight, and can be used at night or in daylight.

Flexibility. Of all combatants in modern battle, infantry is the least protected, the most vulnerable. Nonetheless, during the past decades, infantrymen have developed battlefield techniques and tactics enabling them to survive against the most lethal conventional weapons and to continue as a versatile component of the combined arms team. In fact, in places where armored or mechanized forces cannot maneuver freely (sections of swamps, mountains, jungles, or cities), infantry maintains the central role.

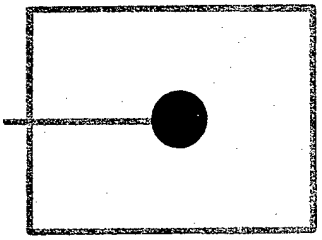
Most countries have armed their infantrymen with automatic weapons, as well as other lighter, more lethal weapons. In the '70's, the US infantryman can carry his equipment, rations, rifle and ammunition plus he may carry items unavailable to his WW II predecessor — a command-detonated antipersonnel mine (CLAYMORE), two to three light antitank weapons (LAW) and an armored vest.

The infantryman of air assault, airborne, or infantry type divisions fights afoot, but, in some cases, *his mobility can be greater than that of his mechanized counterpart.* Strategically, he is easier to deploy. On the battlefield, he and his weapons can be moved about by helicopter. He can often achieve surprise more readily than armored task forces, and more quickly develop critical mass. Dug in, he is difficult to dislodge. He can ambush advancing armor, seize and hold key terrain, block against a breakthrough, and slow and canalize a penetration.

The mechanized infantryman can fight from his armored carrier while maneuvering across the battlefield, adding his suppressive fires and observation to armored task forces. When tanks cannot advance because of reduced visibility, he takes the lead. He can, by fire and movement, eliminate antitank gunners concealed in woods or buildings, breach minefields, and employ stealth or airmobility to seize key terrain.

WHERE ARMORED OR MECHANIZED FORCES CANNOT MANEUVER FREELY, INFANTRY MAINTAINS THE CENTRAL ROLE

TRENDS: FIELD ARTILLERY



ARTILLERY CAUSED MORE THAN HALF OF THE CASUALTIES DURING WORLD WAR II

During WW II, the necessity for massed and sustained firepower closely integrated with large and mobile maneuver forces accelerated artillery developments. Artillery emerged as the greatest casualty producer of that war, causing more than half of the casualties sustained by all armies. Modern artillery weapons and munitions and techniques for their employment have significantly improved in the last thirty years, and all major armies hold substantial artillery inventories. And almost all of the smaller nations have been provided modern artillery weapons by the larger world powers.

SOVIET ARTILLERY DENSITIES IN DIVISION ZONES OF ATTACK

YEAR	BATTLE AREA	ATTACK ZONE IN KILOMETERS	TOTAL GUNS IN ZONE	GUNS PER KILOMETER
1941	MOSCOW	10	30	3
1942	STALINGRAD	2	340	170
1943	KURSK	2	460	230
1945	VISTULA-ODER	2	500	250

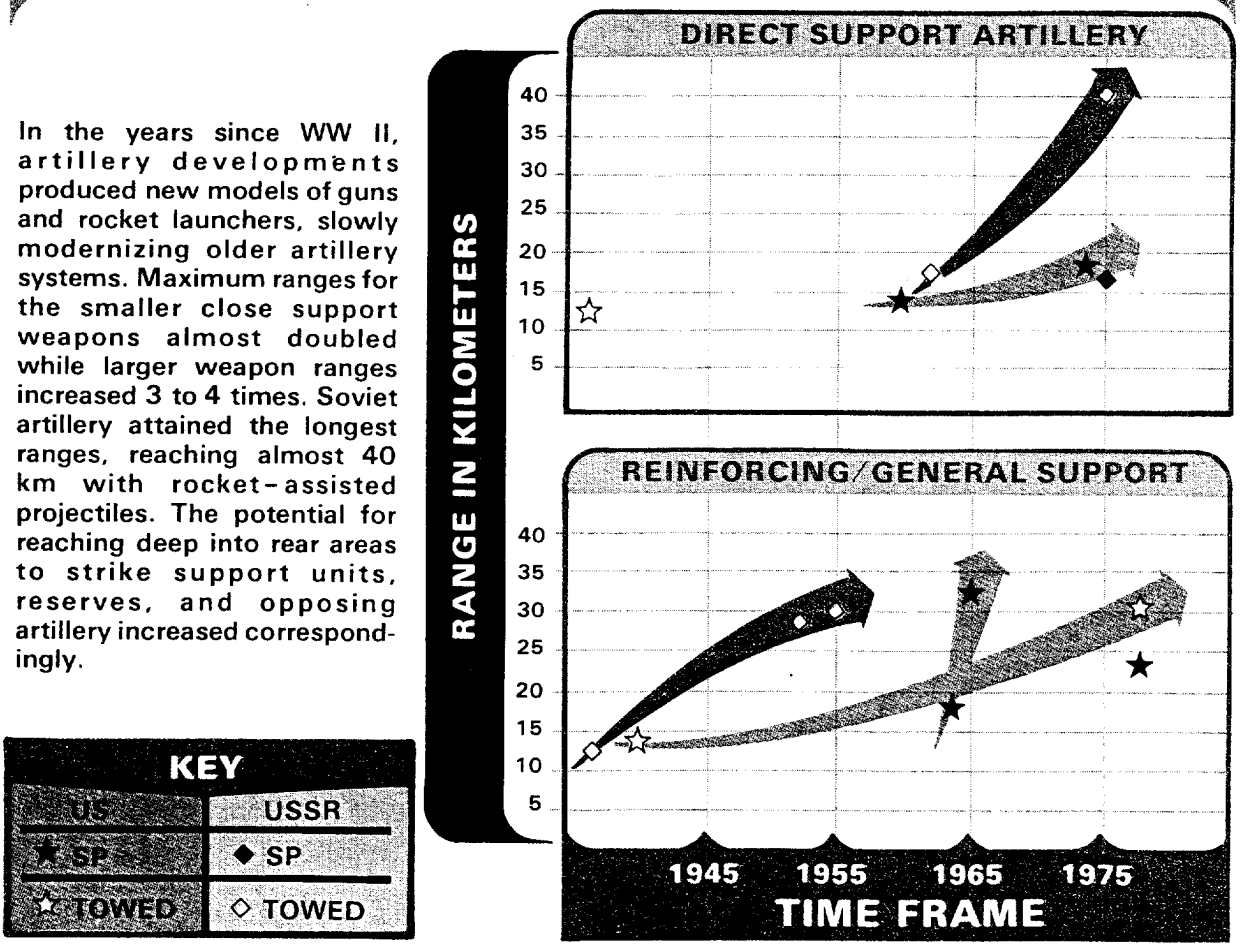
In WW II, the Soviets relied increasingly on massive concentrations of towed artillery of simple and rugged design, backed by rocket launchers, equally simple and inexpensive to produce. As the Soviets developed their breakthrough offensive tactics, they began to increase their artillery in support of breakthrough areas.

Soviet doctrine continued to stress offensive breakthrough tactics into the '70's, requiring artillery densities of 70-100 tubes per kilometer in support of the leading maneuver forces. Client nations of the Soviets have adopted similar techniques, as evidenced in the 1973 Middle-East War. There, under Soviet tutelage, the Syrians fielded 1200 artillery cannon and the Egyptians massed 2000 tubes to support their Suez crossing. To put these figures into perspective, *US artillery in Europe at that time numbered less than 500 tubes.*

US techniques for concentrating artillery during WW II relied on sophisticated fire control procedures to mass the fires of separated units onto a single target area. With these techniques and improved radio communications, one forward observer could request and receive the fires of all of the artillery battalions operating within the corps and in range of the target. Time on target (TOT) surprise fire techniques produced high shock effect among unprepared and exposed infantry. Responsiveness and lethality were significantly increased in 1943 with the introduction of the variable time (VT) fuze. And US artillery increasingly emphasized self-propelled weapons to maintain the fast tempo of mobile warfare. These developments were further refined following WW II and remain significant elements of US artillery doctrine.

MAJOR TRENDS IN RANGE AND MOBILITY OF CANNON ARTILLERY

In the years since WW II, artillery developments produced new models of guns and rocket launchers, slowly modernizing older artillery systems. Maximum ranges for the smaller close support weapons almost doubled while larger weapon ranges increased 3 to 4 times. Soviet artillery attained the longest ranges, reaching almost 40 km with rocket-assisted projectiles. The potential for reaching deep into rear areas to strike support units, reserves, and opposing artillery increased correspondingly.



The Soviets continued to produce large quantities of towed artillery cannon and rocket launchers to support their offensive tactics and in the '70's maintained the largest inventory of artillery weapons held by the major powers.

Artillery Munitions. Since 1945, new explosives and munitions have greatly increased the fire power equivalency per shell. Improved conventional munitions, when compared to ordinary high explosive rounds, provide up to 4 times the amount of casualty effect against personnel targets. Projectiles with time delay sub-munitions extend the suppression capability of a single round over a considerable period of time after impact, and small scatterable antitank mines can be employed by indirect artillery fire. The US, unlike the Soviets, continued to use VT fuzes extensively.

In the mid-'70's, US artillery made revolutionary advances in lethality, adding a point destruction capability to its traditional role of suppression. *Precision guided projectiles fired from standard cannon can kill single tanks with a very high probability of first round success.* These projectiles are terminally guided to either a moving or stationary target by a forward observer illuminating the target with a laser designator. Multiple targets can be hit in quick succession.

Mobility. Improvements in artillery ground mobility, particularly in Western armies, increased the capability of artillery to keep pace with the increasing tempo of modern mechanized warfare. Artillery in US armored and mechanized divisions is entirely self-propelled, enabling it to move with fast armored thrusts, or displace laterally to concentrate fires quickly in a threatened defensive sector. The Soviets, in contrast, support their mechanized forces with extensive numbers of towed cannon and motorized rocket launchers. In the early '70's, the Soviets recognized the mobility limitations of towed artillery to support their doctrine of fast and deep offensive operations, and began to increase their inventories of self-propelled guns.

ARTILLERY IN US ARMORED AND MECHANIZED DIVISIONS IS ENTIRELY SELF-PROPELLED

By the '60's, newly developed air mobility techniques allowed US artillery to operate with the combined arms team in areas where few roads existed, or the terrain otherwise denied rapid ground movement. Forty to fifty percent reductions in cannon weights, coupled with improved air transport capabilities, reduced long distance deployment times from weeks to hours. In a strategic deployment, medium and light artillery can now be airlanded on unimproved runways, and light towed artillery pieces can be dropped by parachute with a maneuver force.

Fire Control and Coordination. Since WW II, advances in fire direction, observation, and coordination have similarly added to the responsiveness, flexibility, and accuracy of modern artillery firepower. In the '60's, small tactical fire direction computers in US battalions and batteries reduced response times and eased the massing of surprise fires and the transfer to new targets. In the '70's, **laser range finders** used by US forward observers reduced initial target range estimation errors from 400 meters, common to earlier map and binocular methods, down to as close as 10 meters. Since FO range estimation is key to fast and accurate adjusted fire, laser ranging produces significant increases in first round effect.

RESPONSE TIMES TO PROVIDE SUPPRESSIVE FIRE WERE REDUCED FROM MINUTES TO SECONDS

Also in the '70's, the US devised new tactics to improve responsiveness. Response times to provide suppressive fire against ATGMs or other infantry weapons were reduced from minutes to seconds by streamlining fire control procedures in the FDCs and at the guns, and by dedicating batteries to maneuver companies moving to contact.

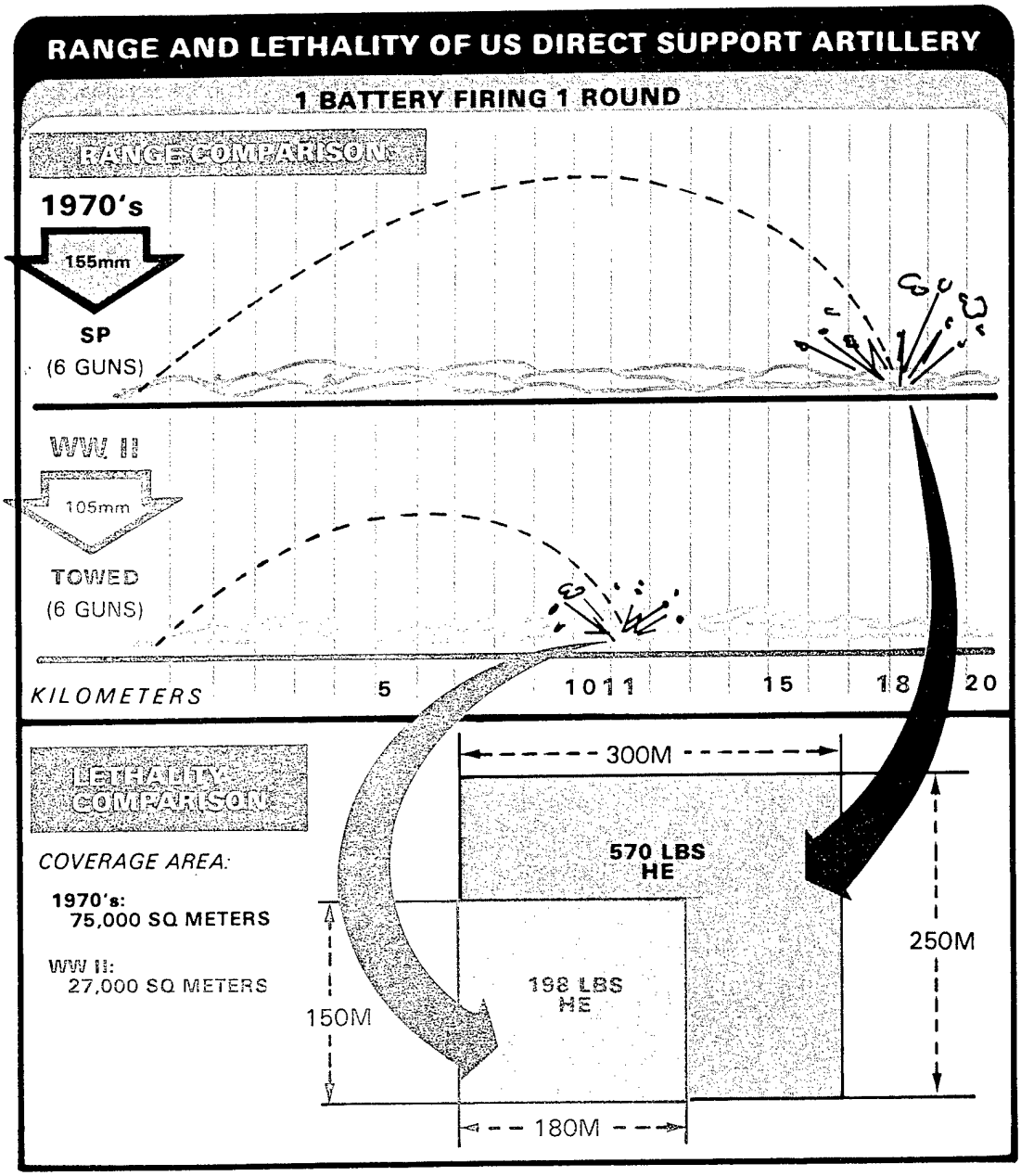
Soviet artillery continued to rely on older and slower fire direction techniques and coordination procedures. Fire planning and coordination was centralized at very high levels, reducing responsiveness to the maneuver units, but providing very effective massed firepower in support of breakthrough operations. US fire planning techniques were more decentralized and adaptable to rapid and unexpected changes during the course of a battle.

INTRODUCTION OF THE TACF SYSTEM WILL PROVIDE FURTH INCREASES IN RESPONSIVENESS TO MANEUVER FORCES

Automated fire control systems, like TACFIRE, began to play an increased role in artillery gunnery, planning, and coordination. The TACFIRE system improves US artillery support to the maneuver forces significantly. TACFIRE automates most of the procedures which were previously accomplished manually, and provides greater accuracy, reduces firing data computation times, and speeds the flow of intelligence, survey, and metrological data.

Artillery Suppression. Increased ranges, improved firepower, and better fire control underscore the importance of artillery as a prime suppressive weapon against opposing infantry weapons, tanks, artillery, and air defense artillery. Artillery suppresses antitank guided missiles, such as SAGGER, beyond the range of infantry small arms or tank cannon by using high explosives to drive the gunners from their sights or smoke to block or obscure their vision. Smoke munitions can also block the vision of attacking tanks; HE fired at tanks causes them to button-up; reducing the crews' effectiveness by as much as 50 percent. Artillery can now reach farther to suppress air defense weapons. Artillery improvements joined with better locating systems also increase the potential of modern artillery to counter opposing indirect fire weapons, particularly those that shoot indiscriminately or do not take measures to avoid detection.

Direct Support Fires. Weapon calibers, overall, changed little since WW II, but larger weapons introduced at the direct support level in US armored and mechanized divisions moved the lethal reach of the maneuver commander beyond that of his WW II, or Korean War counterpart. Firepower immediately responsive to the maneuver battalion has doubled in lethality, while range has increased almost 60 percent.



DIRECT SUPPORT WEAPONS

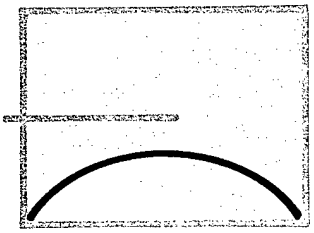
Soviet equipped armies use smaller caliber direct support weapons, but they have higher rates of fire, and are available in greater numbers.

UNIT	AMT	WEAPON
US BRIGADE	18	155mm SP
USSR BATTALION	18+	122mm TOWED

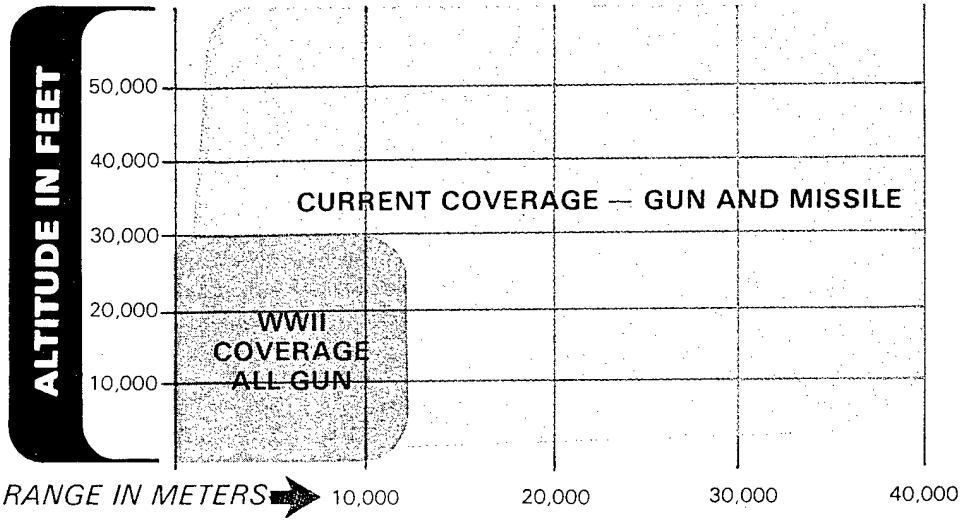
A Soviet battallion leading a division breakthrough attack can have up to two battalions in direct support, backed by additional artillery from higher echelons. A US brigade is provided a direct support artillery battalion, but can also call on the fires of several reinforcing battalions.

Overall, the increased numbers and capabilities of artillery weapons in all armies indicate that, when compared to past conflicts, the modern battlefield will be greatly expanded in size, lethality, and complexity.

TRENDS: AIR DEFENSE ARTILLERY



Since World War II, the range, accuracy, and lethality of air defense weapons have increased dramatically. The antiaircraft weapons of 1945 were guns, some radar controlled, but all limited in range to about 10 km. In contrast, today an air defense complex in a forward divisional area is made up of gun and missile systems covering the battle area forward and behind the area of contact for as much as 40 kilometers *(an increase of 36 times as much volume of air space controlled)*. Moreover, these weapons are mobile, capable of moving with maneuver units, and providing a continuous air defense umbrella.

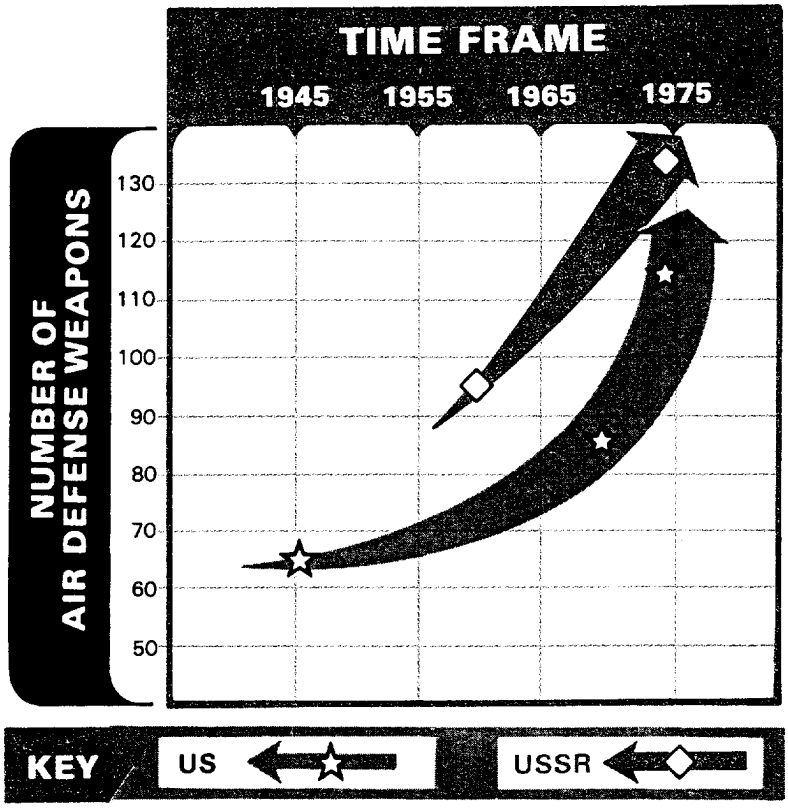


Modern air defense artillery weapons are controlled by automatic guidance systems, plus improved radar and optical sights. Probabilities of hit have increased greatly. Modern divisional gun weapons are commonly automatic cannon (aided by radar), some capable of firing from 40 to 60 rounds in a single one-second burst. Surface-to-air missile systems are highly accurate and reliable, combat-proven. These systems present a formidable problem for attacking aircraft since most ride a designating beam, home-in on the aircraft's heat, or otherwise sense and react to the target.

MODERN SURFACE-TO-AIR MISSILE SYSTEMS ARE HIGHLY ACCURATE, RELIABLE, AND COMBAT-PROVEN

Perhaps the most striking air defense development is the implanting of sophisticated weapons in maneuver units. In all advanced armies, infantry, armor, and artillery units are equipped with weapons which can knock jet aircraft out of the sky. Therefore, besides the air defense artillery weapons and a multitude of direct fire weapons in maneuver units, attacking air forces must contend with soldier-operated, surface-to-air missile systems. Weapons such as the US Redeye and the Soviet SA-7 are relatively simple to use and, although small and light, have high hit probabilities against low-flying, high-performance aircraft or helicopters.

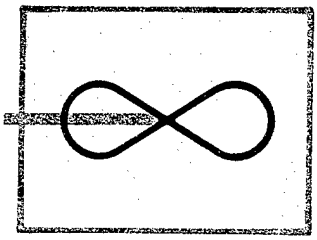
The addition of such weapons to maneuver units is one dimension of the proliferation of modern air defenses.



In 1945, a US division typically had 64 air defense weapons, all inaccurate and short range. In the mid-'70's, the number of weapons with marked advances in accuracy and range, had increased to 113; Soviet-equipped divisions include an even larger number.

Air defense is integral to the combined arms team. All means to prevent suppression of our air defense weapons and ways to suppress enemy weapons must be sought. ***No modern army can expect to win in battle unless its maneuver forces operate under a cohesive, extensive, and mobile umbrella of modern air defense.***

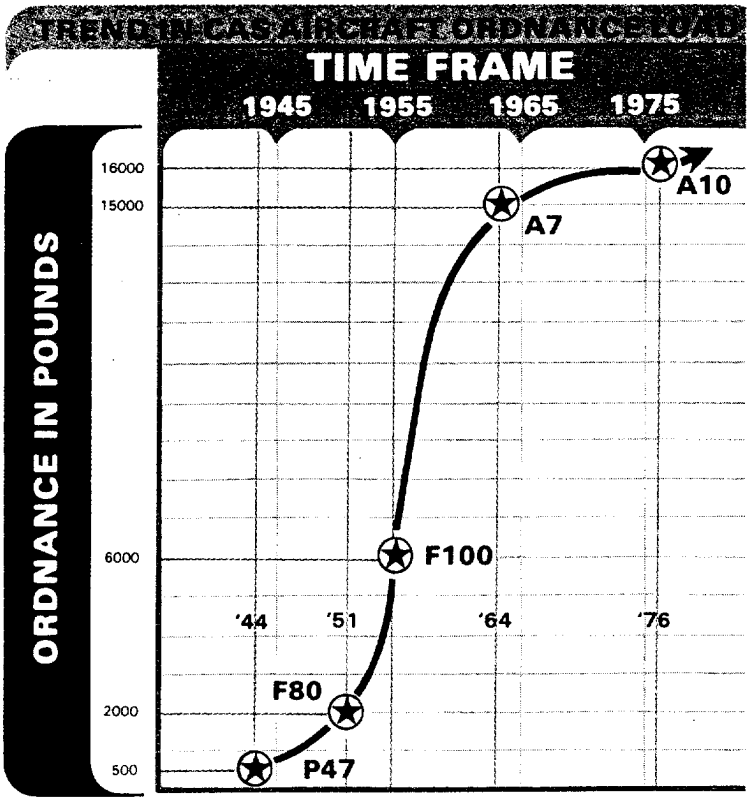
TRENDS: AIRPOWER



Close Air Support. During World War II, air superiority – defeat of the opposing air force – was the first mission for most high performance aircraft. Support missions were, more often that not, flown against convoys, trains, and other targets of opportunity in the enemy rear area. Close air support was regarded a novelty, and doctrine and procedures for coordinating ground and air operations were relatively crude. Maneuver units had to consider close air support as a supplement to their operations rather than as a component of the combined arms team. If they could get air support, they might use it, but they had to prepare to do without. Close air support really meant attacking targets to the immediate front of ground forces, yet control between ground and air attackers was minimal.

Experience of three decades has changed the concept and practice of close air support. In some advanced forces, including those of the US, aircraft are dedicated to the support of the maneuver arms in recognition of the fact that the battlefield will provide an abundance of targets that can be destroyed by close air support. ***Tactical air is in some armies an integral part of the combined arms team.***

US tactical aircraft are far more powerful than those of 1945. The USAAF P47 of WW II, for instance, could fly 100 miles to a target, stay for less than half an hour, deliver 20-mm cannon fire and two 250 pound bombs, and return to its air base. Today, the USAF A10 carries 30 times as much ordnance--about 16,000 pounds of cannon ammunition, bombs or missiles. The A10 can fly to a target 250 miles from home base, monitor the target area for as much as 2 hours, deliver its ordnance, and return. In addition, the ordnance itself is far more lethal. The GAU-8 Gatling gun in the A10, for example, fires a 1.5 pound projectile capable of destroying tanks, armored personnel carriers, and other armored targets. The GAU-8 is 7 times more lethal than conventional 20-mm guns, and for the first time combines the accuracy and flexibility of a gun with a true tank-killing capability.

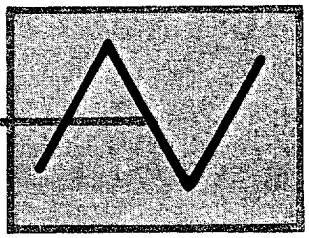


But the main ordnance of modern attac aircraft is guided bombs and missiles. Thes weapons have caused an exponentia improvement in single-shot kill probability. "Smart" bombs, those with electron steering, and guided missiles, such as th Maverick, can achieve high probability of h and kill. Operational tests and experien from the 1973 Middle East War clear demonstrated the effectiveness of attac fighters against tanks. Moreover, bot guided missiles and "smart" bombs provic stand-off capabilities which combine the greatly increased accuracy with sharpl reduced exposure of the attacker to opposin air defenses.

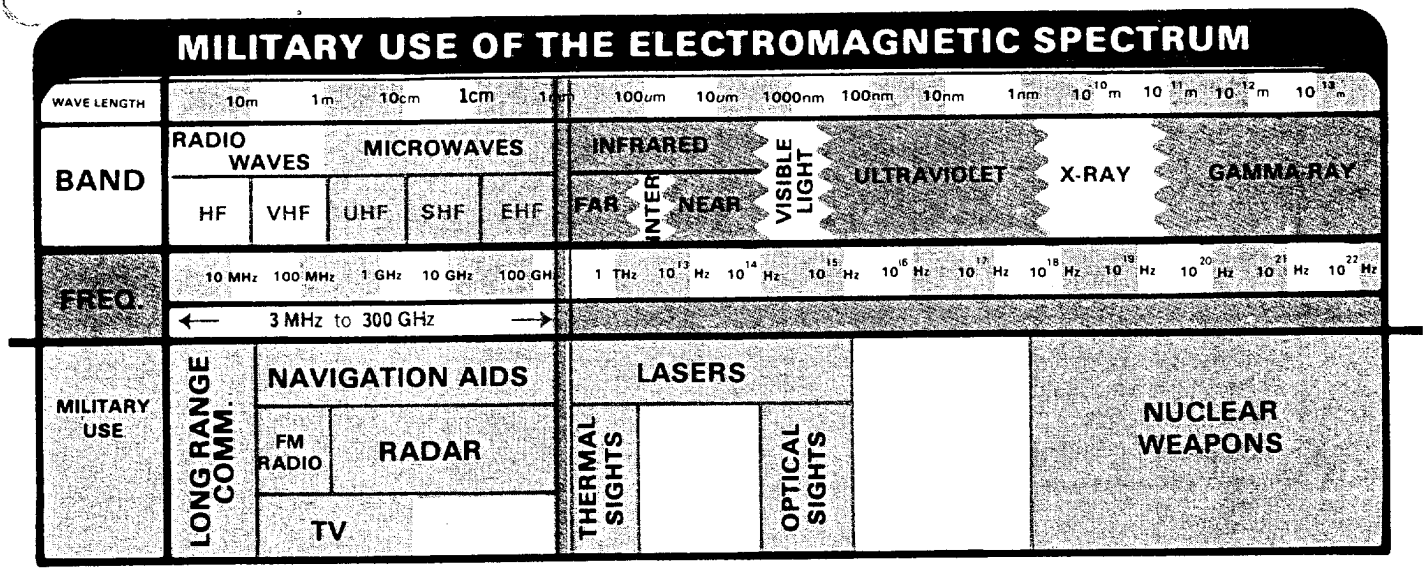
MODERN AIRCRAFT ARE CONSIDERED COMPONENTS OF THE COMBINED ARMS TEAM

Modern tactical aircraft with improve ordnance are now considered components the combined arms team. In addition to clos support missions for ground units, th aircraft of today permit rapid development destructive force beyond the immedia battlefield to deep-lying targets.

TRENDS: WAR IN THE ELECTROMAGNETIC SPECTRUM



In the mid-'70's, there are very few weapons systems or military organizations which do not depend to an extent upon some portion of the electromagnetic spectrum. Today's armies must prepare to meet the opportunities and challenges posed by this invisible dimension of warfare. The following diagram illustrates how extensively the military uses the spectrum:



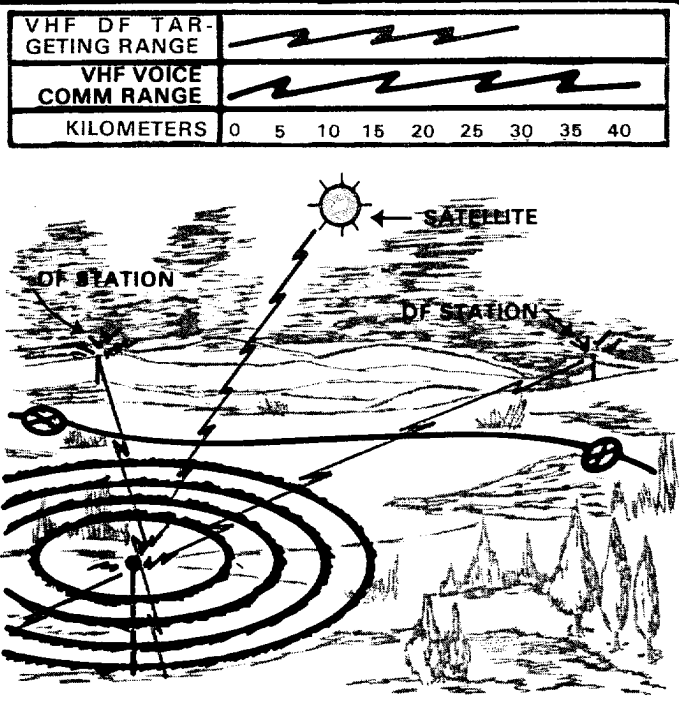
Attempts to use or deny the use of the electromagnetic environment have added new dimensions to warfare. On this invisible battlefield, a crucial struggle for command and control will be waged. *Electronic warfare can suppress or deceive weapons systems.* Countermeasures will be met by countermeasures, and battles may be won or lost by action in this medium. The lessons of World War II, and every military action since, stress that combat power is useless unless it can be brought to bear quickly--at the right point, and at the right time.

EXPECT INTERFERENCE, INTERCEPTION, AND JAMMING OF COMMUNICATIONS

Communications are key to command and control, and the US Army acquired great strength over the past three decades through improved communications. One analysis of modern battle predicts more than 500 US FM nets will operate in a US corps area. There will be nearly the same number of enemy nets, all using the same group of wave lengths. The congestion indicates that even if neither side tries to interfere with the other, there may be few clear channels for commanders. Whether there is unintentional interference or not, however, we can expect interception and deliberate jamming.

THE DIRECTION FINDING THREAT

All modern armies possess powerful transmitters for deliberate jamming or blocking parts of the spectrum. Moreover, all have equipment for locating an emitter. Using the principle called direction finding (DF), it is possible to pinpoint a radar emitter within 50 meters and a VHF communications emitter within a CEP of 1 km. Effective DF target-acquisition range tends to be less than US VHF radio communications ranges, but all radios operated within a US forward brigade area are vulnerable to DF. If there is an unobstructed line-of-sight between the DF station and any radio in the brigade area, that radio can be heard by the intercept station and located -- "fixed." Now satellites can be used to locate both heat and emitters. If it can be fixed, it can be attacked.



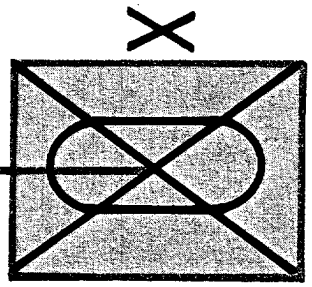
The Middle-East War of 1973, in a very real sense, brought out the need for control of the electromagnetic spectrum. Both sides were well equipped and both used electronic measures and countermeasures in conjunction with other combat power. For example, suppression of air defenses featured concerted DF, extensive electronic jamming, and use of homing missiles to eliminate the radar systems which controlled opposing surface-to-air missiles. Electronic sensing devices, radar and infrared were used to locate ground forces, even foot patrols, and to take them under fire. Tank attacks were met with barrages of radio jamming designed to block effective use of tactical radios for coordinating movement and command and control.

TANK ATTACKS MET WITH BARRAGES OF RADIO JAMMING

Any combatant whose controls are exposed to his enemy, or who is denied use of means to convey orders, provide for fire support, or arrange for logistics and administration, is prone to defeat, whatever his strength in numbers of weapons.

The US Army will face new challenges in the battle for the electromagnetic spectrum. We must use for our benefit all advances in electronic technology -- suppression of enemy weapons systems, intelligence gathering, and target detection. And we must be able to cope with or counter the enemy's attempts to use the spectrum against us.

TREND: BATTLE CONCEPT



Tactical Mobility. Since World War II, all armed forces have pursued heightened mobility through advanced technology and organizational forms adapted to new means of moving, shooting, and communicating. By the mid-'70's, there was a pronounced organizational trend toward increasing the percentage of armored and mechanized troops in Soviet-equipped ground forces. Airmobility was also being stressed, although less prominently than in US doctrine.

US organizational trends since 1945 have evidenced an army striving to increase tactical mobility. While the percentage of armored or mechanized forces has risen in the US Army, the most dramatic organizational advance has been the adoption of the "airmobile" concept. With combat experience in Southeast Asia, *the US Army is the world's foremost exponent of airmobility.* By the mid-'70's, the US had fielded organizations designed to move infantry and artillery about the battlefield rapidly by helicopter, plus air cavalry and attack helicopter forces. The US, almost uniquely, regarded air cavalry as important for reconnaissance and economy of force, a way for a commander to exert influence over large areas. Attack helicopter units provided a ground commander an aerial antitank force with a mobility differential 10 to 20 times greater than armored reserves.

THE "AIRMOBILE" CONCEPT IS THE MOST DRAMATIC ORGANIZATIONAL ADVANCE IN THE US ARMY

Strategic Mobility. **A nation's ability to project combat forces rapidly to any place in the world may shape its national power. Since future conflicts are likely to be short and violent, the need for a swift build-up of combat units is greater than ever before.**

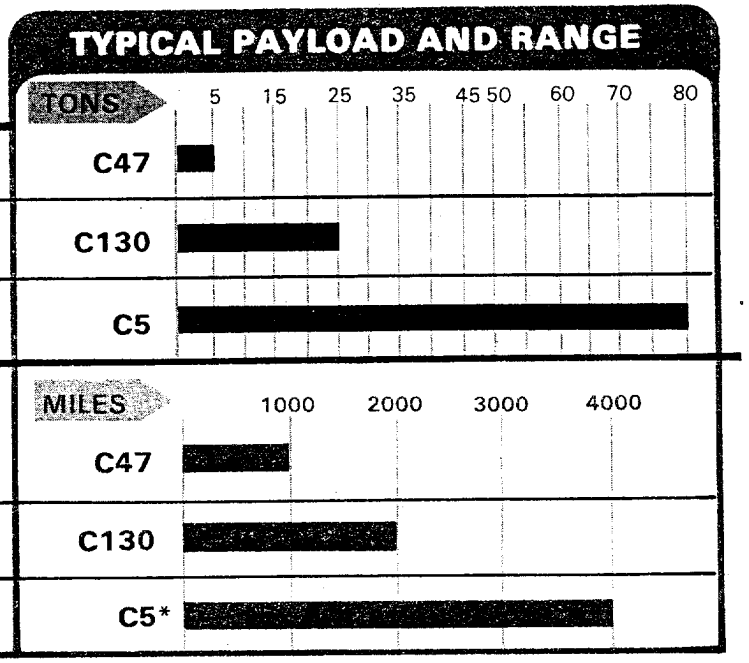
Forces must not only be trained for immediate commitment to battle, but they must be provided the means to transport them to the scene of the conflict.

Sealift has long been the traditional means for projecting US combat power abroad. And it remains today the backbone of strategic mobility. Without it, very large forces cannot be deployed or continuously resupplied. The advent of modern roll on/roll off shipping and containerization has significantly reduced the time required to deploy large forces. The US Navy, responsible for keeping the sea lanes open, and American and allied shipping can provide US land forces significant capabilities to operate overseas.

The most dramatic increase, however, in strategic mobility for US land forces has come about via airlift.

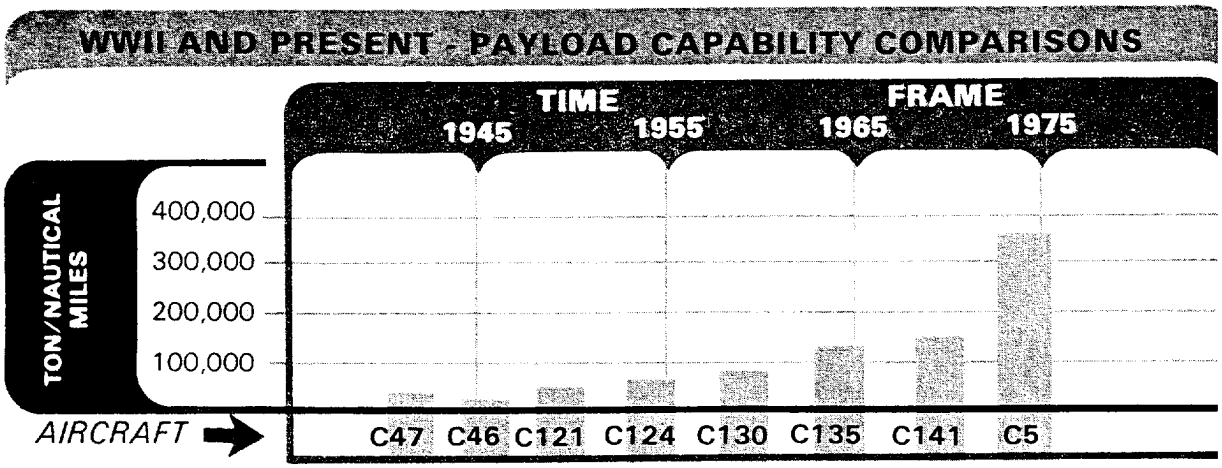
Aircraft designed for inter-theater airlift have a 13-fold increase in payload and a 6-fold increase in capacity over their WW II predecessors. With the C5A, tanks, APCs, artillery pieces, and helicopters can be airlanded overseas in hours. All in all, considering payload, range, and speed, the C5 is 100 times more productive than its World War II counterpart, the C47.

*SPEED MORE THAN 500 MPH — More than twice that of the C47.



The payload capability of the C5 has two particularly important implications. First, it means all combat equipment of a US Army division, including its tanks, can be airlifted. Second, because the C5 can lift relatively large loads of men and materiel at such high speed, combat moves of large units can be done on a significantly shorter time with fewer sorties than ever before.

In 1943, it took two weeks for the invasion force for North Africa to cross the Atlantic. In the mid-'70's, the US could move an armored brigade by air, with all of its heavy equipment, a comparable distance in a matter of days. Aircraft have become central to waging war of any kind, and have assumed roles once performed by transoceanic shipping, railroads, long-range artillery, and even tanks. Air power is crucial for fighting the land battle.



*The equivalent of carrying 1 ton the indicated number of miles; (or) 2 tons half the distance, etc. 300,000 ton nautical miles is equal to a payload of 300 tons carried 1,000 miles (or) 150 tons carried 2,000 miles (or) 75 tons carried 4,000 miles.

Tempo. Modern warfare is characterized by a higher tempo of operations, hence an increased importance on strategic and tactical timing. An attacker who, *by using surprise and mobility,* attains high rates of advance early, can overwhelm a defender before he can react. Any defender must wage an active defense, and seek to concentrate forces at the critical place and time, moving faster than the attacker.

Fifty years ago, a highly trained army division was considered capable of advancing only 2 to 4 km per day. In 1939, the German Army introduced the world to "lightning war," the *Blitzkrieg*. In France, after three days spent penetrating the thick Ardennes forest and closing up to the River Meuse, Guderian's XIX Corps covered 250 km to the English Channel in 8 days, averaging 30.5 km a day (its best drive in one day was 90 km). Rommel's 7th Panzer Division covered 177 km in 8 days at 22 km average per day. In Russia, German initial rates of advance were similar. Guderian's 2d Panzer Group covered 665 km in 24 days, averaging 28 km per day (its best advance in one day was 120 km).

The Soviet Army in WWII quickly learned the value of maintaining high rates of advance, and of driving for deep objectives. This table, taken from a mid-'70's Soviet source, shows the trend toward the greater depth of objectives assigned to Red Army divisions.

DEPTH OF DIVISION OBJECTIVES FOR THE SOVIET ARMY

PERIOD	DEPTH OF OBJECTIVES IN KILOMETERS		
	INITIAL OBJECTIVE	INTERMEDIATE OBJECTIVE	FINAL OBJECTIVE OF THE DAY
WORLD WAR I	.8 — 1.2	—	2 — 4
WORLD WAR II			
1941	1.5 — 2.5	—	3 — 4
1942	2 — 3	—	4 — 6
1943	2 — 4	—	5 — 7
1944	3 — 5	5 — 7	10 — 12
1945	3 — 5	6 — 8	18 — 20
CURRENT	**15 — 20**	—	**35 — 40**

As can be seen from the table, the Soviets perceive division objectives ten times deeper than they sought at the outset of World War II.

Soviet Army doctrine strongly holds that mobility and a high tempo of combat operations bring success in battle. They hold this to be especially true in nuclear warfare--*a high rate of advance reduces the danger of troop destruction by enemy nuclear strikes.* Forces opposing Soviet equipped and trained troops must expect intense, highly mobile combat. Battle will be fought on a scale and at a tempo rarely seen in all history.

The commander who seeks a greater understanding of a specific modern battlefield must first appreciate the potential of the world's first line armies. The leader on the modern battlefield must be an expert in weapons effects and employment-both his own and those of the enemy. War is becoming increasingly complex. Morale and motivation must be backed up in weapons and tactical proficiency.

This is the new and growing dimension of war.

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