

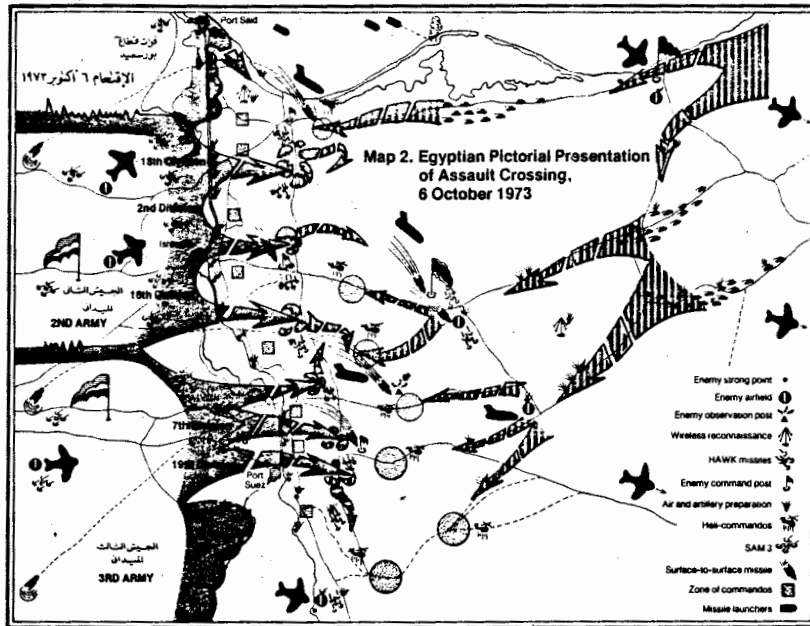
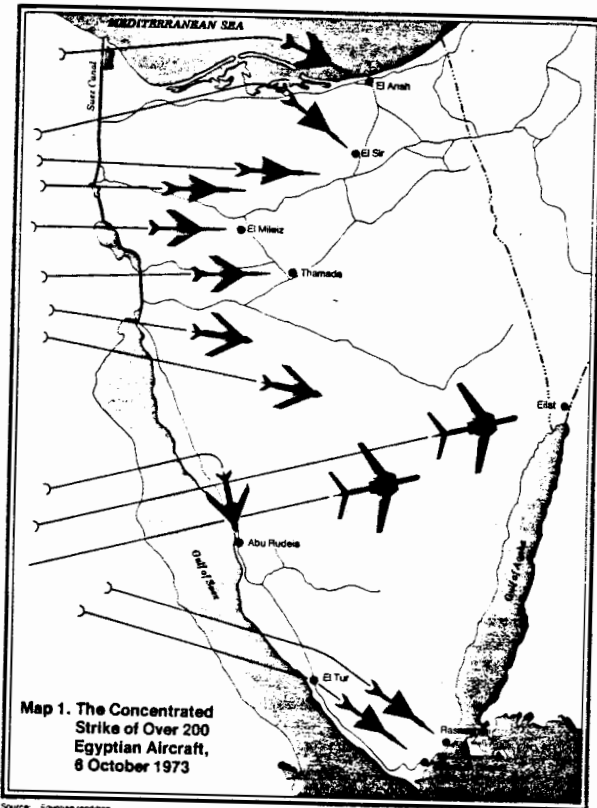
CHAPTER VI

AN ARMY IN TRANSITION

The status of new equipment for the U.S. Army as well as the status of foreign developments was the subject of numerous discussions between Joseph Smith, the Chief of the Weapons Systems Division, (conventional) of the Foreign Science and Technology Center and a former member of the Ordnance Technical Intelligence community. In quoting from his eulogy,

"Joe anguished over the fact that for the past 15 years we have been toying with the development of a main battle tank (the XM-1), which was to be a superior AFV, (Armored Fighting Vehicle). Only recently have serious trials between the Chrysler and GM entries taken place. Now that the Chrysler entry has been chosen, the trials will continue against the German entry and production will probably not commence until some time in late 1978, more likely 1979.

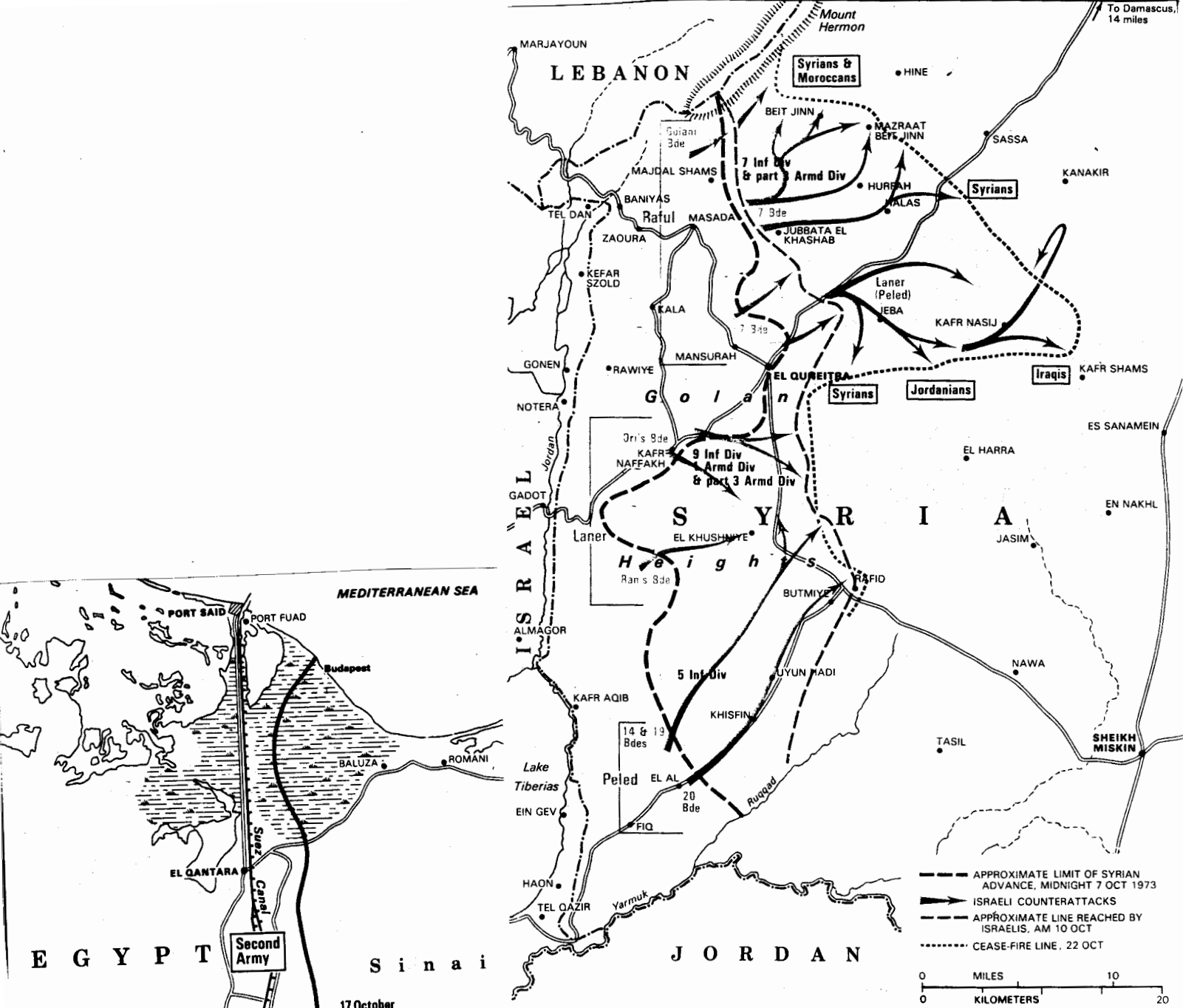
Delays can be traced to fragmented development and decision making in the ordnance system and reluctance in Congress. The legislators would not fund the MBT-70 (a main battle tank developed jointly in the late 1960's by the U.S. and West Germany) because it was too expensive - estimated at one million dollars each - yet today, many inflation years later, the German entry still has a price tag of approximately that figure. Why are we so late? Why have we accomplished so little? The answer to these questions will most likely never be forthcoming. Fault lies with many within both the Department of Defense and Congress. The tank controversy has been argued and hashed about in Congress and the Department of Defense far too long, and unless the officials responsible for a decision stop second-guessing themselves, we are guaranteed additional delays which will be tragic. The current hedge against opting for one vehicle or another is only further postponing a decision that should have been effected seven years ago. The sudden announcement in the Summer of 1976 requesting the contenders submit revised proposals if incorporating a new and bigger gun (120-mm. vs. the standard 105-mm.) and components of the West German contender, the Leopard II, created new obstacles in the path of the eventual adoption of something! How many more years are the men in the field to wait for superior equipment?



Assuming that a decision is ultimately made, one would expect that it would be relatively easy to begin production of a new tank, but a totally unexpected danger to projected tank production and a host of other crucial defense items has appeared; one that endangers our very ability to defend the nation and honor our commitments. This threat is the result of excessive safety and environmental regulations on the American foundries that produce cast iron and steel products for making armor plate and similar defense materials. These regulations have been imposed by the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA). Joe pointed out that the action on the part of well-intentioned but over-zealous environmental control and safety officials who have no comprehension of the industry and the capital expenditure required to install up-to-date control equipment had caused the closure of hundreds of foundries and related metals plants, which obviously affected the ability of this nation to produce all important defense-related hardware. At this point in time, EPA and OSHA appear to be thinking that if a foundry cannot meet all requirements, no matter how drastic and costly, they must be forced out of business. Little thought is given to the critical nature of these facilities of the thousands of skilled workmen who have lost their jobs. He said, "The demise of much of our metals industry has created havoc in the Defense Department and in actual fact, the EPA has gone far toward closing off our ability to defend the nation." In the immediate future, additional harsh and uncompromising new requirements proposed by OSHA and EPA could cripple even the giants in the industry.

The systematic elimination of many American Foundries became generally acknowledged after the 1973 October Arab/Israeli War when the U.S. gave away a large number of our tanks to Israel and was in need of increasing existing production to replenish our depleted inventories - especially from our all-important NATO reserve stocks. It was then realized that the U.S. lacked sufficient specialized foundries so vital to the manufacture of tank turrets.

Today it is now a well-published fact that the greatest industrial nation in the world has only one foundry that is capable of producing cast steel tank turrets. If hostilities should break-out in the near future and the U.S. attempts to increase tank production to 10,000 or more per year (during World War II, U.S. produced approximately 80,000 tanks) we would find it impossible with only one functioning facility available. Consider the implications of the following documented facts excerpted from an article which recently appeared



--- APPROXIMATE LIMIT OF SYRIAN ADVANCE, MIDNIGHT 7 OCT 1973
 → ISRAELI COUNTERATTACKS
 - · - APPROXIMATE LINE REACHED BY ISRAELIS, AM 10 OCT
 ····· CEASE-FIRE LINE, 22 OCT

——— ISRAELI FORTIFICATIONS
 ——— LIMIT OF EGYPTIAN ADVANCE, 14 OCT 1973
 → ISRAELI ATTACKS
 - · - CEASE-FIRE LINE, 22 OCT
 ····· " " " 24 OCT

in the publication National Defense: Approximately 400 foundries have closed since 1969. More than 40% closed as a result of unreasonably strict air standards and too costly employee protection equipment.

Joe talked of the detractors who argue the tank has lost its usefulness on the modern battlefield because the introduction of a multitude of new antitank devices (i.e., wire guided rockets, etc.) now in use. These critics cite the successful use of such antitank weapons in the Arab/Israeli War of 1973.

"This is talk from someone not in touch with reality. The tank will be indispensable until such time as antitank devices are developed and produced which will destroy tanks at ranges much beyond what is possible today (for example lasers). Those with combat experience know that it is very difficult, if not impossible, during a concentrated attack for infantry without armor support to effectively engage advancing armor when rocket, artillery, and heavy mortar fire is raining like hail on them. Soviet attack doctrine is based on mass use of artillery and rockets with conventional warheads for exactly this reason. The Soviets have a preponderance of artillery, rockets and mortars and it is basic to their strategy."

Long-range, high velocity tank cannon and long range anti-armor missile systems dominate the modern battlefield. It will remain a fact for some time to come that one of the best antitank weapons is another tank since it is the primary Armored Fighting Vehicle (AFV) that will survive rocket and artillery fire.

"The Israelis proved this in 1973. Currently they have doubled the number of tanks they had at the start of the 1973 October War and they are in the process of building their own design (which will be in service long before our own design). From experience they discovered the attrition rate on the modern battlefield is staggering and the ultimate winner, in most conflicts, will be the belligerent with the greatest staying power (i.e., most equipment!)"

Joe continued: "The disparity in first-class conventional equipment could tempt the Soviets to attack because they have the West outnumbered with first-class AFV four-to-one, and this ratio could jump to eight-to-one if a surprise attack was successfully launched which would obviously not permit all armor in NATO to be deployed."

We are reaching that point in a time when we are

BELOW: Captured Syrian Army T-62 tanks.



Long-range, high velocity tank cannon and long range anti-air missile system. The tank is a masterpiece of design. It will move fast in any terrain. The turret is of the cast steel type and is another tank since it is the primary armored fighting vehicle. (Left) turret is fully cocked and ready to fire.



MAJOR HOWARD OF 100TH MTC ON SOVIET T62 TANK

close to subjecting the West, particularly our NATO partners, to a form of modern coercion, more precisely put - blatant "conventional" blackmail. The East Bloc has more than the edge in conventional force and they know this situation is not even close to being equal. Even the most "dovish" of those in Congress must see it is imperative that we make this situation less unequal and recreate the balance.

"A successful rapid drive by Eastern Bloc forces to the Rhine or beyond in 48 hours could present the U.S. with a 'fait accompli'. As many doubt we are going to detonate nuclear devices among our own people - the haunting spectre of the Soviets capturing and holding hostage approximately 500,000 U.S. civilian and military personnel should be cause enough to force some in Congress to rethink their position concerning our posture in conventional weapons.

"In light of this distinct possibility, accelerated development, and support for the Army's new lightweight (6.8 lbs.) anti-tank weapon, the Viper, and several other advanced anti-armor systems under study, should be pushed beyond priority basis."

He said: "We have the technology to enable us to develop rapidly this most obvious requirement - extra emphasis should be generated to assure these new anti-tank weapons will be adopted, produced in quantity, and issued in the near future to the user. It would be reassuring if every GI in the field had one of these tank killers."

Very recently, Western intelligence established that Soviet tank commanders in the guise of laborers, on obvious reconnoiter missions, were driving Russian trucks to Holland, at the very heart of NATO, to pick up goods destined for the Soviet Union - the implication of this Soviet action should be clear to even the most naive in the West!

The "Viper" is the offspring of MICOM technology and knowhow in free flight rockets. It is compact and shoulder-fired from a throwaway case that serves as a launcher. "Viper" will weigh less than 3.2 kg. and will be substantially more powerful, accurate and effective than its predecessor, the M-72 LAW (Light Anti-Tank Weapon).

Joe hinted of new breakthroughs in both current weapons systems and some state-of-the-art weaponry by the U.S. and the Soviets - he would not elaborate because he was bound by the code not to divulge classified infor-

FOREIGN
MATERIEL
TRAINING



**OPERATOR'S
MANUAL**




★ T-62 MEDIUM
TANK ★

★ Prepared By: CO D 519 MI BN ★

WT 10-40-1

SELECTED SOVIET WEAPONS AND EQUIPMENT

VOLUME 1



THREAT REQUIREMENTS DIRECTOR
US ARMY ARMOR SCHOOL
FORT ENGL, KENTUCKY
AUGUST 1976

Technical Intelligence Bulletin

11TH MILITARY INTELLIGENCE BN. ABERDEEN PROVING GROUND, MD. 21005



TIB 4-1 (76)

SOVIET T-62 MAIN BATTLE TANK



ITEM DESCRIPTION. The Soviet T-62 tank is a full tracked, heavily armored, combat vehicle. Its weight of 40 tons classifies it as a medium tank. It is designed to meet the needs of the Soviet Armored Forces for a main battle tank. As a new model, it incorporates several new features; the most significant are the smoothbore main gun and the addition of an antiaircraft machinegun on the turret.

CAPABILITIES. The T-62 is operated by a crew of four and is powered by a 580 horsepower, water cooled, V-12 diesel engine. It has a maximum speed of 50 KMH and a range of 450 km. The main armament is a 115mm smoothbore gun that fires four types of fin-stabilized ammunition. An experienced crew can fire 3 rounds per minute. Tanks produced after 1970 mount a 12.7mm antiaircraft machinegun on the right side of the turret. On the right side of the main gun is a coaxial 7.62mm machinegun. It has a basic load of 3,500 rounds and an effective range of approximately 1,000 meters. The tank is also equipped with a snorkel that allows it to operate in water up to 18 feet deep.

LIMITATIONS. The main gun can only be depressed to 4 degrees below level. In rough terrain this will cause the tank to expose more of itself than US tanks in a similar position. There are no support rollers to carry the upper part of the track. Running at high speeds will set up vibrations in the track not in contact with the ground and cause it to break. The clutch plates in the transmission wear rapidly, especially in the hands of an inexperienced driver. The tank cannot cross water obstacles when the water is flowing faster than 3 meters per second.

mation. Since his death one accomplishment by the Soviets has become public knowledge - the adoption by the Soviets of a new assault rifle with ammunition. The introduction to Soviet field forces of this totally new assault rifle with its highly developed ammunition and large capacity magazine is probably not going to decide major battles but it does accomplish some distinct goals - it gives the basic Soviet infantryman the best individual weapon developed to date in the world and it is an obvious psychological boost to know you possess the best when combat is imminent.

The erroneous belief that the Soviet Army is made up of illiterate peasants from the Steppes is completely out of date. Compulsory education was made mandatory years ago, also secondary and advanced education is given to many. The Soviet Union is graduating far more engineers than we here in the U.S. At this time much of the equipment issued Soviet infantrymen is first-class and is, in many cases, undeniably superior to most equipment issued in the West.

Among the items of significance already in service are: camouflage clothing which is specially treated to thwart infra-red detection used in night fighting, readily available special clothing to be used in the event of CBR (Chemical/Biological/Radiological) warfare, outstanding machine guns for both infantry and tank use and the ultra-modern rifle now issued with several inherent advantages. It is apparent that the new cartridge results in considerable reduction in weight. It should now be possible for the Soviet infantryman to carry a larger quantity of ammunition, and vastly increase the firepower of the individual, all of which should make the real image of the new Soviet infantryman something to be admired and envied.

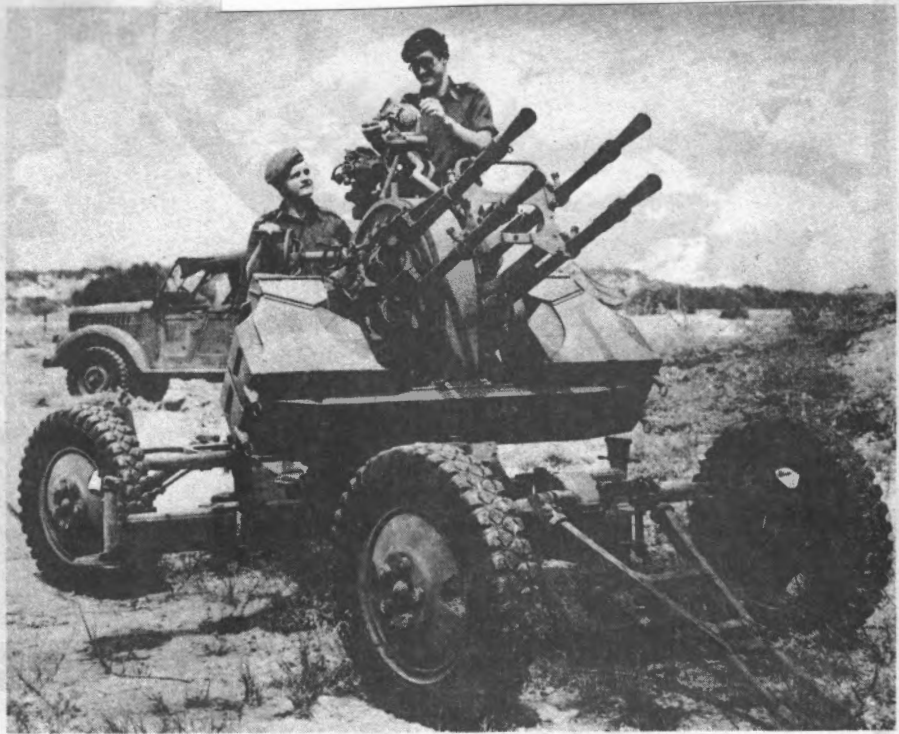
Historically, the Soviets have continually demonstrated in their attitude toward the development of all weapons systems, from the assault rifle to the tank, constant periods of evolutionary improvement. Their new assault rifle represents only one element in this process. It is a continuation in the known state-of-the-art.

As in the past, the appearance of the renowned Soviet designed AK-47 (Kalashnikov) Assault Rifle has signaled Soviet intervention throughout the world, so now the rapid fire of this new assault rifle will indicate a new aggressive phase."

By mid-1976, D Company of the 519th M1 Battalion had been re-organized and began preparation of numerous Technical Intelligence



OP-4 people check out the free action on the turret mounted machine gun of the T-62 tank.



Quickly towed into position by truck, the ZPU-4 AA weapon is, by today's standards, somewhat obsolete and is being replaced by more modern weaponry.



Part of OP 4's program is to illustrate the small arms that Soviet troops utilize. The "Soviet Trooper" in this instance stands 6' 10" tall.



The battlefield spreads out beyond the muzzle of the T-62 tank.



Sloping sides and frontal area plus eight wheels identify the Russian built BTR-60P personnel carrier which is amphibious.

Bulletins and Operators Manuals on the Soviet material from the Mid-East. In addition, as a result of prior experiences in Vietnam, the unit was given the mission of conducting foreign material training.

These reports primarily served as interim reports on "new" equipment and filled in between the production of scheduled reports by FSTC and DIA. In addition, since they were unclassified, they could be distributed to the field. The Army had established the OPPOSING FORCES program and had established the RED THRUST Detachment at Fort Hood whose purpose was to train Army units to field an opposing force that would operate using Soviet tactics. Foreign material was supplied to these cadre units and the Technical Intelligence Company prepared operators manuals. Briefings and displays were also conducted by the unit for various Army Reserve and National Guard units.

The purpose of the Opposing Forces program and the Foreign Material Training program was summed up by a form of mission letters published by D Company of the 519th MI Battalion. It is reproduced below.

OPPOSING FORCES CONCEPT

THE OPPOSING FORCES CONCEPT (OPFOR) WAS DESIGNED TO FAMILIARIZE EACH MEMBER OF THE ACTIVE ARMY'S COMBAT INFANTRY DIVISIONS WITH FOREIGN EQUIPMENT AND WEAPONS SO THAT THEY CAN PROFICIENTLY MAKE USE OF THESE ITEMS SHOULD THE NEED ARISE. THE PROGRAM'S MAIN OBJECTIVES ARE TO TRAIN THE SOLDIER TO:

1. RECOGNIZE, ACQUIRE, AND EFFECTIVELY ENGAGE FOREIGN ARMORED VEHICLES;
2. UNDERSTAND FOREIGN MATERIEL CAPABILITIES, LIMITATIONS, AND VULNERABILITIES;
3. APPRECIATE THE RELATIVE EFFECTIVENESS OF U.S. AND FOREIGN COUNTERPART WEAPONS; AND
4. BE FAMILIAR WITH THE BASIC OPERATION OF FOREIGN WEAPONS APPLICABLE TO THEIR SPECIALITY.

COMPANY D, 519th MI BN, HAS ACQUIRED THE FOLLOWING TASKS IN RELATION TO ACHIEVING THE GOALS OF THE OPPOSING FORCES CONCEPT:

1. PERFORMING ALL LEVELS OF MAINTENANCE DURING THE ACQUISITION/ TRAINING PHASE REQUIRED TO RETURN FOREIGN MATERIEL TO AN OPERATIONAL CONDITION.
2. PROVIDING CONTINUAL TECHNICAL ASSISTANCE TO USERS AS REQUESTED.
3. PERFORMING CICP FUNCTIONS FOR FOREIGN MATERIEL REPLACEMENT PARTS REQUIRED TO SUPPORT OPFOR.
4. PROVIDING GENERAL SUPPORT (GS) MAINTENANCE ADVICE AND ASSISTANCE FOR FOREIGN MATERIEL.
5. STOCKPILING FOREIGN MUNITIONS FOR DISTRIBUTION AS DIRECTED.
6. CERTIFYING ALL FOREIGN WEAPONS USED UNDER OPFOR AS SAFE FOR FIRING.
7. CONDUCTING FOREIGN MATERIEL TRAINING.
8. PREPARING REQUIRED TECHNICAL DOCUMENTATION.

U.S. TROOPS GET FIRST-HAND LOOK

Soviet Tanks 'Not Built for Comfort'

By LARRY CARNEY

Times Staff Writer

ABERDEEN PG, Md. — "The Russians don't build their tanks and armored personnel carriers for comfort like we do," says Sgt. Glenn J. Winters of B Co, 1st Bn, 3d Inf says.

The Fort Myer NCO was one of 100 3d Inf soldiers who received a briefing from Aberdeen Proving Ground's Co D, 519th MI Bn, on Russian tanks, armored personnel carrier and small crew and individual weapons as part of the Army's new Opposing Force Program.

Co D CO Maj. Delter R. Morris, says his unit will get "awful busy" shortly as cadres from each Army division arrive at Aberdeen to receive instruction on how to operate and maintain Russian equipment. The unit, the only technical intelligence company in the Army, has the responsibility for receiving foreign equipment, and preparing it for distribution to other units.

Under OPFOR, each division and some independent brigades are scheduled to receive a small complement of Russian tanks, APCs and other items to use in their training programs. They'll also be furnished several Soviet uniforms so soldiers can see how Russian soldiers dress.

"The program is designed to give the U.S. soldier more information than he's ever had before on his potential enemy," Morris says.

Winters says he's impressed with the compactness, low build and simplicity of Russian tanks and APCs. Crew members must cram into the equipment, leaving no room for drink coolers and other comforts.



A Russian tank at Aberdeen Proving Ground, Md.

Capt. Roger E. Bart, project officer for OPFOR in the 519th, agrees with Winter's assessment of Russian equipment. "They build it simple and make it relatively easy to maintain. The T-54 and T-62 tanks are less than nine feet tall," Bart says, noting that the Russians don't accept anybody over 5-foot-6 in their tank corps.

"Their equipment is definitely not built for comfort," says Lt. Walter F. Hershberger, Co D operations officer for foreign training. "They cram their guys into vehicles like sardines. We add more crew comfort."

Russian vehicles also have ability to operate in water, he says.

Sgt. Ricky L. Starnes of the 3d Inf says he was most impressed with the BMP, the Russians' latest model APC. "It has good speed and firepower and can easily get in and out of tight places. The vehicle's ability to flush out gas and radiological materials while in battle was also impressive," he says.

Bart says the BMP can travel up to 50 miles per hour and is hard to "knock out" because of the way the front slants. He

said the tanks and APCs entering the Russian inventory also have the ability to make smoke, "probably to confuse any helicopters which may be trying to knock them out."

Sp4 Robin L. Hasting of the 3d Inf, says it's one thing to see Russian equipment "in a textbook but another to crawl all over it and see it in person. Because of the trip here, I can recognize the T-62 at a glance."


SSgt. Larry D. Blaine of 3d Inf, says the trip to Aberdeen was important because it will help him pass his skill qualification test. "The new SQTs for infantrymen ask soldiers to identify Soviet weapons," he says.

Sgt. Kerry L. Book of the 3d Inf, says he was "delighted" with a chance to fire the AK-47 rifle. "It was lighter than I thought."

Morris says a cadre from the 4th Inf Div (Mech) Fort Carson, Colo., will visit Aberdeen soon. The 4th Div will be the first division to receive Russian equipment and instruction on how to use and maintain the items.

"We hope to have all Stateside division cadres through here by December 31," Morris said. But, he said, plans could change if we "we don't have the desired amount of Soviet equipment."

The major said the Army has about 12 to 18 months' supply of ammunition available for AK-47 rifle firing. He says plans are under study in the Pentagon to establish an ammunition-making facility for the Russian small arms.



ST 7-193 FY 77
UNITED STATES ARMY

TANK IDENTIFICATION HANDBOOK

UNITED STATES ARMY INFANTRY SCHOOL
FORT BENNING, GEORGIA

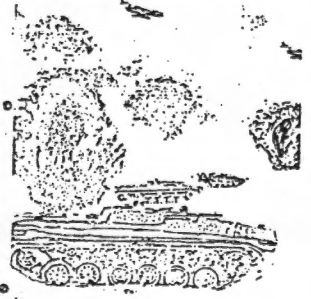
GRAPHIC TRAINING AID 17-2-8
Study Cards 1-48

ARMORED VEHICLE RECOGNITION

DISTRIBUTION: US Army Training Aids Center.

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1977

ORGANIZATION OF THE SOVIET
MOTORIZED RIFLE DIVISION



UNITED STATES ARMY INFANTRY SCHOOL
FORT BENNING, GEORGIA

DEFENSE INTELLIGENCE AGENCY


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Defense
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Reports



SOVIET TANK
COMPANY TACTICS
MAY 1976

DEFENSE INTELLIGENCE REPORT

SOVIET TANK REGIMENT TACTICS



MAY 1977

It is worth noting that this was the beginning of another of the many controversies in the intelligence organizations. In addition to the Technical Intelligence Unit at Aberdeen Proving Ground, the Foreign Science and Technology Center maintained a Field Support Division at Aberdeen. This Field Support Division retained control of foreign material that remained classified. As a result, the information could not be released to the public and visiting dignitaries anxious to be photographed with Soviet material preferred to visit the Technical Intelligence Company. In addition, in 1977 the unit was assigned to the newly established INTELLIGENCE AND SECURITY COMMAND. While the FSTC and the Field Support Division were part of the Army Material Command.

It appears that 1975 was an important year for numerous programs. Technical Intelligence which had been limited to a very few people and for the most part was highly classified was about to be expanded and declassified. This was accomplished by the declassification of the basic products of Technical Intelligence, the Technical Intelligence Bulletins. Both the bulletins and operator's manuals were primarily in support of the opposing forces program which was being developed.

Major Dwight W. Galda, of the Directorate of Tactical/Strategic Intelligence OACSI, prepared a position paper which provides a capsule summary of military training in the years since WW II.

"The Aggressor Program was developed in 1947 to provide training realism while increasing soldier awareness of the Communist threat. The national policy of containment stressed avoiding unintended implications of US military programs which could be interpreted by the Soviets as offensive in nature. The basic Soviet military and political systems were accordingly clothed in the mythical, yet highly suggestive garb of "Aggressorland" and the "Circle Trigon Party." Despite this transparent caution in US Army training, the military and political apparatus of the Soviet Union has been referred to directly and pointedly during annual DOD budget hearings before the Congress since 1947.

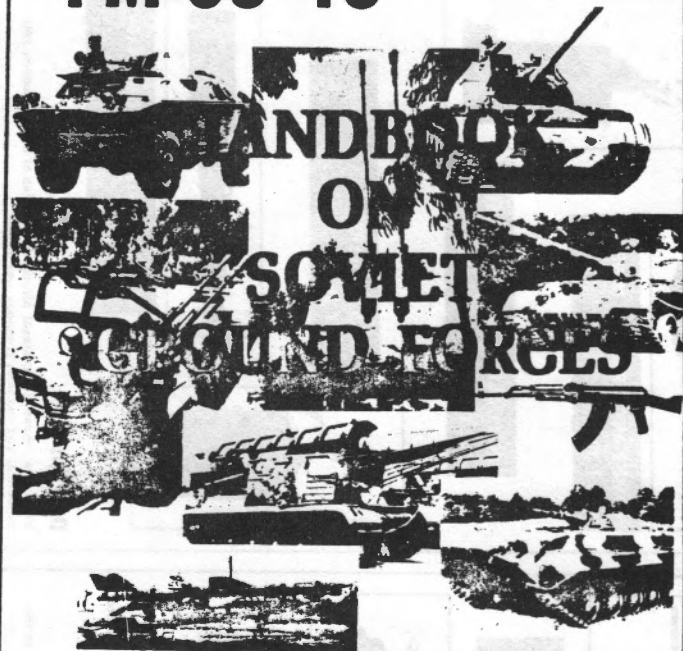
The Aggressor Program remained in use throughout the 1950's and started to fall into disuse as the focus of containment shifted from Europe to Southeast Asia in the early 1960's. The focal point for the program, the Aggressor Center, was disestablished in 1963. Rendered obsolete by Vietnam, the Aggressor Program was revived on 9 May 1972 to again provide training realism for the peacetime Army. The revived program, however, was essentially the old Aggressor concept with a 1970 packaging. OACSI was assigned responsibility for the program, and TRADOC was subsequently designated DA executive agent.

By early 1974, and with the hindsight of the Yom

SOVIET EQUIPMENT RECOGNITION GUIDE



FM 30-40



**HEADQUARTERS
DEPARTMENT OF THE ARMY
30 JUNE 1975**

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of containment shifted from Europe to Southeast Asia in
the early 1960's. The final point for the program, the
Aggressor Center, was



"A Look Down the Soviet Barrel"

A new Army Training film, "A Look Down the Soviet Barrel", (number MF 21-5883) was added to the Army inventory in July 1975. It is an outgrowth of the Foreign Weapons Display that toured twelve CONUS installations in the past year. Sponsored by the Foreign Science and Technology Center, the film familiarizes soldiers at company level with the capabilities of communist world weapons and equipment.

"A Look Down the Soviet Barrel", is introduced by Major General Aaron, ACSI, and

includes a 30 minute briefing by 1LT Brinton K. Harrison and a 4-man team of Intelligence Specialists from Co D, 519th Military Intelligence Battalion, Aberdeen Proving Ground, Maryland. The briefing covers the strengths, weaknesses, and general characteristics of many of the WARSAW Pact weapons and items of equipment. The film also includes portions of a Russian propaganda film demonstrating the maneuvers and firepower of the Soviet Army.

Kippur War, it was apparent that the Aggressor Revival Program (ARP) was not providing the requisite degree of realism essential to preparing for the next war or the genuine challenge sought by ground force commanders, NCO's, and the perceptive young soldiers of the volunteer Army. In September 1974, General DePuy, Commander, TRADOC, proposed a new maneuver enemy to replace Aggressor, one based on real-world tactics and equipment of specific potential adversaries. Subsequent DA and Department of State staffing, however, resulted in reservations which effectively negated the desired enhancements; however, these reservations were inconsistent. A policy permitted the Soviets to be identified as the threat in budget hearings before the Congress but precluded identifying them in military preparedness training. The Soviets, on the other hand, lay out in great detail the US military system in their doctrine and train their soldiers to exploit its vulnerabilities.

The battlefield of 1975 had changed dramatically from that of the 1940's. The political climate had also matured whereby unintended implications were more easily avoided. The Aggressor Program had not kept pace with these changes. A successor to this program was required, one which was consistent with public governmental disclosures of US defense programs, based on threats posed by the Soviets and other potential adversaries. This point has been highlighted by a DA letter to MACOM's that emphasized command support for peacetime intelligence training; this, in turn, prompted General DePuy to again address this point, indicating that "we will be remiss" if we continue to avoid the issue and not tell our troops what a Soviet tank looks like in an unclassified mode. The Secretary of Defense also emphasized the point that we need to do more in explaining Soviet vulnerabilities in our tactical doctrine."

As part of the emphasis on explaining the Soviet threat, the Army produced FM 30-40, "Handbook on Soviet Military." This document was quickly followed by numerous unclassified studies on Soviet Doctrine and Tactics by the Defense Intelligence Agency, INSCOM, the service schools and many units in the field. Over the next decade the opposing force program would expand to every phase of military training. Supported by Technical Intelligence Operations, it would prove to be considerably more effective than the previous Aggressor Program.

By mid 1976, the ground work had been laid for the expansion of the Technical Intelligence Unit and that it would have a two-fold mission. One would be unclassified and would be to support the Opposing Forces program and the other, classified as to technical details, would be to support higher level intelligence programs.

Regrettably the American public had been over-exposed to Vietnam and were sick of warfare. As a result of scandals involving the "Watergate" incident, the CIA and other intelligence agencies fell into disfavor. Once again intelligence operations were scaled back and as a result more emphasis was being placed on what was called Technical Collection methods. This involved satellite photographs and radio intercepts as well as other means. The end result of intelligence operations during the mid-1970's was to document the rapid build up in the Soviet military forces. Military leaders were again confronted with the problems of an increasing threat and an obsolescing military. As a result, efforts continued to develop and field new equipment to counter the postulated threat of new Soviet equipment.

Senior U.S. military planners were not unaware of the Soviet build up, but having just "lost" a war, were not very successful in fielding new equipment or getting funding for research and development of new technologies. In addition, the usual postwar reduction in forces had eliminated many officers from active service.

Because of future developments which would effect the design and development of tanks and other fighting vehicles, it is necessary to backtrack in time and discuss U.S. tank developments.

As of 1986, it is premature to attempt a postmortem on the M1 Abrams tank since it had not been tested in combat, as had the Israeli Merkava tank, however, it is worth discussing some of the historical background to the fielding of the M1 tank.

In quoting from an article by Captain James Warford:

"The use of high-risk technology, in the design and development of armored vehicles can be defined as the employment of any technology of unproven design or capability. The fielding of a weapon system incorporating this type of technology would clearly be regarded as a gamble, or high risk. The decision to take this gamble, or not, thus becomes very important to the future of any armored vehicle program."

The decision to take the gamble includes many factors, to include the state-of-the-art in various fields of endeavor, foreign developments in these areas as well as postulated future threats. With the introduction of shaped charge warheads in WW II, the threat to a tank had increased considerably. Since WW II, there has been a concentrated effort to provide tanks and other armored vehicles with some degree of protection against high explosive antitank (HEAT) ammunition. Early ideas ranged from simple spaced armor to an asphalt and pebble composition known as HCR-2. These early designs, however, did not provide a workable solution. As a result, the Continental Army Command, based upon a review of historical examples of WW II and the early experience in Korea, requested the initiation of a program in 1952 to develop an armor that offered built-in

protection against shaped-charged projectiles, without sacrificing protection against kinetic-energy projectiles or increasing the vehicle's total weight. This armor development program was in progress at the same time that designers were starting work on new tank designs.

In 1954, a series of design studies was begun to develop a new family of armored vehicles of the medium or main battle tank (MBT) class. One of the resulting designs, the T12, was accepted and moved into the development phase and redesignated the T95. It was intended to make extensive use of innovative, unproven technologies. The specific purpose of the T95 is not very clear. Some sources state it was intended to fulfill the missions of both the M48 MBT as well as the M103 heavy tank. Other sources, however disagree, and refer to the T95 as primarily an experimental vehicle; intended for testing all of the recently available technologies. No matter what role the T95 was intended to perform, it was clear from the beginning that it was to be a truly revolutionary tank.

The innovations built into the T95 were included in all three of the basic tank design criteria: firepower, mobility and protection. The main armament fitted to the T95 pilot model was the T-208 SMOOTHBORE, 90-mm. gun, carried in the T191 non-recoiling mount. This new fixed gun mount had several advantages over the conventional recoil system. First, it eliminated the weight, complexity and cost of a recoil system. Second, it reduced the turret opening required to mount the main gun. Third, it reduced the amount of space needed inside the turret to allow for the gun's recoil. Although the smoothbore gun and its rigid mount were very innovative, the most important feature of the tank's firepower was its ammunition. This was an armor-piercing fin-stabilized, discarding-sabot (APFSDS) round, with a 37-mm. tungsten-carbide penetrator centered in the cartridge case and supported by a forward discarding sabot at the mouth of the case and looked much like the current 105-mm. APDS round. The muzzle velocity of 5,000 fps and the low drag projectile were expected to produce target effects similar to those currently achieved. The T95E1, mounted the same main gun as the pilot model, but in a conventional recoiling mount. The following models were fitted with a complete turret from the M48A2; the T95E2 was fitted with the T140E1 105-mm. smoothbore gun. The T95 was also fitted with a developmental turret from the M60A2 program. This latter modified T95 was used to successfully conduct the first cant-angle firing of the SHILLELAGH guided missile. Finally, the British 120-mm. rifle gun which was then being considered as a replacement for the CENTURION'S 105-mm. main gun was considered for use on the T95. As for secondary armament, the T95 and the T95E1 were both equipped with a .30 caliber coaxial machine gun and a .50 caliber cupola-mounted machine gun. Personnel armament included a .45 caliber submachine gun and a .30 caliber M2 carbine.

Another important aspect of the T95's firepower can be found in its various fire control systems. While some models were fitted with conventional range finders, such as the T57 coincidence type, a

very innovative system was used on the pilot model. Another rangefinder, known as the T53 Optical Tracking Acquisition and Ranging (OPTAR) system, was tested on the T95 from 1955 to 1957. The OPTAR system consisted of a light-beam transmitter, a receiver unit, and an offset sighting system. The transmitter, and receiver were located on the right side of the turret, protected by a large, armored buster. The system was designed to enable the tank commander to lay the rangefinder on a target; and by pressing a button, fire a SINGLE PULSE LIGHT BEAM. This beam would reflect off the target and return to the receiver. The data would be processed and given as a range readout. Since the OPTAR used a noncoherent beam of light, the beam had a tendency to scatter, resulting in multiple returns to the receiver. The tank commander was required to visually estimate the target range and determine which of the beam returns was correct. Despite this problem, the OPTAR was a major breakthrough that would prove to be the forerunner of today's laser rangefinders.

It is interesting to note that early work in the area was done by German scientists in WW II. Their early efforts resulted in the OPTIPHONE, a system for communicating between points over a light beam. Specimens of this system were brought back to the United States and samples can be seen in the Signal Corps Museum at Fort Monmouth.

As for running gear, the tank was fitted with a flat track suspension system without support rollers. The track was carried on the top of the five large-diameter dual road wheels that were suspended on torsion bars. Each of the road wheel hubs was fitted with a transparent plastic plug that allowed visual inspection of the hub lubricant level. Many different running gear systems were tested on the T95, ranging from a variable height HYDROPNEUMATIC SUSPENSION to a new type of titanium track mobility trials pitting a T95E2 against an M48A2 from June, 1957 to September, 1959. Two hulls were used logging a total of 3,774 miles and it was determined that the T95E2, with its decreased weight at no sacrifice in armor protection, in most cases exceeded or equalled the M48A2 in performance. The final trial report recommended that the T95 tank chassis, after modifications for improved mobility on muddy terrain and component reliability, be strongly considered for future MBT production.

At the same time that various suspension systems were being tested, the program to develop better armor had resulted in the development of a composit armor. This armor was combined with the T95 and resulted in the construction of 36 siliceous-cored T95 turrets and hulls. While it is true that most of the T95's were built with conventionally armored glacis plates and turret fronts, these specially armored turrets made the T95 the first American tank model to be fitted with composit armor. The armor consisted of an outer layer of about one inch of cast armor, an inner layer of about two inches of cast armor and a center layer of about four inches of fused silica. Silica, or glass, was chosen for the armor because it does not "flow plastically" after an impact as does steel. Silica,

instead, rebounds after the shock wave and radially bombards the oncoming shaped-charge metal jet particles and disrupts the jet's shape.

A series of ballistic tests were conducted on composit-armored T95 turrets and hulls from 1 June 1958 to 1 August 1960. The purpose of the tests was to confirm the effectiveness of the composite armor against currently fielded antitank weapons. The following projectiles were fired: 12 rounds of 90-mm. HEAT; 33 rounds of 3.5-inch rocket; 54 rounds of 105-mm. armor piercing (AP); 24 rounds of 120-mm. high explosive (HE); 12 rounds of 105-mm. HE; 1 round of Soviet 100-mm. armor-piercing, high-explosive (APHE) and 64 rounds of 106-mm. HEAT. The most interesting results is clearly that of the Soviet 100-mm. APHE round. The round was fired to impact on the upper glacis plate, which was sloped at 65 degrees. The round displaced a piece of armor from the cast armor outer layer measuring 38-1/2 inches by 14-1/2 inches and caused several outer layer cracks. No damage was classified as a protection, partial penetration (PP-P). The entire area from the inner layer of the glacis plate to the rear of the hull was undamaged. However, despite the effectiveness of the fuzed-silica composite armor, it's design had some severe limitations. First, upon impact by either a shaped charge or an AP projectile, an undetermined amount of fuzed-silica would be pulverized. This would occur whether or not the round defeated the armor. Second, upon impact from nonpenetrating AP projectiles, the case armor could be severely damaged. The amount of damage could vary from displacement of a piece of outer layer cast armor (as above) to large-scale silica pulverization and inner layer cast armor bowing. In either case, the effectiveness of the armor against a subsequent projectile impact would be greatly reduced. Even so, it was determined that fuzed-silica composite armor provided superior protection against shaped-charge HEAT projectiles, and at least equivalent protection against AP projectiles as that of an equal weight of solid steel armor.

The T95's mobility was also given a high priority, and the most important item in this area was the powerpack. This was a Continental Model AOI-1195-5 engine coupled in Allison Model XTG-410-1 manually-controlled, full-torque-shifting transmission. Power was supplied by the 8-cylinder, 180-degree horizontally-opposed, air-cooled fuel-injected engine that delivered 560 gross horsepower at 2,800 rpm. This gave the T95 a power-to-weight ratio of 13.5 hp/ton and a maximum speed of 35-37.6 mph. Other engines were also tested. There was an engine with its cylinders arranged as an X, as well as a commercial diesel engine that was mounted in the late model T95E8. Finally, in March 1961, a T95 was displayed at the Pentagon with a Solar Saturn 1,100 hp gas turbine engine.

In 1961, after Congressional criticism and the appearance of several problems during its development, the Army decided to halt the T95 program in favor of a product-improved M48. The T95 program was widely regarded as a failure. It ran for seven years and cost \$26.6 million. In spite of all the time and money spent on the

project, no new tank entered the service. The program experienced many problems that ranged from the fact the T95 did not comply with the Berne International Loading Table because it was one inch too wide, to the fact that the nonrecoiling main gun mount transmitted too many G-forces into the turret structure. However, these limitations must be kept in perspective. If the innovative technology of each of its subsystems is examined individually, the T95 does not appear to be such a failure. A high-velocity smoothbore main gun firing APFSDS ammunition, a light-beam, or laser, rangefinder, a powerful diesel or gas turbine engine, and composite, or special, armor, are almost mandatory characteristics of the modern main battle tank.

In 1961, the Soviets fielded their T62 Main Battle tank which as first observed by U.S. personnel at the parade in 1965. The Soviets were also in the process of developing a newer tank, the T64, which was similar to the T95.

It is hard to say what the exact impact of the T95 would have been had it been fielded. Perhaps the best way to determine this impact is to compare the T95 to a tank that also made extensive use of high-risk technology, the Soviet T64. In spite of numerous reported problems, it was put into production and serviced in the mid-to-late 1960's. The similarities between the T64 and the T95 are surprising. While the 125-mm. smoothbore gun and its PAFSDS ammunition, as well as the probable mounting of a newly-developed laser rangefinder are well known, the engine and armor protection fitted to the T64 are still surrounded by speculation and concern. The T64's powerplant is a 750 hp diesel engine that represents a drastic change from conventional Soviet designs: being a flat, five-cylinder design, with HORIZONTALLY OPPOSED pistons. The performance and reliability of this new engine has been under close examination by the west for some time. Some of the most recent information indicates that this engine has been plagued by problems. The Soviets, however, seem to be pleased with this innovative engine and, according to some sources, have incorporated an updated version of it into the design of new armored vehicles.

The United States continued to improve the M48 series of tanks and fielded the M60. At the same time the Soviet Union began an unprecedented peace time build-up of their armored forces. The main battle tank in the early part of the decade was the T62 which had first been introduced in 1965. It was upgraded with a laser rangefinder and supplied in large numbers to the Warsaw Pact armies. It had a weakness in thin armor and its main armament, a 115-mm. smoothbore gun, was inferior due to a lack of accuracy and poor quality ammunition, to the smaller caliber, computer-controlled M68 105-mm. gun on the U.S. M60 medium tank. (This was proved during the Yom Kippur War when the T62's were massacred by the Israeli M60's and even by the older M48's. These battles disclosed a serious flaw in the M60 also. A turret hit from a Russian built 'Sagger' AT missile invariably ignited the inflammable hydraulic fluid incinerating the crew!)

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In 1961, the Soviets fielded their T65 Main Battle Tank which was first observed by U.S. personnel at the parade in 1955. The Soviets were also in the process of developing a newer tank, the T67, which was similar to the T65.

It is hard to say what the real intent of the T95 would have been had it been fielded. Perhaps the real way to determine this intent is to compare the T95 to a tank that also had innovative use of high-risk technology, the Soviet T64. In spite of numerous reported problems, it was put into production and service in the mid-to-late 1960's. The similarities between the T64 and the T95 are surprising. While the 125-mm smoothbore gun and its PARASAT ammunition, as well as the probable mounting of a newly-developed laser rangefinder are well known, the engine and armor protection fitted to the T64 are still surrounded by speculation and conjecture. The T95's powerplant is a 1,500-hp gas turbine engine that runs on diesel fuel, and its armor is a composite of steel and ceramic tiles. The T95's turret is a 100-ton turret, being a 100-ton turret.



The T95: A Gamble in High-risk Technology

In 1974 the Russians began replacing the T62 with a new main battle tank, the T72, a formidable machine mounting an auto loading 115-mm. or 125-mm. gun in a heavily armored turret. It is equipped with laser rangefinding improved suspension and a crew compartment designed for comfort in long distance operations. It can travel at speeds up to 50 mph and cross nuclear battlefields with its NBC protective system. By mid-1979 9,900 of these had been deployed, mainly with Soviet armored battalions in Eastern Europe and in the U.S.S.R.'s western military districts. The older T62's were not scrapped; at least 12,000 were transferred to storage depots. (The overall strength of the Soviet armored forces was estimated, in the 1978 Fiscal Year Military Posture Report by the U.S. Chairman of the Joint Chiefs of Staff at 45,000 tanks versus 10,000 for the U.S. forces and the gap has widened since then.)

United States military planners had seen the need for a main battle tank in the late 1960's and proposed the ultra modern state-of-the-art MBT70. Like the B1 bomber it was killed as too expensive and we lost our chance to field a superior armored force before the Russians. After the introduction of the T72 it became painfully obvious that the M60 was outclassed and that the U.S. Army needed a main battle tank. This is the XM1. Two prototypes were produced, one by the Chrysler Corporation and one by the General Motors Corporation.

The Army's specifications called for the same 105-mm. gun on the XM1, as carried by the M60, but with a laser rangefinder, computer fire control and a new armor piercing discarding sabot shell for the gun. The Army also preferred the diesel engine on the GM model over the gas turbine engine of the Chrysler version. The then Secretary of Defense, Donald Rumsfeld, insisted however on a tank that could be standardized with the new West German MBT, the Leopard II, which was to be equipped with a gas turbine engine. He was also convinced that a 120-mm. gun, like the one on the West German tank or the new British Chieftain, was imperative to match the new breed of Russian tanks. A prime consideration too was crew survivability.

When Chrysler submitted modified plans for their tank turret to mount a 120-mm. gun Secretary of Defense Rumsfeld approved their prototype and the Army announced on November 12, 1976 that the Chrysler XM1 had been selected as America's tank of the future, despite protests from GM that the \$4.9 billion program was low bid just to cut them out and hints by Department of Army officials that the 120-mm. gun could not be ready when production started late in 1979. The new tank was christened the Abrams, after the late General Creighton W. Abrams, the former Army Chief of Staff and one of Patton's best tank unit commanders in World War II.

Development of the XM1 stalled in 1977 when the standardization agreement broke down, first when the Germans complained that comparative tests between their tank and the XM1 at the Aberdeen test center had been weighted in favor of the American tank. Then

the U.S. Army renewed its objections to the 120-mm. gun prompting the Germans to threaten to use a different engine than the American Avco Corp. gas turbine in two-thirds of their proposed 900 Leopard II tanks. Then the British entered the picture asking that their 120-mm. gun being developed for the Chieftain tank be given the same consideration as the German gun.

Both guns were tested at the U.S. Army's Aberdeen Proving Ground along with the improved 105-mm. gun. Secretary of the Army Clifford Alexander, Jr. announced in January 1978 that the German gun had proved more advanced and showed better penetrating power than the others and that it had been selected for the XM1. Secretary of Defense Harold Brown gave it his stamp of approval and sent it to Congress for review. This healed the potential rift with the Germans and it appeared that development of the XM1, a year late, could now proceed.

Then in April 1979 the General Accounting Office, the Congressional investigation branch, issued a report which listed many deficiencies that had been found in the XM1, including a tendency to shed its tracks in desert operations, leaks in the engine air filtration system, fuel control and transmission problems. The GAO called on the Pentagon to defer production until these problems were solved.

The Army acknowledged that it was aware of these defects and was working to overcome them. Secretary Brown ordered the initial production of 110 tanks to begin on May 8, 1979. The projected cost of producing 7,000 tanks over the next nine years had now risen to \$9.8 billion. The first deliveries from the Chrysler assembly plant at Lima, Ohio were expected in February 1980 with full scale production of 90 tanks per month to start in February 1981.

Secretary Brown's order was premature as it was not until March 1980 that the bugs in the engine and transmission were eliminated and he was able to announce that production would commence on the first of the 352 tanks authorized by Congress for fiscal year 1980. The tanks would be equipped with the 105-mm. Army gun since the 120-mm. German gun, to be built under license from Rhein Metall at the Army's Watervliet Arsenal, New York, was not expected to be ready for production before 1985.

The military planners in the Kremlin had closely watched the U.S. stop and go effort to develop the new tank and by December 1977 were ready for mass production of their brand new main battle tank, the T80, designed to give them superiority over the XM1 and the other new NATO tanks. The T80 was to be equipped with a 125-mm. gun, a hydropneumatic suspension to provide a stable gun platform on rugged terrain (this same system had been tested for the Western tanks but was abandoned as too expensive), a laser rangefinder and an AT missile launcher. Like the XM1 it was to carry armored side skirts. The T80 was expected to become operational with the Soviet frontline forces in mid to late 1980.

The real threat of the T80 was that it was protected by a new form of armor that was virtually invulnerable to Western AT missiles on which NATO military planners have depended to blunt any Russian tank attack. William Perry, Under Secretary for Research and Engineering in the DOD, and Percy Pierre, Assistant Secretary of the Army for Research, Development and Acquisition, testified before the Congressional Armed Services Committees in 1979 that neither the Army's frontline TOW and Dragon antitank missiles nor the Franco-German HOT and Milan missiles could penetrate the frontal armor of this tank. (In addition the Soviets were adding this new armor plate to their T72's.) They testified that even the new TOW2 and improved version of the Dragon with their increased range and punch might fail against the T80. General Alexander Haig, former Supreme Commander of the Allied Forces-Europe, warned previously that the T80 and other new weapons being deployed by the Soviet forces created an imbalance between East and West that would force the West to the early use of nuclear weapons to stop a Soviet attack.

There is an untold story behind the new Soviet armor. In June 1976 the British Ministry of Defense announced that its Military Vehicles and Engineering Establishment at Chobham Common, Surrey had developed a new armor plate at a cost of \$10.5 million which was expected to offset the numerical tank superiority of the Soviets. The Chobham armor had amazing properties of resistance to both AT shells and missiles as shown by the U.K. Defense Ministry chart.

In August 1977 the Daily Express of London, citing unidentified U.S. intelligence sources, reported that Soviet agents had smuggled samples of Chobham armor out of West Germany to the Soviet Union. The article contended that the British had provided samples and information on the new armor to the West Germans in 1976 as part of a joint British-German project for a new MBT in the late 1980's. The Daily Express article said that the Soviets had already produced sufficient quantities of the new armor against which to test their AT guns and missiles.

Undoubtedly these tests convinced the Russian military planners that they had found the armor of the future and they ordered mass production of it for their new tanks. The evidence that the Soviets patterned their armor after the Chobham armor, which is an amalgam of a new plastic, ceramicized aluminium and specially hardened steel, is that the secret of the new Soviet armor is also a plastic material capable of limiting damage from hollow charge warheads. The turret of the expected T80, unlike the round turrets of the older Russian tanks, was to be angular and box-like to maximize the deflecting capabilities of the armor and shows the influence of Britain's Chobham armored Chieftain tank. The turret of the M1, which has a form of Chobham armor, also reflected the influence of the British design.

As of 1985, the T80 had not been tested in battle but the Syrian armed forces had placed an order for some of the new tanks and it may first be blooded, like many other new Soviet weapons, in

the Middle East. If the Russians are able to produce the T80 in the same numbers that they have produced their T62's and T72's (about 2,000 a year) then the present imbalance between the NATO and the Warsaw Pact forces may become irrevocable. The West cannot expect that, as in the past, the quality of its weapons will redress the quantitative gap because the T80 and other new Soviet weapons are just as sophisticated and technically excellent.

The United States and its allies had to concede that at least through the 1980's the Soviet superiority in tanks, armored fighting vehicles and artillery cannot be overcome. This was a dangerous situation because most defense analysts predicted that the mid-1980's would present a "window" to the Soviets; that is, the optimum moment when their military forces will be at maximum strength while the West had just started rebuilding its depleted armed forces. This was also considered the time of greatest pressure on the Kremlin leaders to use their military power, either to neutralize or bring Western Europe into the Soviet political sphere or, as their domestic oil reserves dry up, for a move into the Middle Eastern oil fields. The invasion of Afghanistan was proof that they were not hesitant to use their military might when they perceive weakness and discord in the West.

One of the severest criticisms of the M1 tank appeared in a letter to the editor of National Defense Magazine in October 1980. It was written by CWO Thomas F. Swearingen, a former member of the Combined Materiel Exploitation Center. CWO Swearingen pointed out that:

"It is an enigma why the Department of Defense, in good conscience, can insist on continued production of the XM1 tank. The DOD has been informed numerous times, both officially and unofficially, that the XM1 cannot survive on the battlefield.

As Col. Robert J. Icks pointed out (Nov-Dec 1979) and Gunter Scherrer noted (June 1980) the turret of the XM1 is fraught with shot traps. A single high explosive projectile trapped between the turret and hull can readily remove the turret. The least damage that can occur in this situation is distortion of the turret race, effectively jamming the turret.

Another configuration area displaying poor survivability is the glacis. It is relatively flat allowing ready penetration or maximum damage by HVAP, HEAT and HEP. This area should possess an inclined angle of not more than 55 degrees and provide a ricochet surface to discourage penetration.

It appears that the gun mantlet invites turret penetration. Again, a single HE projectile can jam

the gun into position effectively taking the XM1 out of action. There is some speculation that it may be possible to jam the gun with small arms fire.

A careful study and redesign of the XM1 must be undertaken immediately with a view toward maximum ballistic protection from sloped armor and elimination of shot traps, all to enhance battlefield survival. No amount of Chobham armor can help the XM1 in its present configuration.

It appears that the United States ignored all the design lessons learned from previous tank battles around the world when the XM1 was designed. The result is a virtual death trap. The XM1 is certainly a trap this country can ill-afford. We simply cannot produce the XM1 and train crews fast enough to replace battlefield casualties."

The immediate conclusion from these facts pinpointed that the lack of a Technical Intelligence operation at the Tank Automotive Command in the early 1970's, combined with a lack of attention to historical developments and an ineffective intelligence system resulted in a new main battle tank which cost a great deal and had serious defects in the basic design. The Army and its major tank supplier, General Dynamics (who purchased the tank business from Chrysler in 1982) were forced to embark on a massive public relations program to convince the troops and the American public that the M1 tank was not as bad as its critics had claimed. In addition, product improvements were to be incorporated in future tanks.

In addition to the lack of Technical Intelligence Detachments at the arsenals, there was an equal lack of Technical Intelligence in the field. There were some stop and go efforts at Intelligence newsletters put out by various organizations, but they were sporadic. U.S. Army Europe continued to publish Equipment Recognition Guides and on one occasion copies filtered out to various reserve units. The Maneuver Training commands had intelligence officer positions, but they were seldom used for any form of meaningful training. With each reorganization there were fewer and fewer positions for intelligence.

It is a credit to the officers of the combat arms groups of the MTC that any form of combat intelligence and opposing forces action was included in the battalion level training exercises. Again the 100th MTC, who pioneered the use of the computer assisted map maneuver, were among the first to recognize the value that intelligence operations would play in combat. Unfortunately, the unit lacked any form of intelligence support, either from internal assets or from external military intelligence units. We did manage to assemble a reference library for the use of team personnel, but its scope was limited. By 1976, I had the impression we were fighting a losing battle, there being a lack of equipment available

through military channels, as well as a lack of interest.

1977 proved to be an important year for a variety of reasons. At the highest level, the CIA prepared the annual National Intelligence Estimate. The main point that has since been made public was that the Soviets had deployed the SS-18 and SS-19 missiles and the Central Intelligence Agency said the accuracy of the two missiles was improving faster than expected, posing the danger that by the early 1980's, they would be able to wipe out the 1,000 Minuteman missile silos in a pre-emptive strike. That estimate was central to the view that the United States faced a "window of vulnerability." It also influenced President Carter's approach to arms control. The Americans had initially focused attention on the larger SS-18, and sought to limit the destructive power of missiles. But after the 1977 estimate, the Carter Administration accepted an overall limit on numbers of multiple-warhead missiles and, because of Soviet resistance, set aside efforts to limit destructive power.

In April 1977, the Department of the Army prepared an unclassified pamphlet entitled, "Understanding Soviet Military Developments." In the introduction it was stated:

"This pamphlet has been prepared by the Office of the Assistant Chief of Staff, Intelligence. It is based entirely on unclassified sources. Because it is intended to have general appeal, the standard army manual format has not been used."

This publication was not intended for the specialist, but was addressed to the general reader without substantial knowledge of the Soviet Union. It was hoped that the reader's interest would be stimulated sufficiently to turn to some of the additional sources listed in the Appendix. The emphasis was on the Soviet Ground Forces with some discussion of tactical air power in support of ground forces. A section on "historical perspective" was included because, without some knowledge of historical development, it was not possible to understand the unique relationship between the Soviet military establishment, the Communist Party which controls it, and the Soviet state.

In brief, the introduction pointed out that, at the end of the Civil War in 1921, the Red Army was a badly equipped, poorly trained and ill disciplined force. Today, it is a modern, technologically sophisticated, and highly effective army. This transformation has been most dramatic and mirrors similar advances made by the USSR as an industrial power. The threat of the Soviet army lies not in its unchallenged quantitative superiority alone, but also in the determined effort to achieve qualitative superiority in weaponry as well. The Soviet army today is not invulnerable nor does it possess an assured capability to defeat the forces of the Western alliance in a conflict. However, the great strides made by the Soviet Union in technology, production, and the development of tactics, indicate a trend which could pose a deadly threat in the future.

Several years later in an article entitled, "The Third World War -- How Close Are We?," Patrick Wall, a member of the British Parliament and Chairman of the Military Committee of NATO pointed out that it has now become fashionable to write novels about the Third World War. The scenario is invariably based on a Soviet blitzkrieg against NATO in Central Europe, which either succeeds or leads to the defeat of the Allies or is checked, which leads to the disintegration of the USSR.

Due to events in Africa and the Middle East great changes have taken place in American and European thought and people now realize that in fact the Third World War is a possibility. If this is so, it is surely important to examine what are the chances of war and whether the novelists have got their scenarios right?

The facts are that not only does the Warsaw Pact outnumber NATO by some 1.2 : 1 in men, 2 : 1 in armour and 2.3 : 1 in aircraft, but the USSR now spends 20 per cent more each year than the United States on military research and development, 25 per cent more on weapons and equipment and 60 per cent more on strategic nuclear forces.

Perhaps more significant is the increase in mobility and fire power by the Warsaw Pact Forces due to the widespread introduction of the T72 tank; the provision of an Armoured Personnel Carrier Regiment per Division, designed to spearhead a breakthrough; the provision of wholly self-propelled artillery; the increase in rocket launcher strength by some 250 per cent; a much improved river crossing capability (indeed the Rhine could now be crossed in half-an-hour) and a continued emphasis on chemical and biological warfare. There has been a considerable increase in the assault helicopter capability and some 200 per cent increase in fighter bombers, in an air force that is now designed for deep interdiction.

In short, it is an army and air force designed for a rapid breakthrough and one which could concentrate, perhaps at 10 : 1 superiority, at the vital point. The Soviets also possess a number of airborne Divisions and an immense air transport capability in the Aeroflot airline, together with a growing amphibious force all of which could strike at NATO's rear areas (for example the British Isles) or its vulnerable flanks.

To counter such an attack NATO must have time to mobilize; in the past planners counted on some three weeks, now the warning time could be as short as three days. Not a very happy picture unless the politicians take the risk of increasing world tension by moving reinforcements from the United Kingdom, the United States and Canada before war breaks out. After war starts such reinforcements would have to face the world's largest nuclear submarine fleet and modern Soviet aircraft such as the swing-wing Tu-22M Backfire and would suffer heavy losses.

NATO started waking up to these dangers in 1977 when a short-

term and a long-term re-armament program was agreed. Immediate priority was given to more rapid reinforcement, anti-armor weapons and increased supplies of ammunition and fuel; this plan has now been completed.

The long-term plan looks ahead for 15 years and includes matters such as improved command control and communications; the standardization of weapon systems; electronic warfare; air and anti-armor defense; maritime posture; theatre nuclear weapons, etc. Under this plan the Allies agreed to increase their defense expenditure by three per cent a year in real terms.

At the same time that the "world" was waking up to the Soviet threat, the U.S. Army was implementing changes. The major changes were new doctrine and tactics. Backtracking in time again to January 1977, a series of events was taking place that would affect training of the U.S. Army.

In January 1977, the 100th MTC was notified that there would be a Fifth U.S. Army Conference in February for all the MTC's. One of the topics to be discussed was an adequate organization that would be mission oriented. Along with this, the MTC's were to discuss past activities and future planned activities. Three members of the MTC were authorized to attend: the Commander, Col. Morgan; the Deputy, Col. Gray, and the S-3, Col. Adam, along with the Senior Advisor, Col. Nutter. Although contacts at Fifth U.S. Army admitted their lack of knowledge about MTC's, they expressed a high interest in improvement and a desire to assist and to learn. The majority of the period was spent in discussing organization or re-organization of the MTC's; 85th Division MTC, 95th Division MTC and the 100th Division MTC....

In March 1977, the group got back together and a definite organization was agreed upon. The general configuration of the Maneuver Training Command would be as follows: A Commander, a Deputy Commander, a three-member staff as Directorates (Personnel and Administration; Plans, Operation, Intelligence, and Training; and Logistics), three Combat Groups with mission-oriented organizations (Combat Group, Combat Support Group and Combat Service Support Group). Nineteen Exercise teams to be located within the three groups.

The 100th MTC asked for permission to reorganize effective 1 June 1977, under the proposed TDA, as a provisional organization pending final action on the TDA. This was granted and, based on a proposed TDA for the MTC's, the 100th MTC was authorized to reorganize. This required some major changes as the unit lost the coordinators for Training Support and Team Support as well as the S-2.

These changes resulted in the elimination of the OPPOSING FORCES section as well as the S-2. The OPPOSING FORCES Section, of which I had been branch Chief had never been fully staffed, had never been

allowed to function as it was intended and simply taught a war game called "Firefight" which taught company level tactics.

The RED THRUST Group at Fort Hood was getting organized and was beginning to conduct classes for the Active Forces and the Reserve. I took most all of the material that I had put together on training exercises and sent it to them. In addition, I wrote up a series of recommendations for increasing realism in training to include the manufacture of OPFOR uniforms and sent it to TRADOC. It would take another three years before TRADOC would finally develop an approved OPFOR uniform and it would not become available through training aids until 1981.

Apart from the admitted lack of knowledge of the Reserve by 5th Army, the failure to include the S-2 or even the OPFOR Section Chief at the planning conferences was the prime cause of the disappearance of the S-2 and OPFOR Sections, the major element in including intelligence in training as well as injecting realism.

At the same time that the intelligence/OPFOR was being drawn down in the MTC, NATO and Western Europe were beginning to wake up to the Soviet military Build up. General Alexander Haig was the NATO Commander, and made many efforts to point out the changing balance of forces in NATO. The RED THRUST detachment began publishing a newsletter, the Red Thrust Star. It was designed to keep troop units informed on Soviet developments in both weapons and tactics and on methods of injecting intelligence into training. There seemed to be an effort to make training more realistic; however, National Guard and Reserve units were equipped with obsolete equipment or, in many cases, no equipment. While it was the same equipment as the regular army, it was not up to competing with similar Soviet equipment.

By late 1977, the Technical Intelligence Unit had begun the process of transporting displays of Soviet weapons to various sites in the United States. I had the opportunity to see one such display in 1978 at Camp Grayling where the National Guard troops were attending their annual training. It was an interesting display, similar to the ones I had helped to set up in Vietnam. In discussing the display with one of the NCO's, I learned that the program was encountering some success but they had been thrown off several posts because as one commanding general put it, "They were scaring the hell out of the troops."

I had assumed the duties of opposing forces operations officer for the MTC's Combat Service Support Group. Hospitals, supply, transportation and maintenance units were our client units. In looking for a means to include OPFOR/Intelligence into their training exercises, I decided they would be more receptive to technical information. I wrote to General Blanchard, the Commanding General of U.S. Army Europe, pointing out the briefings I had given him in Vietnam and that we lacked the technical intelligence bulletins which were being produced. General Blanchard advised that

he would have his staff look into the matter. By March 1979 I received a letter from LTC Paul Hays. The major points brought out by LTC Hays was that;

"We in USAREUR intelligence share your concern about technical intelligence. As you know well, it is difficult to maintain high command visibility for intelligence in peacetime as it is seldom part of the commander's "pass or failure matrix."

Our high state of readiness against the potential enemy just across the border, however, does provide a natural impetus toward having a viable intelligence program. We have supplemented this through the availability and use of selected Soviet armored vehicles and equipment at our Combined Arms Training Center.

Of course, we are almost totally dependent upon CONUS agencies, such as TRADOC and The Intelligence School at Fort Huachuca to provide our soldiers with training manuals, films, and aids to support our real world mission."

*- Need for overview
Task Order*

By early 1979, the basic document needed to support the U.S. Army's major logistical exercise, LOGEX, had been printed. I was pleased to note that there was a situation that included renewed emphasis on Technical Intelligence. The message is reproduced here as an example.

ANTICIPATED PLAY FORM	SPONSOR ENGR	SITUATION NUMBER ENB6
DATE AND TIME TO INTRODUCE: 6 day/1500 INTRODUCER(S): 14th COSCOM (Reactor) MONITOR(S): 54th Engr Bde		
SITUATION Renewed Emphasis on Technical Intelligence		
PURPOSE To familiarize the player with procedures of TI collection and reporting and to cause coordination with logistics channels for evacuation of captured equipment.		
INFORMATION FOR CONTROLLERS: (To include anticipated player action, instructions to controllers and, if necessary, instructions to reactors and reference information.)		
ANTICIPATED PLAY Subordinate commanders should recognize that this message requires that policies and procedures governing the recovery and evacuation of PEA material must be coordinated with intelligence officer and their logistic counterparts to insure a coordinated evaluation and movement of captured material.		

DISPOSITION FORM			
<small>For use of this form, see AF 200-15, the proponent agency is TAGCDB.</small>			
<small>REFERENCE OR OFFICE SYMBOL</small>		<small>SUBJECT</small>	
		Renewed Emphasis on TI	
<small>TO</small>	<small>FROM</small>	<small>DATE</small>	<small>CONT</small>
Cdr 54th Engr Bde S2	Cdr 14th COSCOM	20 Aug 79	1
<p>1. In view of the current combat situation it is anticipated that the enemy may introduce new weapons and weapons systems in an attempt to continue the attack. A considerable amount of these new weapons and equipment may be captured by friendly forces. It is therefore necessary to place a renewed interest on TI at all unit levels. All units will be alerted to the necessity and the importance of detecting and reporting the following:</p> <ol style="list-style-type: none"> a. Weapons and weapons systems not previously found in the AO. b. Introduction of protective equipment of any type which could indicate possible use of NBC agents. c. Introduction into the AO of any equipment used to dispense CB agents. d. Any document found relating to PEACE systems, e.g., code books, call signs, CEOI, and crypto data. <p>2. In order to continue effective exploitation of TI information and material, request you revise your TI procedures. Advise this office immediately of any problem areas.</p>			

Among the new items of equipment that was being fielded was the West German Leopard 2 tank. This was the most modern tank to evolve from the Leopard series. The original prototypes were the Leopard I developed in 1961 and 1962 and finally adopted in 1963. Work on what would eventually emerge as the Leopard began in 1957 as a multi-national venture on the part of West Germany, Italy, and France. The goal was to develop a European-designed and produced tank with which to replace the second-hand American-made vehicles that were then in service with the NATO nations. France dropped out of the program in early 1962 to pursue a tank design of her own (which eventually appeared as the AMX 30). But West Germany and Italy persevered, and the first Leopard prototypes, built by Porsche, appeared in late 1962.

Troop trials carried out in West Germany with the Leopard prototypes resulted in numerous modifications. The first true production Leopards began rolling off the assembly line of Krauss-Maffei, the prime contractor, in September, 1965. As of 1984, more than 4,000 Leopards had been built by this firm, and under license by OTO-Melara in Italy. In addition to the regular gun-tanks, anti-aircraft, tank recovery, and bridge-laying versions of the Leopard were in production and service.

The Leopard 1A4 version resulted from studies begun at Porsche in 1966 to update the original Leopard design. Eventually 250 of this highly improved A4 variant were ordered from Krauss-Maffei for use by the West German Army. A new, welded turret with "spaced" armor was designed for the A4 (though the last 110 tanks of the A3 production batch also received this turret), as well as a new, fully-automatic transmission, a new weapon stabilizing system, thermal gun jacket, wider tracks, and an extremely advanced stereoscopic rangefinder. This rangefinder is said to nearly guarantee a hit on a

moving target with the first shot, well over 50% of the time -- and this at ranges exceeding 1500 yards.

In addition to West Germany, Leopards were operated by the armies of Holland, Belgium, Italy, and Norway. Very similar vehicles to the A4 model had been ordered by Canada and Australia to replace their aging Centurion tanks.

As soon as the Leopard 1A4 was entering the system, production of a newer weapon version, the Leopard 2, was entering service. The development of the Leopard 2 MBT can be traced back to a project started in the 1960s. At this time the Germans and the Americans were still working on the MBT 70 program, so this project had a very low priority. Once the MBT-70 was cancelled in January 1970 the Germans pushed ahead with the Leopard 2 and 17 prototypes were completed by 1974. These prototypes were built by the manufacturers of the Leopard 1, Krauss-Maffei of Munich, with the assistance of many other German companies. Without doubt, the Leopard 2 is one of the most advanced tanks in the world and the Germans have succeeded in designing a tank with high success in all three areas of tank design: mobility, firepower and armor. In 1977 the German Army ordered 1800: the first was delivered late in 1979 and production was to continue through to 1986. MaK of Kiel was to produce 810 and Krauss-Maffei of Munich the remainder. Main armament of the Leopard 2 was a 120mm Rhein-Metall smooth-bore gun which fired two types of fixed ammunition, APFSDS (Armor-Piercing Fin-Stabilized Discarding Sabot) and HEAT-MP (High-Explosive Anti-Tank Multi-Purpose). A total of 42 rounds of 120mm ammunition were carried on board the Leopard 2.

Section II of this book is primarily devoted to Foreign Material Acquisition, weapons research and development, and the impact of both on Combat Intelligence. While Section III, on Strategic Intelligence, covers in detail Strategic level intelligence, arms control and budget procedures, it is worth mentioning at this point some of the situations in Washington and the National Intelligence Organizations.

In his memoirs published in 1985, entitled "Secrecy and Democracy: The CIA in Transition," Admiral Stansfield Turner discusses his tenure as Director of Central Intelligence. In a review of the book it was pointed out that this is a remarkable account of Admiral Turner's monumental effort to reverse the decline of the U.S. Intelligence. It casts the admiral standing alone against the intransigence, ignorance, and proprietary interests of the CIA, the Directors of NSA and DIA, the National Security Council staff, the White House staff, the national security advisor, and the Secretary of State, as well as suffering a few disappointments at the direct hand of the President.

Following his dramatic arrival in Washington via Concorde from Paris in 1977, Turner learned that he was President Carter's second choice as the nominee to head the CIA. He had hoped to be put back

into consideration as a future Chief of Naval Operations but, instead, was relegated to what he later told his wife was "the Bush league," a "family code" reference to George Bush and the CIA.

Admiral Turner took up his duties at Langley with the certain conviction that he understood the underlying problems of the intelligence business and the identities of the men who had caused them. Despite the protective counsel of the naval officers who acted as his janissaries, it became essential to make eventual contact with the "professionals" who peopled the Agency. Recruiting among this group seems to have been based on the principle that if they expressed themselves as lifelong enemies of his enemies, they qualified as prospective allies deserving of his trust.

Throughout the book, the admiral invokes his high ethical principles, dedication to democratic ideals, and his unswerving determination to rebuild on the shambles which he found on his arrival. To allow the reader a firsthand exposure to the problems besetting a new DCI, Admiral Turner successively builds and then destroys a number of straw men of his own creation. His proposals for change, modestly advanced as original thoughts, are mostly recognizable as ideas that have been under intermittent discussion for 35 years. His views on counterintelligence, espionage, and covert action betray an innocence that he somehow managed to preserve during his four years ad DCI.

Innocence, however, does not explain his selective omissions relating to his authorship of a number of events that were ill-considered and harmful to his effort to bring respectability to Intelligence. The fact that he is prepared to accept credit for shifting the U.S. focus to technical collection methods suggests that he remains unaware of the fact that there was recognition of this obvious trend while he was still a plebe at the Naval Academy. There has never been a credible charge that U.S. Intelligence has been a demonstrable laggard in the field of innovative technical collection.

Among the missteps he admits, there always seems to appear an exogenous force to which at least partial blame can be ascribed. In several instances, lack of staff support and faulty advice led him, to his later regret, to suspend his better judgment. There was an informed consensus at the time Admiral Turner took office that U.S. Intelligence sorely needed corrective surgery. Among those who understood the problems, few saw them later corrected by Turner's measures.

For those of us out in the field, the conflicts in Washington were simply business or politics as usual. We still had troops to train, weapons to develop, and countermeasures to design.

From 1976 until 1979, I was a full-time student at the College of Engineering at the University of South Florida, a part-time

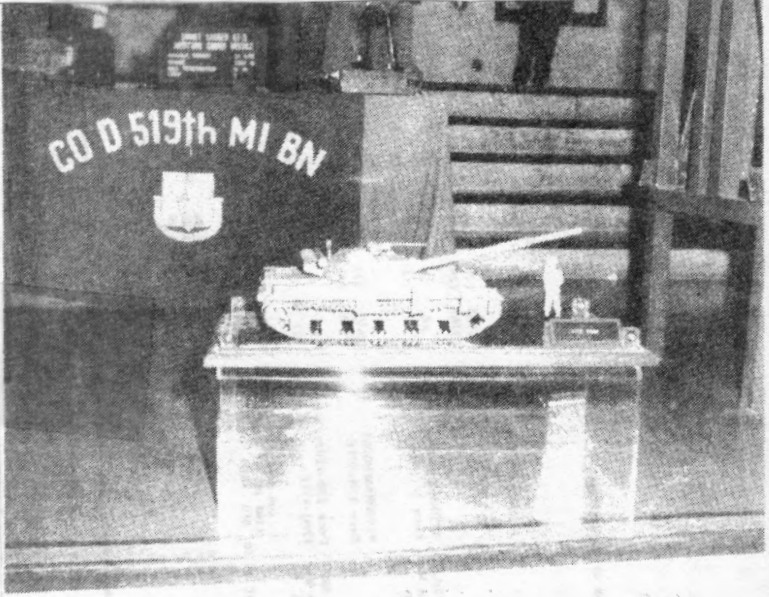
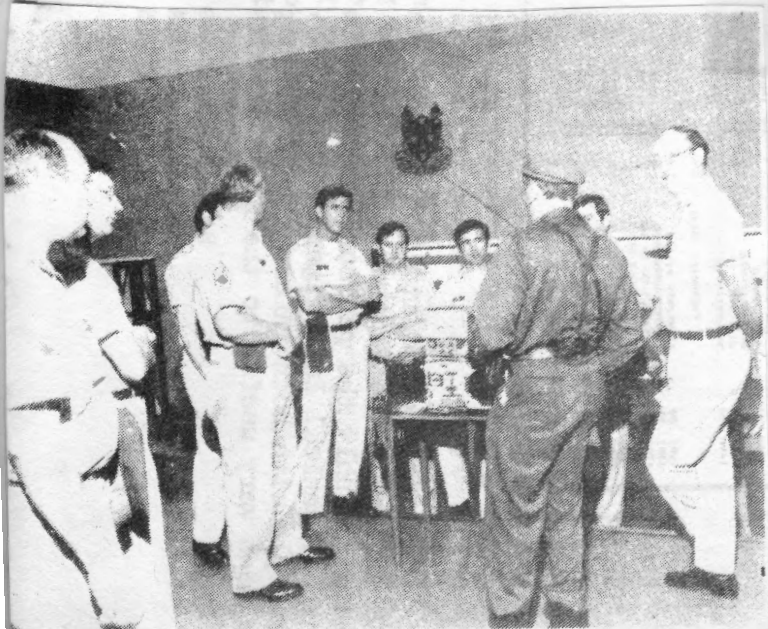
student at the Army's Command and General Staff College, a member of the 100th MTC and spent weekends commuting from Florida to Kentucky. I also served as an instructor at Fort Knox. Numerous studies and books had appeared on the conduct of the Vietnam War. All of the Army's training programs were in the process of changing. Through the efforts of the Defense Intelligence Agency, numerous classified studies were redone in an unclassified format. Slowly the various displays of Soviet weapons were getting the military's attention. As they compared Soviet equipment with U.S. equipment, it was becoming obvious that our arms and equipment were not up to modern combat nor was our training.



HOW CAPTURED Soviet communications equipment works is explained to Army Reserve and National Guard officers by a member of the 519 Military Intelligence Battalion. From left they are Maj. Gen. Benjamin Butler, CG, 100th Army Reserve Division, and Maj. Gen. James Lison, Wisconsin Adjutant General. About 500 local Reserves saw the display of weapons, personal gear, models of heavy equipment and other material on display at 100th Division HQ, at Louisville, Ky., and 67 Wisconsin Guardsmen were flown in.

18 The Officer March 1975

D Co, 519th Military Intelligence Bn. having been re-activated and charged with the implementation of the Foreign Material Training Program began conducting displays and demonstrations. Part of the displays were the models of new Soviet Equipment. On display here is the model of the Soviet T 72 Main Battle Tank.



Col. Hal Griffin, 100th Maneuver Training Command and his Supply and Service Team receiving a briefing on the Soviet Radios from a member of the Technical Intelligence Team. Pictured left to right are: SSG Ted Neimeyer, Col. Griffin, unidentified NCO, Lt. Paul Simms, Captain Jack Englert, Lt. D. King, Captain Harold McCrackin and Major Cordell Huff and a member of D Co./ 519.

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UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

TRADOC BULLETIN 1^U

- WEAPONS
- TACTICS
- TRAINING

RANGE AND LETHALITY OF U.S. AND SOVIET ANTI-ARMOR WEAPONS

30 SEPTEMBER 1975

UNCLASSIFIED

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UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

TRADOC BULLETIN 2^U

- WEAPONS
- TACTICS
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SOVIET ATGMs: CAPABILITIES & COUNTERMEASURES

APRIL 1975

UNCLASSIFIED

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

BULLETIN NO. 1^U

RANGE AND LETHALITY OF U.S. AND SOVIET ANTI-ARMOR WEAPONS

- I Modern Weapons
- II Soviet Weapons: Range
- III U. S. Weapons: Range
- IV Lethality
- V Implications for Training
- VI Training Aids
- VII Obtaining TRADOC Bulletins

This TRADOC BULLETIN is intended to provide to commanders, and others concerned with military training, timely technical information on weapons, tactics, and training technique. 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, which probe "why".

Comment or criticism is welcome, and should be directed to:

COMMANDER
US ARMY TRAINING AND DOCTRINE COMMAND
ATTN: AITING-CON (TEL: AUTOVON 680-2972/3153/3555/3951
FORT MONROE, VIRGINIA 22051

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY TRAINING
AND DOCTRINE COMMAND
Fort Monroe, Virginia 23651

TRADOC Pamphlet
No 71-9

10 October 1976

Force Development CATALOG OF TASO TRAINING DEVICES

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3. TASO-PRODUCED DEVICES

3-1

* This pamphlet supersedes TAMA TAsO Training Material Catalog, 5 Dec 74.

OPPOSING FORCE SMALL ARMS



AK-47
ASSAULT RIFLE
DVC-T 30-6



RPK SQUAD
MACHINE GUN
DVC-T 30-7



PM-50 PISTOL
(WITH HOLSTER)
DVC-T 30-8

DESCRIPTION

1/1-size, full arr, dimensions, plastic, replicas of, national

ARMOR VEHICLE MODELS (1/10 Scale)

T-62 Medium Tank,
DVC-T 17-81



BMP Infantry
Combat Vehicle,
DVC-T 17-82

ZSU-23-4 Self-Propelled
Antiaircraft Gun,
DVC-T 17-83



122mm Self-Propelled
Artillery,
DVC-T 17-84

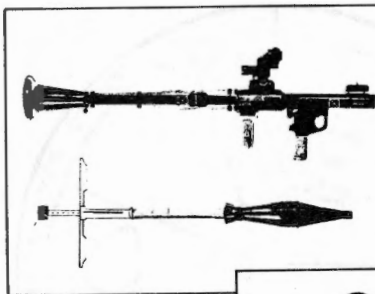
DESCRIPTION

Plastic, three-dimensional, 1/10 scale, static models of foreign nation armored vehicles.

TRAINING APPLICATIONS

These models may be used for classroom or outdoor instruction in the recognition of foreign nation armor vehicles.

RPG-7 ANTITANK GRENADE LAUNCHER (WITH ROUND)



DVC-T 30-5



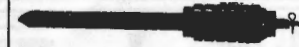
DESCRIPTION

A full-scale, three-dimensional, plastic replica of the RPG-7 Antitank Grenade Launcher.

TRAINING APPLICATIONS

Designed to enhance the realism of Opposing Force simulation during tactical training, the RPG-7 can also be used for classroom or field instruction on foreign nation weapons. It duplicates the size and physical appearance of the actual RPG-7, facilitating instruction on its components and characteristics. A removable model of the 85mm round with the firing pin and fuze is included.

OPPOSING FORCE GRENADES/MINES



POMZ-2 ANTIPERSONNEL MINE,
DVC-T 30-9



RG-42 ANTIPERSONNEL GRENADE,
DVC-T 30-10



RGD-5 ANTIPERSONNEL GRENADE,
DVC-T 30-11

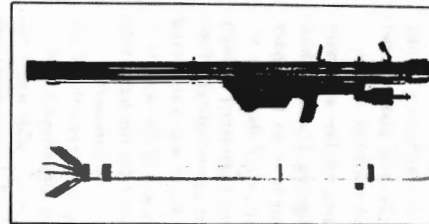


RKG-3 ANTIPERSONNEL GRENADE,
DVC-T 30-12

DESCRIPTION

Full-size, three-dimensional plastic facsimiles of foreign nation antipersonnel and antitank grenades and mines.

SA-7 (GRAIL)



DVC-T 30-14

DESCRIPTION

A full-scale, three-dimensional plastic and metal replica of the SA-7 Guided Antiaircraft Missile System (GRAIL), consisting of the launcher and removable missile.

TRAINING APPLICATIONS

The GRAIL is used during classroom and field instruction to emphasize the lethality of foreign nation antiaircraft capabilities. It is also used by the opposing forces during tactical exercises to enhance realism and introduce aircrew to the system.