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Armored Forces

U.S. Marine Corps

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FOREWORD

1. PURPOSE

Fleet Marine Force Reference Publication (FMFRP) 12-35, *Armored Forces*, is published to ensure the retention and dissemination of useful information which is not intended to become doctrine or to be published in Fleet Marine Force manuals. FMFRPs in the 12 Series are a special category: reprints of historical works which are not available elsewhere.

2. SCOPE

This reference publication is the writings of one of Germany's leading advocates of the use of armored forces. Major General Heinz Guderian saw the future uses of armor, aircraft, and infantry as a combined force. His text offers suggestions on employment of these elements together, and points out some of the problems related to the use of such units. This book is ideal reading for all military professionals when referencing the use of combined arms.

3. CERTIFICATION

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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ARMORED FORCES

By Major General (now Colonel General)
Heinz Guderian, German Army

(1937)

* * * * *

A military conflict of the future is inconceivable without the participation of air and armored forces. As early as 1919 General Buat of the French Army expressed his reaction to the experiences of the World War in the following words:

> Of the two elements of tactics, only fire power profited by the invention of the machine. In fact, mechanical aid proved so helpful to fire power that mobility in combat ceased almost completely. The horse was virtually eliminated. Fighting was carried on from trenches. The soldier could move only when all firearms of the opponent were silenced. However, with the appearance of the motor on the battlefield, mobility has regained its full importance. The infantry company of the line henceforth will be a tank company, though this does not mean that the foot soldier will disappear altogether. The automatic weapon designed for killing human beings will give way to the automatic weapon intended for the destruction of armored vehicles.

The tremendous strides made since the World War in the technical development of the air service and the mechanized arm have greatly added to their importance. Their effect on theories and plans, on strategy and tactics is increasingly felt. Therefore, it is the natural desire of the older arms to become better acquainted with their younger relatives.

In this article we shall illustrate the organization and tactics employed by today's amored forces and examine their influence upon the other arms when co-operating with them.

We may base our study on the fact that the mechanized arm is divided into two main groups, reconnaissance forces and combat forces.

Mechanized Reconnaissance Forces

Reconnaissance calls for highly mobile, flexible, and easily handled units that possess a wide radius of action and good means of communication. Reconnaissance forces must observe and report to a maximum, without being observed themselves. Therefore, the smaller the reconnaissance element and the more readily it lends itself to concealment, the easier the accomplishment of its mission will be. It must possess enough fighting power to be capable of defeating any similar opponent. Certain reconnaissance missions call for additional fighting power; in such cases the reconnaissance elements must be suitably reinforced.

The heavy armored scout car constitutes the principal means of modern ground reconnaissance. For this purpose most armies employ a wheeled vehicle, designed primarily for travel on roads but which, when equipped with three or more axles and a multi-wheel drive, is also capable of cross-country movement. Recent years have witnessed considerable progress in the construction of cross-country vehicles, and further advances in this field are being made constantly. These vehicles possess a maximum speed of 40 to 60 mph and a radius of action between 120 and 200 miles. They are armed with machine guns and 20-mm. to 37-mm. guns firing armor-piercing ammunition. The armament of these vehicles is limited to a certain weight because of the speed required, but it offers protection against small-arms ammunition.

Depending upon the mission, the organization of the armored-car troop varies in number and types of vehicles employed. In some instances the armored-car troop must be reinforced by engineers, motorized infantry, and heavy arms. The armored-car troop is capable of maintaining permanent contact with the enemy, even at night, and reporting its observations by radio.

The reconnaissance squadron is generally composed of two or three armored-car troops of nine to twelve armored scout cars each. As a rule its mission will be to reconnoiter the main roads and, on the basis of the results thus gained, to enlarge upon the reconnaissance net in the vital directions. When in close contact with the enemy the latter type of work may be executed best by light armored scout cars and motorcycle elements.

Reconnaissance is of value to the command only if the results are reported in time. Therefore, the problem of equipping the reconnaissance unit with adequate communication requires careful study. Of primary consideration, in this respect, are the radio and the radiotelephone. The number and radius of the communication means control the tactical employment of the reconnaissance squadron. To avoid interception and interference with radio communication, the trend is to limit its use as much as possible. Until contact with the enemy is established, reliance is placed upon other means of communication, such as the telephone, motorized messengers, and aviation.

The mechanized reconnaissance squadron is the communication center of its respective armored-car troops. It devolves upon the squadron commander to furnish timely reliefs for the troops on reconnaissance; moreover, he must have in reserve a sufficient number of armored cars to enable him to execute reconnaissance missions that may require several days and, if necessary, to make a sudden shift of the direction of his effort without depending upon outside support.

To some extent missions involving minor combat and protection of the communication centers of the mechanized ground reconnaissance elements require reinforcements of infantry carried on motorcycles or cross-country trucks, light guns or mortars, pioneers and anti-tank guns. In sudden clashes the armor and armament of the armored-car troop and reconnaissance squadron will usually permit offensive tactics. A mechanized unit on reconnaissance should not provoke combat that might divert it from its reconnaissance mission, but it may properly take advantage of a favorable opportunity to inflict damage upon the enemy. Moreover, the general rule that a reconnaissance unit avoids combat need not interfere with the occasional assignment of combat missions to it when there is a shortage of other forces. Such assignment may become necessary, for instance, in situations involving pursuit, cover of a withdrawal, screening, and protection of flank and rear.

Mechanized reconnaissance units may execute both strategic and tactical reconnaissance. In the case of strategic reconnaissance they function as army troops or as independent units operating between armies and groups of armies. They perform tactical reconnaissance for armored forces and other highly mobile bodies of troops, such as motorized infantry divisions. Strategic ground reconnaissance supplements air reconnaissance or may even replace it, especially at night, in fog, and in wooded and mountainous country. In turn, strategic ground reconnaissance, particularly that executed by mechanized elements, must be supported by air reconnaissance whose elements are much speedier and have a larger radius of action. The command and reconnaissance elements of both these arms must be carefully trained in this co-operative work.

Tactical reconnaissance for infantry divisions and army corps takes place within a narrow zone of limited depth; moreover, both flanks usually are joined by other forces. This type of reconnaissance is most suitably assigned to horse cavalry, but the combination of horse and motor in a reconnaissance unit does not seem advisable.

The mechanized reconnaissance forces are the first units to contact the enemy. Upon the outbreak of hostilities the mechanized elements are given their first as well as their greatest opportunity for speedy gains, for no one can say how the situation may develop after the initial encounters. It is vital, therefore, that the individual components of the reconnaissance units be thoroughly trained in co-operating with each other; that the leader and his command work together as a team, and that the crews of the scout cars be well acquainted with their means of communication and support weapons. For this reason the organization of the reconnaissance units in peace must be identical with the war organization.

Armored Combat Forces

The bulk of the armored forces is most usefully organized into large combat units, as is done in Great Britain and Russia. On the other hand, France continues to adhere to an organization which provides for the employment of one or more battalions within the infantry division or army corps.

The mission of the armored combat forces is the delivery of surprise attacks with concentrated strength, with the view to gaining the decision at the point determined by the command. The armored combat forces combine fire power with mobility and armor protection that is proof, at least, against small arms. They are, therefore, exclusively an offensive arm whose advantage over other ground forces consists in capacity to fight while in motion.

Compared with tanks of the types used in the World War, the modern tank is principally noted for its considerable increase in speed, which makes it impossible for the older arms to follow a tank attack closely for an extended period of time. Armament, fire effect, aiming devices, means of observation and communication have all undergone great improvement, but at the same time the defense against armored forces has also been considerably strengthened. The principal foes of the tank are the hostile tank and anti-tank gun; these compel the tank to take all possible advantage of its own speed. Other dangers are obstructions of all kinds, especially mines.

We shall briefly describe the most important types of tanks now in use.

(a) *The light tank* is armed with one cannon, 20-mm. to 50-mm. in caliber, and several machine guns. Automatic rifles, pistols, and hand grenades serve the crew in close combat. Some tanks carry smoke-screen equipment. The armor throughout is proof against steel-core projectiles; the vital parts of the superstructure and the turret are often constructed of still heavier armor. The light tank averages about 12 mph on the march and 7 to 10 mph in combat. Its maximum weight is about 18 tons. This tank is designed for combat in the forward zone of the infantry, where it attacks hostile tanks with its cannon and animate targets with its machine guns.

(b) *A lighter tank* armed exclusively with machine guns and weighing between four and seven tons, is largely used for missions involving close reconnaissance, close security, and transmission of orders. In addition this lighter tank is useful in combat against animate targets. Presenting a small target and possessing great speed and mobility, it is also one of the most dangerous foes of the anti-tank gun. Its low construction cost permits manufacture on a large scale.

(c) *The medium tank* carries guns, 75-mm. to 100-mm. in caliber. Its speed and armor are comparable to that of the light tank. It supports the light tank, especially in attacking distant objectives, immobile targets, localities, field fortifications, woods, and anti-tank guns.

(d) *The heavy tank* is armed with several machine guns, light cannon, and guns larger than 100-mm. in caliber. As a rule this type of tank is heavily armored (in France up to 50-mm. steel plates) and is designed for attack on field or permanent fortifications. Weighing up to 90 tons, it sometimes requires specially constructed carriers for railway transportation.

Medium and heavy tanks with armament larger than 100-mm. guns usually carry smoke projectiles for blinding hostile observation posts, artillery, and, above all, anti-tank guns.

Tank units designed for mobile warfare include a combination of light, medium, and heavy tanks. The ratio of light to medium tanks depends upon the kind of combat for which the particular unit is intended. The heavy tanks constitute separate units designed for attack on fortified positions. Hence the distinction drawn in some countries between battalions of light, medium, heavy, and mixed tanks. Two or more battalions form a tank regiment, several regiments a tank brigade.

While the tank unit in action is directed by radio, small elements (such as companies and platoons) may be guided by visual signals. Up to the time the radio goes into operation, orders and messages may be transmitted by telephone, motorized messengers, and aviation.

The staffs frequently have at their disposal radio-equipped command tanks and a platoon each of lighter tanks for messenger service. The command of tank units from an airplane—an idea repeatedly advanced in some countries—presupposes that control of the air over the zone of attack is established in advance. Also, it requires faultless radio communication and a special type of airplane. To date, this problem remains unsolved.

Let us assume that the command tanks, from the brigade commander down to the platoon commanders, are equipped with both transmitting and receiving sets while the other tanks contain only receiving sets. Let us assume further an average speed of 12 mph on the march and 10 mph in action and endeavor to draw a picture of the attack of a tank brigade.

We know that a tank attack ordinarily produces decisive results only when the requisite mass effect is obtained by a concentration of force. Consequently the tank brigade should be the smallest combat unit to be entrusted with an independent mission (cf. the Russian maneuvers of 1935, where one thousand tanks were massed for an attack in four waves).

As previously stated, mechanized forces fight while in motion, their attack being a combination of fire, movement, and armor protection. But the fact that they fight while moving does not mean that it is the primary object of the tank to run down an opponent steam-roller fashion. It is the actual fire effect—the destruction of the enemy by fire—which is the important thing; the crushing effect is merely incidental, of secondary consideration, and is chiefly used for the destruction of matériel.

The fire effect of the tank depends upon:

(a) *The quality of the arms and ammunition used.* In firing from a moving tank a rapid rate of fire and the use of tracer ammunition are desirable.

(b) *The perfection of the aiming devices.* Good telescopic and open sights as well as an easily manipulated elevating and traversing gear are essential.

(c) *The construction of the running gear of the tank,* especially of the springs. Good springs absorb shocks and minimize vibration.

(d) *The terrain.* Uneven ground results in unsteadiness and causes difficulty in keeping the sights on the target. Steep slopes may produce large dead angles, both horizontal and vertical. Ground covered with high grain, brush, woods, settlements, and so on, tends to interfere with the recognition of targets and reduces the fire effect.

(e) *The state of training of the tank crews.* Constant practice in the use of the aiming devices; thorough knowledge of the weapon as well as experience in serving it in dusk or poor light or while the tank is being shaken about; fixed attention upon the enemy and alertness in firing—all these qualities are vital for the tank gunner. The driver must know how to co-operate with the gunner by driving smoothly while the guns are in action.

When the vehicle is in motion machine-gun fire is effective up to five hundred yards and cannon fire up to about one thousand yards. The French training regulations state that "the tanks can use their armament at short range with precision and rapidity." The British training regulations have this to say: "One must clearly bear in mind, however, that the mission of the tanks consists not merely in gaining a certain objective but in locating and eliminating all resistance from machine-gun and small-arms fire . . ." to which I may add "and from tank cannon fire."

Of course when stationary the tank can fire effectively on more distant targets. When the situation and a due regard for the cohesion of the tank unit permits, fire from the stationary tank is preferable to fire from the moving tank. Yet this opportunity will rarely present itself in an attack by large units. Hence fire from the vehicle in motion constitutes the essence of tank gunnery training.

Possessing both strategic and tactical mobility, mechanized forces may be more speedily concentrated and employed than any other ground force. This inherent characteristic of the mechanized arm permits surprise, and the preparations for the attack must aim to get it. This calls for the utmost abbreviation of preparatory measures. The concentration must take every advantage of speed and darkness. Also necessary are careful traffic regulation, timely storage of most urgently needed supplies, and precise and comprehensive orders. In 1918, at Amiens, the British successfully concentrated their tank forces within two nights. During the night of August 6–7 the tanks occupied the concentration zones located two to three miles behind the front, from whence they proceeded the following night to the line of departure about one thousand yards behind the front line of the infantry. In the future the speed of the modern tank will generally render it unnecessary to occupy a special line of departure but will permit the mechanized forces to launch an attack from a concentration zone out of range of the hostile artillery, unless terrain obstructions and other circumstances demand the employment of a different method. The concentration zones must provide concealment and contain a good road net, for in these areas the tank forces make their final preparations for the attack, refuel, feed the troops, and replace crews wearied by long marches. Necessary reconnaissance and liaison with the other arms must be established.

The reconnaissance should take up no more time than that of the other arms. Expert map reading, correct evaluation of aerial photographs, and, in certain instances, a personal air reconnaissance of the zone of attack by the tank commanders must furnish the basis for the attack orders. Careful determination of the various approaches in friendly territory, especially for night movements, will add greatly to a smooth traffic flow. Guided by an ample number of road signs and traffic guards, the tanks may reach the concentration zones quietly and without the use of lights.

From the concentration the tanks develop for the attack. By development is meant an advance equal in width and depth to the combat formation that the tanks will assume. The individual units should remain in column to take advantage of roads, negotiate narrow defiles, and pass through the front line without interfering with the other arms already deployed there. Greatest care must be taken to avoid disturbances to the communication service.

A favorable time for the attack is at dusk or, better yet, at dawn, when fog, smoke, and poor light reduce the field of vision of the defending side to a few hundred yards, thus minimizing the effect of the hostile defensive weapons. Camouflage, artillery fire, smoke screens, air activity and attacks simulated along other parts of the front, all tend to divert the attention of the opponent from the actual zone of attack. A simultaneous advance made on a wide front will help disperse the hostile fire effect.

Immediately before entering actual combat the tanks change from the development to the combat formation. Until the tanks open fire, all maneuvers that take place within sight of the enemy must be at great speed, and advantage must be taken of all cover offered by the ground. A terrain which slopes toward the enemy will help to increase the speed of the attack and consequently favor surprise effect. Topography to a large extent determines the direction of the tank attack; it is more important to assign the tank units favorable ground than to co-ordinate their attack with that of other arms on unfavorable ground. Thus, driving home a powerful and uniform attack on a wide front and in great depth, the mechanized forces may take the enemy by surprise and penetrate his front. Each component of the tank brigade must endeavor to gain its objective as rapidly as the hostile resistance permits. Provided all weapons are held in readiness to open fire without delay and the crews are well trained and constantly on the alert, the fire action may be executed with great force and at most effective ranges. For it is the actual fire effect which, in the end, determines the moral effect of the tank attack.

From the foregoing we may draw certain conclusions regarding the conduct of the combat. Firing requires that speed be reduced to between 7 to 12 mph, depending upon terrain and vehicle types. This speed range will permit an accurate aim. The tactics must be simple and permit of an effective use of the weapons, without causing mutual interference between the tanks.

The platoon of three heavy or medium tanks or of five to seven light tanks comprises the lowest tactical unit. The platoons cross the terrain in line or wedge formation, with about fifty yards' interval between tanks. Preparatory to the attack, the companies form in waves. The companies of light tanks, which constitute the first wave, often are directly supported by a number of medium tanks armed with cannon; Great Britain, in particular, favors this practice. Similarly disposed are the battalions, which form in several lines. The brigade may form its regiments either in waves or in line. In the former case the regiments generally will form their battalions in line; in the latter they will form in column or echelon. All commanders must post themselves far in front, where they may constantly supervise the advance of their units and bring their personal influence to bear.

Each wave and, within it, each unit must receive a clearly defined combat mission. For instance, if the mission be to penetrate the hostile front, the orders would read: "First wave will penetrate to and eliminate the hostile command posts and reserves. Second wave will silence the hostile artillery. Third wave will attack the hostile infantry and contain

it until the friendly infantry has moved up. Upon accomplishment of its mission, third wave will follow the commander of the tank forces and remain at his disposal."

The zone of attack covered by a tank brigade of four battalions measures one to two and a half miles in width and two to three miles in depth. The width corresponds to about that of an infantry division; however, the tank brigade brings a larger number of light and heavy firearms into action in the forward zone of combat.

At the end of the tank attack the various units are reorganized for further employment. At this point it may be necessary to bring up ammunition, supplies, and reinforcements and replace worn elements by fresh ones.

The most dangerous foes of the tank and anti-tank weapon are hostile armored forces. Therefore, they must be attacked first. Hostile tanks may be initially engaged by fire delivered from a stationary front of tanks and anti-tank guns, but if this be not feasible, or if it becomes necessary to interrupt the fire, the tanks must change to combat in motion. Since fire will determine the outcome of such an action it is important to maintain order among the various tank units and adhere to a prescribed rate of speed so that the fire may be effective. Intelligent utilization of the ground will help to reduce losses, and in certain cases it may be of advantage to use smoke screens. But fire control and a high standard of gunnery training are the factors that will contribute most toward victory. And, once launched, an attack on hostile armored forces must be carried through to annihilation; other missions must wait until that one is accomplished.

Infantry

In the matter of co-operation between mechanized forces and other arms there exist two directly opposing views. The advocates of one contend that the infantry is the principal arm and that all others merely exist to serve it. They believe that the tank must move no faster than the foot soldier. In a sense it should constitute a moving shield for the infantryman who is unable to attack in the face of hostile machine-gun fire without this protection. The inherent speed of the tank is not to be exploited. For the sake of the infantry the adherents of this conception are willing to accept the considerable tank losses which these tactics make inevitable. They take little account of the strategic potentialities of a speedy armored force. The protagonists of the other school look far into the future. They are not much inclined to co-operation with other arms. They prefer to combine the armored forces in purely mechanized units and use them primarily against the enemy's flanks and rear or on large-scale raids that reach far into hostile territory. By taking the defense by surprise they would overcome road obstructions, difficulties of the terrain, and fortifications. They expect this method of employing the mechanized arm to decide the war.

In point of fact various unresolved technical difficulties handicap this adventurous conception to such an extent that, for the time being, it is better to compromise between these two schools of thought. Therefore, we seek a solution that will permit the mechanized force to support the other arms and at the same time take full advantage of its strategic and tactical potentialities. Above all, we must be careful not to hamper the development of the mechanized arm by adopting a rigid and inflexible organization or by saddling it with obsolete tactical conceptions.

Co-operation is necessary, for, like any other arm, the tank is incapable of solving all combat problems by itself. This necessity for co-operation

imposes certain obligations both upon the armored forces and the other arms. These obligations are especially binding upon the arms which are suited for habitual co-operation with tanks. On this point the German training regulations state:

> The commander must synchronize tank operations and their support by the other arms. Within the tank zone of attack the action of the other arms depends upon that of the tanks.

The British regulations say, in substance:

> The conception that armored cars must always operate in close liaison with cavalry or infantry is obsolete; armored cars are weapons of opportunity. They can exploit their inherent strength best at the time and place and with the combat methods that best suit their characteristics.

The British point out that the direction of an attack is selected with regard to its tactical results, regardless of whether or not it runs parallel to that of the infantry. The German regulations say much the same thing in a different way:

> The ground is of decisive importance [for the direction of the attack]. Close contact with the infantry will deprive the tanks of their advantage in speed and possibly sacrifice them to the hostile defense.

Of late there has been a return to the conceptions that prevailed during and shortly after the World War. In Great Britain the maneuvers of 1935 were marked by close teamwork between tanks and infantry. The tank brigade was divided and a tank battalion attached to each infantry division, despite the fact that the British tank is not ideal for joint action with infantry. The British vehicles, on the whole, are too speedy and too large, and their armor is too weak for this purpose. Tank units larger than the battalion were not used. Because of this division of strength the effect of the tank was negligible. Nor did the motorized infantry brigade play a decisive part in these maneuvers, for it operated in close contact with the foot troops.

The British explain this return to World War tactics by claiming that the introduction of a heavily armored, low-speed accompanying tank would materially reduce the disadvantages cited and permit close cooperation with the infantry. However, in order to be proof against the minimum caliber (25-mm.) anti-tank gun, armor must exceed a thickness of 30 mm. The weight of such armor would require a much bigger power plant, hence a much larger tank. And the cost of producing such tanks in large numbers would be tremendous. Yet only a large number could effectively support infantry.

But even disregarding the cost, there are important strategic and tactical objections to the organization of separate low-speed tank units for the infantry. The tank units that are designed for strategic purposes may also be used tactically, either as entire units or divided. On the other hand, it would be impracticable to combine the division tank battalions for strategic employment. Aside from the fact that their equipment is not suitable for missions of this kind, the combined force would lack the requisite headquarters and could not produce them at will. The greater the speed of an arm on the march and in combat, the more important that it and its commanders be trained in units that are organized in peace the same as they would be in war. In this respect we have a valuable lesson in the misfortunes suffered by the German cavalry in 1914 as a result of untrained staffs, poor communications, inadequate equipment, and faulty march technique on the part of large units: all of this can be attributed to its prewar organization. With the exception of the

Guard Cavalry Division, the cavalry was parceled out to the infantry divisions by brigades—a peacetime practice that had an unfavorable influence on the early operations of the large cavalry units. This error should not be repeated with our armored forces. Slow infantry tanks, even though their armor be reinforced, will be unable to execute their mission in infantry combat if speedier hostile tanks are encountered. The slow tanks have no chance against a similarly armed opponent of greater speed. In this connection Major General J. F. C. Fuller says:

> . . . infantry cannot under their own fire attack infantry equipped with magazine rifles and machine guns. . . . They can do so only when supported by a dense shell barrage or when led forward by tanks, in which case they are but a drag on the free movement of these machines. To give them special tanks for this purpose is merely to restrict the value of these weapons. . . . (*The Army in My Time*)

In an article published in the *Army, Navy & Air Force Gazette* of September 26, 1935, General Fuller says:

> Even if the frontal attack is persisted in, and even if infantry are to continue to assault—seeing that most enemies we shall meet in the next war will possess three to four times the number of machine guns they did in 1918; will have an artillery designed and trained in anti-tank tactics, and will be equipped with fast-moving tanks (the most effective of anti-tank weapons)—is it sane to suppose that in this war a slow machine will be superior, even as a protective weapon to infantry, to a fast machine? It will have more machine guns to destroy and more anti-tank projectiles fired at it, and if attacked by fast-moving tanks it will be bunkered.

Although certain British views lean toward independent employment of tank forces, the French continue to demand closest co-operation between infantry and tanks. The latest edition of *Réglément d'Infanterie, Deuxième Partie (Combat), 1935,* cites tank figures that are based upon the technical development of the tank as of the final phase of the World War. For instance, light tanks are given a maximum speed of 7 km.p.h., a combat speed of 2 km.p.h., and an average speed on tracks of 3.5 km.p.h. In other words, the regulations treating of co-operation between infantry and tanks refer to an old equipment whose speed in combat is no greater than that of the infantry.

The French call for close teamwork between the two arms and make it a rule to subordinate the tank units to the infantry. Infantry and tanks both are assigned the same objectives. The tanks are to withdraw rather than to advance independently beyond the objectives of the infantry. As a rule, the attack of an infantry company is to be supported by a platoon of tanks, that of a battalion by a company of tanks.

The principles governing the employment of the modern French tanks have not yet been released. According to a number of statements published in the French press, the modern French tank is more heavily armored, carries more powerful guns, and is a good deal faster than its World War forerunner. Discussions of the new Tank D in current publications indicate that, despite these technical improvements, the French continue to rely mainly on close co-operation between tanks, infantry, and artillery. This conception, however, is not without opponents, even in France. For instance, Colonel de Gaulle, in his book *Vers l'Armée de Métier,* has this to say:

> The tanks, usually divided into three waves, form for attack a favorable distance to the rear. The first wave is made up of light tanks whose mission it is to establish contact with the enemy. The second or combat wave is composed of the mediums and heavies. . . . Finally comes the reserve wave which is designed to relieve the forward waves or to exploit their gains. . . . Leaving the

line of departure at a high rate of speed, the light tanks make the initial attack. Then, organized in large groups, the combat wave enters the battle. . . . The direction of attack will usually be oblique to the hostile front, so that resistance may be taken in flank. The advance must not be unduly delayed by the time-killing task of clearing the zone of attack. . . . In other words, the forward waves must merely clear a passage for themselves and then push on to their objectives as rapidly as possible. As soon as the tank attack shows results the infantry, too, will gain ground. The infantry may advance either by cross-country vehicles or on foot. Its mission is to occupy the ground that the tanks have seized. In many cases it may be necessary for the infantry to wipe out the final vestiges of resistance; to do this it will have to put its accompanying guns into action.

Modern tank forces must not be developed merely with the object of using them in direct support of the slow, laborious attack of the infantry. On the contrary, there must be tests to see whether it is possible to utilize the characteristics of the tank more fully, so that its effect may be more beneficial to operations as a whole. Several countries, for instance, are conducting experiments to discover ways and means of increasing the infantry's battlefield mobility, thus enabling it to keep up with a faster tank attack. There are several methods of accomplishing this. One is to issue the soldier a lighter-weight uniform and to remove his pack. Another is to motorize those rifle units designed for permanent co-operation with tanks. This method has already materialized in France in the form of the *dragons portées*. The *dragons portées* are largely equipped with Citroën-Kegresse cars—half-track vehicles of considerable cross-country ability. A number of these are now protected by light armor, proof against small arms.

Co-operation between tanks and infantry may be carried out in a number of ways:

(1) The tanks attack in advance of the infantry. The infantry follows, taking advantage of the neutralizing effect of the tank attack upon the hostile infantry and machine guns. The infantry supports the tanks by assaulting positions known or suspected of harboring hostile anti-tank guns. This situation will occur if the attacking force has to cross large exposed areas in gaining its objective.

(2) The tanks attack simultaneously with the infantry. In this case the infantry supports the attack in the same manner as above. This method is suitable if the enemy is close and the terrain favorable for the attack.

(3) The infantry attacks in advance of the tanks. In this case the infantry must be initially supported by other arms, especially by artillery and combat engineers. This method should be used if obstacles, such as rivers or blocked roads, prevent the immediate employment of tanks and if bridgeheads or passages must first be established.

(4) The tanks, jumping off from a different zone, attack obliquely to the direction of attack of the infantry. This method is contingent upon a suitable terrain.

In crossing the hostile zone of combat the tanks must clear a path for the infantry by destroying recognized targets—primarily anti-tank guns, heavy arms, and machine guns—and neutralizing suspected localities. Merely to push through the hostile combat zone with the idea of shattering the enemy's morale is not enough; the tanks must break the enemy's strength by the full use of their weapons and open a gap in the hostile defense system.

Rarely, if ever, will the tank attack completely wipe out the resistance of the hostile infantry. Individual machine guns will remain undiscovered or come to life again. Tanks can materially facilitate infantry action and, in many cases, will be indispensable in preparing the infantry attack, but they cannot take over the infantry's role in combat. The infantry's job lies in an immediate exploitation of the tank attack by a rapid advance. Nor

does the foot soldier pause until the ground seized by the tanks is definitely cleared of the enemy.

While advancing with tanks the infantry must maintain formations that permit it to move rapidly and must display signs that will enable the tanks to identify it as friendly infantry, especially in twilight and fog.

Artillery

Armored forces have also created new tasks for the artillery. In the World War, for example, it was practicable and advisable to cover a tank attack by an artillery barrage, but today the high rate of speed of a tank attack prohibits this method of support.

When tank units attack as part of an army, the division artillery assists mainly by firing a preparation; in this it must put forth its utmost effort. The shorter the artillery preparation, the more effective. If enough artillery is not available in the zone of attack, and if the concentration of adequate artillery and ammunition is so conspicuous and involves so much time as to render a surprise effect doubtful, it is advisable to dispense entirely with the preparation. In event of this the artillery will be charged with guarding the tanks and firing on any targets that might endanger their attack.

As a rule the artillery must shift its fire out of the zone of attack simultaneously with the opening of the tank assault. It may then box off the flanks of the zone of attack, shell suspected anti-tank positions, or engage localities unsuitable for tank attack, such as woods and steep slopes. These tasks may be carried out partly with high-explosive shell and partly with smoke projectiles. While this requires great attention and expert fire control, it is facilitated by modern means of communication, especially radio.

This type of support does not reach very deep into the hostile zone of action. Furthermore, it is impossible for the artillery observation posts to keep up with the rapid development of the tank attack. And, finally, an aggressive artillery would not be content to see itself limited to such a small battle role. Actually it is the aim of the artillery of all armies to participate in the tank attack and, with this end in view, to motorize its components. Motorized artillery may be either motor-drawn or self-propelled. Drawn artillery has been the rule so far. Its advantage lies in the divisibility of gun and tractor; the tractor can be easily exchanged and does not have to be taken into the firing position. The question of weight is of little consequence in motor-drawn artillery.

The self-propelled mount is something new; it possesses the advantage of constant readiness for fire, combined with constant readiness to move. It gives a great radius to the individual gun and to the entire battery. It also has a certain degree of armor protection. Self-propelled artillery seems to be a desirable companion of tank units. Great Britain has employed several types of this artillery for some time, and both the United States and the U.S.S.R. are experimenting with it.

As to the tactics employed by this artillery, Colonel de Gaulle says:

> The rapid development of combat will not permit artillery to carry out missions in the manner customarily established for the opening of an attack. It cannot be assigned definite zones of fire as in position warfare; nor can its firing data be prepared with mathematical accuracy. On the contrary, as soon as the hostile position is taken, the artillery fire must keep up with the rapid development of events. In other words, the artillery must tread closely upon the heels of the attacking elements not only with its guns and combat trains but with its observation and communications sections as well. Thus, the artillery itself becomes a *masse mouvante* whose components, on their own initiative, select

the most favorable positions in accordance with the needs of the situation and deliver their fire from all angles on the most fleeting of targets. When it is equipped with anti-tank weapons and machine guns the artillery can protect itself. It compensates for lack of established position, inability to deliver indirect fire, and the loss of uniform fire control by its mobility, direct observation, and inherent independence.

In this description Colonel de Gaulle gives his idea of an ideal artillery. He calls upon it to discard habits acquired in a long war of position, with its reliable firing bases, its careful, studied survey methods, and its abundance of time, in order to be capable of speedily following the tank attack.

Chemicals

Smoke screens are becoming more and more important as an adjunct to the tank attack. Three main forms of employment can be recognized: (1) smoke projectiles fired by artillery in position during the preparation and at the beginning of the tank attack; (2) smoke projectiles fired by self-propelled artillery accompanying the tank attack, and (3) smoke produced by the tanks themselves.

There is nothing new about the first method. It is used to blind enemy observation. So, too, screens are laid down between the advancing tanks and localities suspected of harboring enemy troops or anti-tank guns. This enables the tanks to approach the enemy unobserved or outflank and invest him without drawing fire. Smoke may also be used for purposes of deception.

When smoke is fired by self-propelled artillery accompanying the tanks, the fire is executed by platoons or batteries. These guns travel immediately in rear of the forward tank waves and seek to blind any anti-tank guns that put in their appearance. Smoke projectiles are fired by trench mortars or by guns of 105-mm. caliber or larger. In England light, medium, and "close-support" tanks are combined into companies with the object of assuring teamwork between tanks and accompanying artillery.

Originally great results were expected from the method of tanks concealing themselves by self-produced smoke. It was soon found, however, that, owing to the conspicuousness of its source, the smoke tends to reveal the position or course of the tanks. The tanks travel either within the smoke or—still worse—are clearly outlined by the screen they have just laid. Therefore, it is only under the most favorable weather conditions that this method can be used in the attack. On the other hand, it may serve to facilitate a withdrawal.

Tank crews are relatively immune to gas. This applies particularly to corrosive gases used in the contamination of an area. Protection is furnished either by the gas mask or by the overpressure maintained in the interior of the tank. Some countries are trying to make tanks that are inherently gasproof; others are experimenting with filters to purify the incoming air. The U.S.S.R. mentions tanks equipped with a gas-blower apparatus.

Engineers

The tanks have given the combat engineer some knotty problems to solve, especially in getting them over streams, marshes, and soft ground, and in removing obstacles, particularly mines. Minor tasks of this nature may be carried out by the regimental pioneer sections, but major obstacles will usually require entire units of specially trained and specially equipped combat engineers.

Several countries, notably Great Britain and the U.S.S.R., have produced amphibious tanks that have proved highly satisfactory for crossing unfordable streams. It is to be assumed that these will be used for reconnaissance and for the establishment of bridgeheads.

Bridging material must possess a high carrying capacity because of the tremendous weights it is to support. On the other hand, bridges designed only for the accommodation of tanks do not require full decks.

Engineer units must be specially trained to recognize obstacles and schooled in ways and means of removing them. Particular emphasis should be placed on the removal of mine barriers.

Where engineers work in co-operation with tanks their jobs will ordinarily have to be accomplished in great haste and in sight of the enemy. If they are to reach their place of activity and be effective they must be protected by tanks. Some countries, especially Great Britain, have introduced bridge-carrier tanks and mine-sweeper tanks and placed them at the disposal of engineer units designed for co-operation with tanks.

Combat engineers will find another field of activity in operations against hostile field fortifications. A tank attack on field fortifications can be successful only if the size and strength of the obstacles do not exceed the capacity of the tanks. Whatever the obstacle, both the heavy and medium tanks are capable machines. For instance, the French heavy tank can negotiate a thirteen-foot trench, a slope of forty-five degrees, a vertical wall of six feet, a stream seven feet wide, and trees up to three feet in diameter. If the tanks are unable to negotiate the obstacles the engineers must go into action. Frequently they will be employed in advance as a precautionary measure. During the World War special anchors were constructed for the removal of wire entanglements, and fascines were carried along to be used in crossing trenches. There will be frequent calls for demolitions and excavations for the purpose of overcoming obstacles or enabling stalled vehicles to move on.

All of these tasks require training which in many respects goes far beyond the former sphere of action of the engineer soldier. Therefore, co-operation between tanks and engineers will be most successful if the latter are familiar with the characteristics of the tank and possess the requisite equipment. Irrespective of this requirement, however, the entire corps of engineers must train for co-operation with tanks in offensive as well as in defensive action.

Signal Corps

The width and depth of tank units and their motorized support weapons on the march and in combat, the dust clouds raised by them, smoke, fog, and rough or covered ground prohibit the use of visual signals in controlling units larger than a company. The swift maneuvers over wide areas which the tanks must execute even in combat make it impracticable to employ the field telephone except in quiet periods and during approach marchs behind the front. Therefore, we find that all command tanks carry radio transmitters, and even the light tanks carry radio receivers.

Signal troops designated for co-operation with tanks will therefore consist primarily of radio elements. Their task is to maintain communication from the commander of the tank unit down to the regiments and independent detachments, with adjoining troops, with the air service, and, in certain cases, with the next higher commander in the rear. Abbreviated codes and special signals must be used in order to assure the speedy delivery of messages and orders. To this end signal detachments

permanently assigned to tank units must receive special equipment and training.

Maneuver being rapid and it being necessary for the commander of a tank unit to be at the head of his command, only armored signal vehicles that possess a high mobility and full cross-country ability can meet his demands.

Air Corps

Information is valueless unless it be delivered to the commander in time for him to act on it. This means that reconnaissance elements must be speedier than the troops following them and must possess highly effective means of communication. These two basic requirements throw into sharp relief the difficulties that beset tactical and combat reconnaissance for speedy tank forces.

Aerial reconnaissance promises the best results. As early as the World War, the British High Command permanently assigned aviation to the Royal Tank Corps with good results. Air reconnaissance personally conducted by the commander of the tank forces before going into action may be of material advantage.

The reconnaissance aviator receives his instructions before taking off; supplementary orders or changes may be transmitted by radio or pickup. He reports either upon arrival at his landing field or by radio or dropped messages. Of course it must not be forgotten that the aviator cannot maintain continuous contact with the enemy and that his ability to observe still depends on weather conditions.

To allow for the high rate of speed of the tank unit, instructions must be issued carefully before the movements begin. The reconnaissance air forces must be acquainted with the plan of attack and, if possible, with the general course to be followed by the tank unit. Above all, they must be able to distinguish between friendly and hostile tanks. Even with this information the aviator may encounter difficulty in locating the tanks and establishing communication. He communicates by radio, by dropped messages, or by landing in the zone of action. Training should be conducted in all three methods.

Air reconnaissance must be supplemented by a fast, strong ground reconnaissance force which relays its messages either by radio or motor vehicle. At present the demand for speed is best met by wheeled vehicles, although their cross-country performance is inferior to that of track-laying types. Of course wheeled vehicles are more sensitive to obstacles.

Combat aviation can lend considerable support to a tank attack. As early as August 8, 1918, British airplanes effectively supported the advance of tanks by bombing and machine-gunning German batteries, reserves, and troop columns. Today, owing to the great improvements in anti-tank defense and to the mobility of the enemy's motorized and armored reserves, the employment of air forces against ground targets becomes increasingly important. By attacking such targets as mentioned and lines of communication, known locations of troops and headquarters, air forces will render it practicable for the ground attack to penetrate speedily the hostile zone of defense. Particular pains must be taken, however, to synchronize the actions of the two arms both in time and space.

The U.S.S.R. is working toward a still closer teamwork between air and ground forces, specifically the landing of infantry contingents by parachute. Landed in proper time, parachute troops may seize vital points in rear of the hostile front and then establish points of support and supply bases to assist the break-through by the tanks. Parachute troops working in co-operation with tanks may seriously damage and interfere with the hostile services of supply.

Antiaircraft

Since tanks will quickly attract the attention of hostile aviation, an antiaircraft defense must be provided. Tanks can contribute substantially to this defense by an intelligent use of their own weapons and by skillful camouflage. Though the danger is not to be minimized, only direct or very close hits will destroy the modern tank, and this is not an easy thing to do when the tank is in motion. On the other hand, an air attack that catches the tanks at rest with their crews dismounted or—worse yet—while fueling strikes them where they are most vulnerable.

Since most of the support weapons of tanks are not armor-protected, separate antiaircraft weapons must be furnished them. This applies also to all combat trains.

Supply

The supply problem is the ball and chain of the tank commander. The more far-reaching the plan of tank employment, the more vital and the more difficult this problem becomes. Tank units cannot fight indefinitely without drawing ammunition, rations, and fuel; nor can they stay in action without medical service, repair shops, and replacements. It is of paramount importance that fuel and ammunition be supplied in proper time.

When operating as part of an army tanks are supplied by the army; when operating independently they require a separate service of supply and a mobile base of operations. And in this connection it should be remembered that tank units will operate independently as soon as the desired penetration is accomplished, and particularly during an envelopment or investment of the hostile front.

Since a large part of the supply vehicles are unarmored, they require covering elements as soon as they enter the zone of hostile fire. Furthermore, since supply trains offer a prime target for the enemy's armored attack, the attached covering elements must have a liberal allotment of anti-tank weapons. On occasion it may even be necessary to withdraw armored cars or tanks from the front and assign them a protective role with the trains.

Conclusions

Since the mechanized arm, its supplementary weapons, and its various counteragents are still in a state of development, no final answers can be given to the problem of co-operation between armored forces and other arms. And yet there *are* certain conclusions which may be drawn from the evolution of the mechanized arm to date.

First, there are a number of fundamental elements which determine the construction, organization, training, and employment of armored forces. These are:

(1) The matériel on hand and its past performances.
(2) The domestic facilities for the manufacture of mechanized weapons.
(3) The maintenance and supply facilities, particularly with regard to fuel.
(4) The effect of the weapons fired from and against tanks, as determined by experience gathered on proving grounds.
(5) The organization of the command, as determined by maneuver experience.
(6) The order of battle.
(7) The nature of prospective theaters of operations.
(8) The armament of prospective opponents.

Although the various nations follow different routes in their development of the mechanized arm, they all move in a more or less common direction. This general trend can be summarized somewhat like this:

(1) The importance of aviation is incontrovertibly established and is admitted even by those who refuse, in general, to accept the doctrines of the Italian General Douhet. The air forces require the support of a partner on the ground who is in a position to supplement and exploit the results gained by aerial reconnaissance and combat. This partner must be speedy, aggressive, and strong.

(2) The older arms lack the penetrative power, mobility, and speed to carry the attack so rapidly and deeply into the hostile front that the enemy will not have time to take countermeasures. On the one hand, the defensive power of modern firearms and, on the other, the speed with which motorized reserves may be shifted to critical points prevent the older arms from decisively exploiting gains. If the defense has motorized reserves at its disposal the attack must also have motorized forces, and vice versa.

(3) The older arms cannot repulse the attack of strong armored forces. Even a large number of anti-tank guns cannot strengthen the defense enough to frustrate surprise attacks by large bodies of tanks. An attack of this kind must be met by tanks.

(4) On the other hand, the increasing effectiveness of the anti-tank defense calls for the utmost concentration of force on the part of the mechanized arm if decisive results are to be obtained. In order to be decisive, a tank attack must be launched on a wide front; this is to prevent the enemy from striking the spearhead of the attack in flank. The attacking forces must be organized in considerable depth in order to secure their flanks, effect a deep penetration, and roll up the flanks thus created. To be decisive, an attack must cover much wider zones than can be occupied by a brigade. In 1917, at Cambrai, three brigades, each three battalions strong, fought in a zone six miles wide without any organization in depth. In 1918, at Soissons, sixteen battalions attacked in two waves—twelve battalions in the first, four in the second—on a twelve-mile front. In 1918, at Amiens, fourteen British and French battalions (two battalions and several cavalry corps were combined in the second wave) attacked in a zone about eleven miles wide. The widths of the zones of attack employed in major operations during the last year of the World War must now be regarded as minimum in view of the defensive powers of modern armor-piercing weapons and armored forces. In the future many times the number of tanks that fought in 1918 will take part in battle.

(5) The tank attack must be carried out with the utmost speed in order to take advantage of the surprise effect. It must drive deep into the hostile front, prevent the reserves from going into action, and convert tactical gains into strategic ones. In other words, speed is the main requirement of armored forces. As the great Frederick said, "The faster the attack, the fewer men it costs. By making your battle short you will deprive it of the time to rob you of many men. The soldier who is led in this manner will gain confidence in you and expose himself gladly to all dangers." The swift execution of the tank attack being of decisive importance, the auxiliary weapons of tank units must be as fast as the tanks themselves. Auxiliary weapons designed for co-operation with tanks should be combined with them into permanent units comprising all modern arms. This should not be construed as meaning that the whole army must be motorized. Nevertheless, it must be emphasized that armored forces without speedy auxiliary weapons are incomplete and will not be able to realize their maximum potentialities.

(6) Even in earliest times armies included slow infantry and more mobile units, such as chariots, elephants, and horsemen. The numerical relationship between the two arms varied according to the ideas of the commander, the ability of the arms, the technique of the weapons, and the object of the war. In periods of indecisive position warfare the armies had to be content with a few mobile units. As a rule such times indicate a decadence in the art of war. Nobody desires them, but since nobody can predict them, they cannot be provided for. Great generals have always aimed at decisive warfare, which is another way of saying mobile warfare. To that end they have seen to it that the strength of their fast troops compared favorably with that of their slower ones. Alexander,

at the outset of the war against Persia, commanded 32,000 foot soldiers and 10,000 horsemen. Hannibal, at Cannae, had 40,000 dismounted and 10,000 mounted troops; Frederick the Great, at Rossbach, went into action with 27 infantry battalions and 45 cavalry squadrons. These few figures indicate that the great leaders maintained mobile elements comprising one fourth to one sixth of their entire strength. Similarly, modern mobile units can be of decisive value only if their strength is in due proportion to that of the whole army.

As early as his campaign in Spain, Hannibal entrusted his gifted brother Hasdrubal with the training and command of the mass of his cavalry. At Rossbach, Frederick placed 38 of his 45 cavalry squadrons under the brilliant General von Seydlitz. As a rule, improvisations of mobile units and their commands have proved of little value. Therefore, in the future mobile forces should have a uniform command even in time of peace and should be formed in large units. The leaders of those forces will do well to recall the trenchant expression of Frederick the Great: "Be active and indefatigable; cast off all indolence of body and mind."

It was my intention not to stray beyond the limits of the technical possibilities of today. Yet I could not deny myself the right to study new methods of employment for new weapons. There will always be men eager to voice misgivings, but only he who dares to reach into the unknown will be successful. The man who has been active will be more leniently judged by the future.

"Until then, we, whose fate is spun without our being conscious of it, are left to our own determination and courage and are consigned to the voice of our inspiration."

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