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THE ARMORED FORCE COMMAND AND CENTER

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The Army Ground Forces

HISTORY OF THE ARMORED FORCE, COMMAND AND CENTER.
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HEADQUARTERS ARMY GROUND FORCES

WASHINGTON 25, D. C.

314.7(1 Sept 1946)GNHIS 1 September 1945

SUBJECT: Studies in the History of Army Ground Forces.

TO: All Interested Agencies

1. The history of the Army Ground Forces as a command was prepared during the course of the war and completed immediately thereafter. The studies prepared in Headquarters Army Ground Forces, were written by professional historians, three of whom served as commissioned officers, and one as a civilian. The histories of the subordinate commands were prepared by historical officers, who except in Second Army, acted as such in addition to other duties.

2. From the first, the history was designed primarily for the Army. Its object is to give an account of what was done from the point of view of the command preparing the history, including a candid, and factual account of difficulties, mistakes recognized as such, the means by which, in the opinion of those concerned, they might have been avoided, the measures used to overcome them, and the effectiveness of such measures. The history is not intended to be laudatory.

3. The history of the Army Ground Forces is composed of monographs on the subjects selected, and of two volumes in which an overall history is presented. A separate volume is devoted to the activities of each of the major subordinate commands.

4. In order that the studies may be made available to interested agencies at the earliest possible date, they are being reproduced and distributed in manuscript form. As such they must be regarded as drafts subject to final editing and revision. Persons finding errors of fact or important omissions are encouraged to communicate with the Commanding General, Army Ground Forces, Attention: Historical Section, in order that corrections may be made prior to publication in printed form by the War Department.

BY COMMAND OF GENERAL DEVERS:

J. L. Tarr

J. L. TARR
Colonel, AGD
Acting Ground Adj General

1 Incl:
Historical Study

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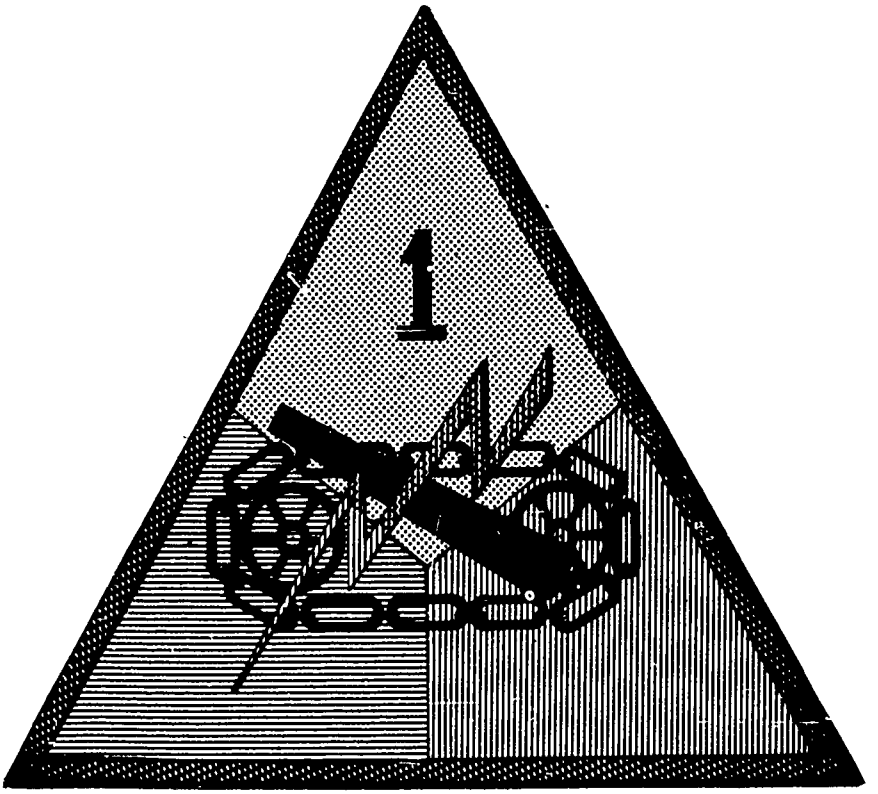
Prefatory Note

The history presented in this study is written from the point of view of officers who were directly responsible for the development of armor in the U. S. Army in World II. The facts were supplied by them or obtained from the files of the armored headquarters at Fort Knox, successively designated as the Armored Force, the Armored Command, and the Armored Center.

The history for the period from 12 July 1940 to August 1943 was written by Maj. Kenneth Hechler, under the supervision of the Historical Officer, Lt. Col. T. E. Sims. Later instalments were prepared by Sgt. William Gottlieb in the G-3 Section of the Armored Center, and by Sgts. Garver Wheeler and Manford F. Ettinger in the Public Relations Section, under a succession of Historical Officers. On the return of Colonel Sims from overseas duty in August 1945 he was appointed Historical Officer on full time and charged with the completion and revision of the history. In November Colonel Sims was relieved, and Lt. Col. William L. Wells, transferred from the 20th Armored Division, completed the history. The final draft was edited in the Historical Section, this headquarters by Major James M. Snyder.

Earlier drafts of the history were reviewed by Gen. Jacob L. Devers and Lt. Gen. Alvan C. Gillem, Jr., commanding the Armored Force and Command. The history finally submitted to this headquarters was reviewed by Maj. Gen. Charles L. Scott, Commanding General of the Armored Center at the termination of Hostilities.



ARMORED DIVISION
(with Arabic Numerals)

The Armored insignia and shoulder patch, symbolize the union of forces, each of which has a tradition worthy of identity, and which the union is not intended to sacrifice.

The predominating colors are those of the basic arms, yellow for Cavalry, blue for Infantry, and red for Field Artillery. The union of these three carries the symbol of the coordination of the components of the Armored Force.

The basic design and combination of colors are taken from the original insignia of the World War Tank Corps, and subsequent tank units of the Infantry. The superimposed symbols are taken from the original insignia of the Seventh Cavalry Brigade (Mechanized).

In the center of the patch is an outline of a tank track superimposed by cannon and a bolt of lightning. The superimposed symbols represent the characteristics of the Armor; shock action and armored protection (the tank track); fire power (the cannon); and speed and mobility (the bolt of lightning in red).

Chapter I

PRELUDE TO ARMOR

In World War I and World War II the development of tanks went through a cycle marked by three phases: the determination and drive of a few forward looking men; the inertia of the great majority too involved in routine to give their proposals serious attention or support; and the crucible of war forcing new ideas to the front. Inspired by the advanced thinking of its commanding generals and implemented by American inventive genius, its development could never have come about had not military necessity broken through the inertia of a peacetime Army.

The tanks of World War I were a product of military necessity. Trench warfare, the defensive power of maching guns, and a defensive spirit had sapped the offensive power of the Allied Armies. The British and French studied the problem; and with great secrecy, the British produced a number of lumbering armored vehicles which they led many people to believe were water carriers. Hence the name "tanks!"

The Tank Corps of the U. S. Army was created 26 January 1918 and Col. Samuel D. Rockenbach was assigned as its chief. Gen. George S. Patton, Jr., then a colonel, commanded the 304th U. S. Tank Brigade. American tankers distinguished themselves in the offensives at St. Mihiel,[1] in the Meuse Argonne, and, with the British, in cracking the Hindenburg line near Le Gatelet.[2]

It was assumed that tanks would always be used in support of infantry to batter down the strongest points of resistance. World War I tanks suffered frequent mechanical breakdowns, and then as now were always outrunning the infantry, but they destroyed the dominance of the machine gun and enabled the attack to go forward.

The National Defense Act of 1920 assigned the development of tanks to the Chief of Infantry. The Infantry inherited the remnants of the Tank Corps, which was inactivated in 1920. Battalions were broken into separate companies and assigned on the basis of one company to each division. Other units were formed into "infantry regiments (tank);" still others were inactivated.

Most of the early work in tank development was accomplished by the Infantry. An Infantry Tank Board tested many modifications and new equipment. The Tank School at Fort Meade, Maryland, trained large numbers of officers and men during the postwar period. In 1932 the School was moved to Fort Benning, Georgia, and in 1933 was renamed the Tank Section of the Infantry School in conformity with the National Defense Act. The course of instruction was for one year, during which both officer and enlisted students received thorough training in tank tactics, operation, and mechanics.

The Mechanized Cavalry Board performed functions similar to those of the Infantry Tank Board but looked to mechanization as a modern substitute for the horse whose importance had declined with World War I. Mechanized cavalry was consequently developed along the line of independent units, in contrast with the infantry idea of infantry-tank cooperation. The cavalry development of mechanization was based on tactics designed to exploit the mobility gained. As the mechanized cavalry program developed the need for a heavy full-tracked vehicle was met by using a "combat car" which was actually identical with the Infantry "tank." In this way the provision of the National Defense Act of 1920, assigning the development of "tanks" to the Infantry, was circumvented.

Secretary of War Dwight F. Davis visited England in 1928, and was much impressed by a tank demonstration at Aldershot. After returning he expressed his desire that something be done to develop a tank force in our army.[3] As a result an "Experimental

Armored Force" was assembled at Camp Meade, Maryland. From 1 July to 20 September 1928, this experimental force encamped. A War Department Mechanization Board studied the possibility of giving separate existence to the experimental force and recommended the expenditure of $4,000,000 over a period of four years to develop a mechanized force. A second experimental force was assembled at Camp Meade in 1929, the operation of which led the War Department Mechanization Board to recommend that a Mechanized Force be organized as an integral part of the Army.

In 1930 Congress appropriated $284,000.00, to implement mechanization plans -- a sum which, by 1945 standards, would barely equip a platoon of five medium tanks. Before General Summerall left the office of Chief of Staff in October 1930, he directed, "Assemble that mechanized force now, station it at Fort Eustis, Virginia. Make it permanent, not temporary." The mechanized force which assembled at Fort Eustis was pitifully weak in personnel and equipment. Old World War I Liberty trucks towed its artillery. The tanks were largely Renault relics of 1917-18. These and ten armored cars, (one of which was equipped with a radio) constituted its striking power. Almost every branch contributed personnel. Years later General Summerall stated: "In studying the problem I was convinced that the tank must be a part of an artillery-infantry-machine gun team."

LIEUTENANT GENERAL DANIEL VAN VOORHIS
"The Armored Force Has Sprung From the Seeds He Planted"

Colonel Daniel Van Voorhis commanded the Mechanized Force. Late in 1931, over his protests, the War Department disbanded the Mechanized Force and directed the existing arms and services to carry on the work of mechanization. The leadership of Colonel Van Voorhis during the early development of mechanization earned for him the title "grandfather of the Armored Force." In the Headquarters of the Armored Center at Fort Knox the portrait of General Van Voorhis is given an honored place among the portraits of Commanding Generals of the Armored Force.

A dozen years later General Van Voorhis explained:

> In person I pointed out to the then Chief of Staff and Deputy Chief of Staff that to assign the mechanized mission of the Army to one particular branch would be a great mistake; that mechanization was a problem which concerned all branches of the service and that they should not be deprived of the opportunity to develop mechanization as applied to their respective branches in a coordinated all-out mechanized effort; that I could not conceive of branches developing mechanization within their own respective spheres. 4

In 1931 the War Department decided that every part of the Army would adopt mechanization and motorization as far as practicable and possible. This policy decentralized the development of mechanization, and the various arms and services went their several ways to adapt it to their need in accordance with their own ideas. Whether mechanization would have developed quicker and along sounder lines had it followed the pattern of a separate force of combined arms visualized by General Van Voorhis is difficult to determine. On the eve of the formation of the Armored Force one of the firmest supporters of mechanization observed with regard to the policy of decentralization: "This proved to be a very wise move since at that time the exact trend of mechanizations's role and organization could not be foreseen ...."

The Cavalry was assigned the role of developing the reorganized nucleus of the Fort Eustis group. Camp Knox, Kentucky,[5] was selected as the new site in accordance with the recommendation of Colonel Van Voorhis, who believed that there it would not be dominated by the chief of any branch.[6] Shortly after the abandonment of the mechanized force stationed at Fort Eustis, Virginia, the 1st Cavalry Regiment moved to Fort Knox, Kentucky, from Marfa, Texas, and was mechanized. Colonel Bruce Palmer, who commanded it, assisted in developing the tactics and technique later used by the Armored Force. His views on the improvement of mechanized equipment proved to be sound and practical. He inspired and encouraged all officers under his command to think boldly and to use initiative. His progressive ideas continued to exert an influence long after he left the Mechanized Cavalry.[7]

Late in 1936, the 13th Cavalry Regiment, commanded by Col. (now Maj. Gen.) Charles L. Scott, was transferred from Fort Riley, Kansas, to Fort Knox, Kentucky, and mechanized. Long an advocate of mechanization, and one of the key figures in both the organization and development of the Armored Force, Colonel Scott's major contribution to Armor was in the fields of tactics and training.

Throughout the lean years when there was opposition both in and out of the Army, Adna R. Chaffee clung to his conviction that the army needed machines as well as men. He conducted a one-man campaign for mechanization while on duty with the Budget and Legislative Planning Branch of the War Department. Shortly after the Mechanized Force was assembled at Fort Eustis, Virginia, Lieutenant Colonel Chaffee was made second in command to Colonel Van Voorhis. He became post executive when the 1st Cavalry Regiment

was moved to Fort Knox, then after servir another tour of duty in Washington, returned to Fort Knox in 1938. The entire force at Fort Knox was merged to create the 7th Cavalry Brigade (Mechanized). Colonel Chaffee assumed command of the Brigade, and shortly afterward was promoted to brigadier general.

While the Infantry and the Cavalry were carrying on their experiments, the Command and General Staff School at Fort Leavenworth, Kansas, was spreading new ideas concerning the use of armor. Lieutenant Colonel Allen F. Kingman and Lt. Col. Sereno E. Brett, later brigadier generals, were the leaders in this field. Colonel Kingman was tank instructor at the School during the period 1933-1936, and Colonel Brett was his successor. Their opinions, together with the ideas of the other instructors at the Command and General Staff School, had a great deal to do with laying the foundation for the concept of an armored division. These officers visualized an armored (tank), mobile force, with great fire power, for use in the rapid attack of hostile rear areas.[8]

In 1938, the War Department revised its 1931 policy of decentralizing the development of mechanization as distinguished from motorization to all arms and services, and decided to centralize mechanization in the two combat arms which could best exploit its possibilities -- the Infantry and the Cavalry. Under the 1938 policy, the Infantry developed tanks as an additional supporting weapon to facilitate Infantry combat. Tank units organized for close support of infantry did not need reconnaissance and security elements.

On the other hand, the Cavalry, substituting the machine for the horse under the 1938 policy, looked to mechanized operations of a more independent character. The Cavalry extended its traditional missions, such as reconnaissance, pursuit, envelopment and exploitation of the break-through, and visualized a type of organization which had organic supporting elements including artillery, air, signal, and engineer units.

> "When you consider that ten years ago this whole question of mobile mechanization was nothing but a piece of paper on a desk in the War Department, I think the progress we have made is nothing short of remarkable, both in tactics and in capabilities of men and materiel."

wrote General Chaffee in the spring of 1939.[9] He had just cause to be proud. The First Army maneuvers in 1939 revealed the power of the Mechanized Cavalry Brigade. In his critique of the maneuvers, Lt. Gen. Hugh A. Drum commented:

> The Mechanized Cavalry Brigade had taught us many lessons. It is a powerful arm and a great asset. It is a psychological (morale) weapon as well as a tactical one. As the battle progressed, my troops first called it "the mosquito" - then "the hornet" - then "the devil" and at the end gave it a name I dare not mention.

The 7th Cavalry Brigade (Mechanized) lacked certain essential elements which differentiated it from the later armored division. The Brigade did not have the armor protection, and fire power possessed by medium tanks, it was low in reconnaissance strength, had no infantry, and was generally too small and light for the missions assigned to the armored division.

Constant efforts were made to expand the Mechanized Cavalry Brigade into a division. General Van Voorhis and General Chaffee took the lead in making these recommendations, and they had the hearty support of the Chief of Cavalry. The Chief of Infantry likewise backed any effort to expand Infantry tank units during the 1930's.

Yet the Chiefs of the two branches most intimately concerned with mechanization made no secret of the fact that their first love was the foot soldier and the horse. For example, the Chief of Cavalry wrote in a memorandum to the Chief of Staff in 1938:

> It (mechanized cavalry) has not yet reached a position in which it can be relied upon to displace horse cavalry. For a considerable period of time it is bound to play an important but minor role while the horse cavalry plays the major role so far as our country is concerned .... I feel that the psychology of the public as well as that of important key men in our legislative branches and men in the army itself has mistakenly become unfavorable to the horse ... We must not be misled to our own detriment to assume that the untried machine can displace the proved and tried horse. 10

Likewise, the Chief of Infantry, although he supported increases in tank units, opposed the actual conversion of any foot troops to tank units. Early in 1940, representatives of G-3 of the War Department General Staff presented to the Office of the Chief of Infantry proposals for converting various infantry units into armored units. They were vetoed.[11]

Meanwhile, the German blitzkrieg in Poland had stimulated new thought concerning the use of armored units. It took war-mad Nazis to demonstrate the efficiency of armored armies. Although all foreign nations had studied and tested armored equipment after the World War, Germany concentrated upon this phase of warfare. A special section of the German War Ministry Staff made a frank analysis of the experience of German armies during the World War and noted their consistent inability to exploit breakthroughs of the enemy front. A second subject of study, which provided the solution to the first, was the use of and defense against armor.[12]

The Germans did not hesitate to look abroad for ideas and undertook exhaustive research into the development of mechanization in England, France, Russia and the United States. Von Schell, later German Chief of Motorization, was one of several military visitors to the United States. He spent several months at Fort Benning, where he was graduated from the Infantry School, and visited factories and Army Camps throughout the country surveying American progress in mechanization. At Fort Knox, where he was a guest at the quarters of Col. Charles L. Scott for two weeks, he witnessed extensive demonstrations of the use of armored equipment and took copious notes on American ideas on organization and tactics of armored units. 13

General Van Voorhis says:

> It might be interesting to note that in 1933 I was advised by the War Department that two German officers, one an Ordnance tank expert from Germany, and a German Staff Officer attending our school at Leavenworth, would visit Knox to see what we were developing in the way of mechanization. These officers remained for three days and manifested a good deal of interest in our activity. They were not particularly interested in our equipment, which was certainly not very formidable at that time, but were interested in our conception of the proper equipment. They were keenly interested in our views on the proper tactical and strategical employment of mechanized forces .... As late as 1938 the Germans made frequent visits to Knox. I was very much interested when the Germans overran Poland to see how closely their operations

coincided with our conception of the employment of Armored Forces. 14

Though funds for American mechanization were meager and official opinion often lukewarm if not actually unfavorable, the Germans found in the United States isolated groups of men with sound ideas on the organization and employment of armored forces. They found the concept of mobile armored units and their function of exploitation developing in the mechanized cavalry and at the Command and General Staff School, the appreciation of tank striking power, and an understanding of the importance of the tank in the combined-arms action in the Infantry tank units and at the Infantry School. As early as 1930, well in advance of the formation of the German armored division, American pioneers were considering a similar organization.

An early study was prepared by Col. (later Maj Gen.) James Kelly Parsons as a result of observing our experimental groupings of mechanized units in 1930.[15] Colonel Parsons, then commandant of the Tank School at Fort Meade, drew up a plan recommending that six tank divisions be organized in the Army. Although certain elements of the study now seem rudimentary, (he suggested that artillery needed no armor protection, since it would always be in the rear; that foot troops were unnecessary "as their inclusion would unnecessarily restrict the radius of action and mobility of the Tank Division") it blazed a trail in the field. Capt. (later Col.) Emerick Kutschko, whose work in G-3 of the War Department General Staff played a large part in organizing the Armored Force, reports that Colonel Parsons proposed table of organization was "astoundingly similar to our Armored Division T/O of 1940, both in composition and strength. Had I discovered it sooner, it would have saved me untold hours of labor."[16]

The proposal to organize tank divisions in 1930 was rejected by General Summerall because the Army had "neither a standard tank nor satisfactory means of commanding and controlling fast-moving mechanized units." Nevertheless, the study was included for some years in the course of the Command and General Staff School where it was available to American officers and may have been seen by the Germans.[17] It will remain for a post-war examination of German documents to establish the degree to which American ideas and development influenced the organization, tactics and equipment of the German armored forces. Unlike the American Army, the Germans had the money with which to implement their ideas.

By 1937, three German armored divisions were ready for "maneuvers" in the Test laboratory of the Spanish Civil War. Ten panzer divisions were used in the Polish campaign to disrupt communications, installations, and morale behind the lines.

While the development of armor together with its tactical employment by the Infantry and Cavalry branches of our Army was independent of similar developments in Europe, the early German successes resulted in increased developmental activity by both branches. Even before the fall of Warsaw, General Chaffee had written a memorandum analyzing the reasons for German successes and urging the expansion of mechanized Cavalry along more adequate lines.[18] The Infantry tank resources were pooled in the winter of 1939-1940[19] by the formation of the Provisional Tank Brigade[20] under the command of Brig. Gen. Bruce Magruder. This Brigade included one full regiment and two separate battalions of light tanks, and one company of medium tanks. It comprised all Infantry tank elements except one company at Fort Lewis, Washington, and another company in Hawaii.

In making plans for the Third Army maneuvers to be held in Georgia and Louisiana, the War Department decided to assemble all the armored equipment and units except the two Infantry tank companies mentioned above. General Chaffee used this opportunity to gain additional supporting units. He wrote to Colonel Scott: "A month ago I went to Atlanta, and as an upshot of that and some missionary work in the War Department I

will have the Sixth Infantry in trucks attached to the Brigade for the period of the Third Army maneuvers ... So little by little we are getting the troops if not the name and dignity of a mechanized division."[21] Subsequently the historic Sixth Infantry, which traced its record back to 1769 and boasted thirty-one battle streamers, moved from Jefferson Barracks, Missouri, to Fort Knox for training with the 7th Cavalry Brigade (Mechanized) prior to taking part with the Brigade in the maneuvers.

Reasonably adequate supporting motorized troops were available to the Provisional Tank Brigade and the 7th Cavalry Brigade (Mechanized) during the maneuvers. The mechanized troops were the heart of the maneuvers, and were used in many combinations and changed from one side to another as the exercises progressed. This unprecedented concentration of armor and intimate contact of Infantry Tanks and Mechanized Cavalry marked a step toward unity of effort.

In the second phase of the 1940 maneuvers, a provisional Mechanized Force was tested, combining General Chaffee's Seventh Cavalry Brigade (Mechanized) and General Magruder's Provisional Tank Brigade. All preliminary training for this grand scheme was ruled out on the ground that "the operation would be a test of the initiative and resourcefulness of the unit to organize the means made available to meet a special situation."[22] "We are given 48 hours to organize a provisional Mechanized Force and move 75 miles into an offensive action" explained Colonel Gillem. Considering the time limitation and total lack of opportunity to work together, the makeshift force worked smoothly and inspired the leading officers to take thought of the future organization of such a unit.

During the Third Army maneuvers of 1940, it became plain to farsighted Infantry Tank and Mechanized Cavalry leaders that the development of mechanization under control of the traditional branches had followed lines which were too conservative for a rearming America. Mechanization needed preferential treatment in equipment and personnel, and it was being given a back seat and forced to play second fiddle to the horse and foot troops under the Chiefs of Infantry and Cavalry.

Following the maneuvers, in late May 1940, the officers participating were assembled for a critique in the auditorium of the Alexandria High School, Alexandria, Louisiana. Brig. Gen. Frank M. Andrews, Assistant Chief of Staff, G-3, War Department General Staff, gathered the leading officers of the Seventh Cavalry Brigade (Mechanized) and the Provisional Tank Brigade for an impromptu conference in the basement of the schoolhouse. It was the first opportunity that these officers had to exchange their views and combine their knowledge and experiences into definite recommendations. General Chaffee, General Magruder, (and his Executive, Colonel Gillem), General Andrews (and his Executive, Lt. Col. T. J. Camp), and Col. George S. Patton, Jr., were among those present at the meeting.[23]

The unanimous conclusion was that the unified development of armored units could no longer be delayed. It was further decided that it was not feasible to continue this development within either the Infantry or Cavalry arms, and that it must be conducted on a "non-sectarian" basis. As to equipment, it was agreed that the relatively large number of light tanks then on hand should be used, but that thereafter the production of medium tanks should be stressed.[24]

General Andrews immediately started these decisions moving in official circles, through a memorandum to the Chief of Staff.[25] By 10 June 1940, War Department plans had progressed sufficiently to hold a full-dress meeting to announce the decisions[26] to the Chiefs of Infantry, Cavalry, Field Artillery, Ordnance, Signal Corps, Quartermaster Corps, Medical Corps, Engineers, G-1, G-3 and G-4 of the War Department General Staff, the War Plans Division, and Generals Chaffee, Magruder and Scott along with Lt. Col. Sereno Brett.

This meeting still revealed the "old order" in military circles holding out to the bitter end by raising new problems and intimating that the task was impossible. General Chaffee, after listening to such talk for hours, cut through it with a clean stroke: "Speed is an essential... We must not stop and haggle over a lot of detail and figure out a lot of things that have been studied over by boards and by commanding officers in the field and tested in maneuvers time and again."[27]

When the smoky conference air had cleared, it was agreed that the recent German successes proved the value of armored units; that we had been going in the right direction, tactically and technically, although on too small a scale; and that all mechanized resources should be brought under one head to avoid duplication and to utilize our limited personnel and materiel to the fullest extent.[28]

A five man board was created to make recommendations for the development of equipment for armored divisions.[29] It consisted of the following officers:

Brig. Gen. Adna R. Chaffee (Cavalry)
Brig. Gen. Charles L. Scott (Cavalry)
Col. Gladeon M. Barnes (Ordnance)
Col. Sereno M. Brett (Infantry)
Maj. Ingemar M. Oseth (Infantry), Recorder.

Even before the curtain had descended on these meetings, the Nazi war machine had turned westward and its panzer units rolled through the Low Countries and France. Indecision and branch jealousy began to evaporate. The time for concerted action had arrived.

Chapter II

INITIAL STRUCTURE

The Armored Force was born on 10 July 1940. On that day the War Department issued a directive stating: "For purposes of service test, an Armored Force is created."[1] The words "service test" were used because the National Defense Act of 1920 made no provision for a separate armored branch, and prohibited such a move without congressional authorization. The Chief of Staff realized that congressional approval could not be secured for a large increase in the size of the Army to meet any but the most pressing needs. These most pressing needs were the strengthening of our foreign garrisons and the expansion of existing units to full table of organization strength.

The new unit was named "Armored Force" because of apparent objection by the Chief of Infantry to using the word "mechanized" in the title, and similar objection by the Chief of Cavalry to the use of the word "tank" in the title.[2] As it turned out it was a fortunate choice.

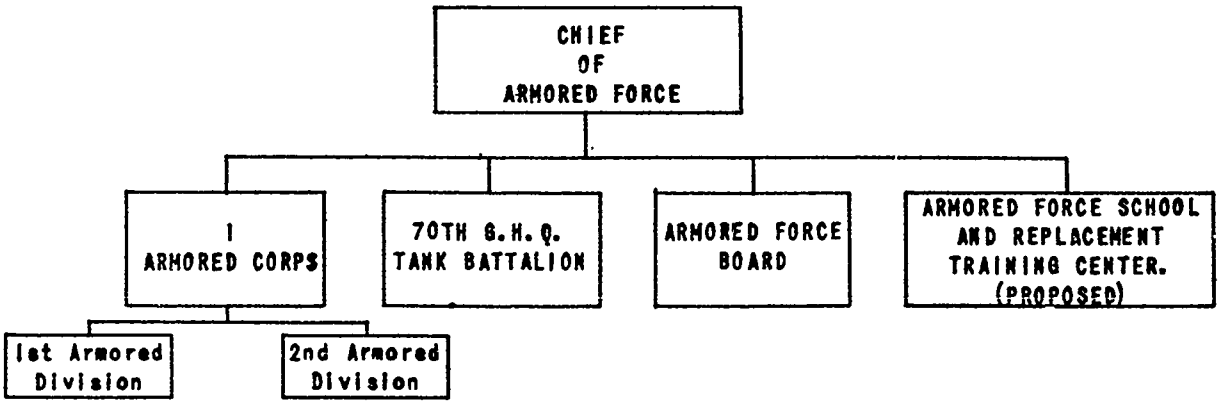
It came as no surprise when General Chaffee was designated as the first Chief of the Armored Force. To him fell the task of building a new military arm while America was at peace, and funds were limited. His untimely death on 22 August 1941 removed the man who did the most to bring about the organization of the Armored Force and who guided it in its infancy. The medical report found in General Chaffee's 201 file, stating "underweight 29 pounds as per table of weights in Par 11, AR 40-100," does not fully reveal his physical suffering during the year he commanded the Armored Force.

On the same day that the Armored Force was born, 10 July 1940, its leading officers met in the Officers' Club at Fort Benning, Georgia, to map organizational plans for the future.[3] Among those present were: General Chaffee, General Magruder, Colonel Alvan C. Gillem, Jr., formerly Executive of The Provisional Tank Brigade; Lieutenant Colonel Sereno E. Brett, Chief of Staff; and Lieutenant Colonel Charles H. Unger, Assistant Chief of Staff, G-3. The personnel at this meeting formulated the basic plans for the grouping and tactics of the new Force.

When it was established, the Armored Force had as its backbone the Seventh Cavalry Brigade (Mechanized) and approximately six battalions of Infantry tank units which had comprised the Provisional Tank Brigade. Five hundred and thirty officers and 9,329 enlisted men were made available or authorized for the Force.[4] Out of the above units the basic components of the Armored Force were organized: the I Armored Corps, composed of the 1st and 2nd Armored Divisions; the 70th GHQ Reserve Tank Battalion at Fort George G. Meade, Maryland; the Armored Force Board, to test new equipment; and the Armored Force School and Replacement Center, to train recruits and specialized technicians. (See chart, following this page).

Administratively, the I Armored Corps at first supervised the organization and training of the two armored divisions. These two divisions were activated on 15 July 1940, the 1st Armored Division under Brig. Gen. Bruce Magruder, and 2nd Armored Division under Brig. Gen. Charles L. Scott. General Scott, a cavalryman, was selected to command troops in the traditional center of Infantry activity, Fort Benning, Georgia. General Magruder, an infantryman, fell heir largely to Cavalry troops and established his headquarters at the center of mechanized Cavalry activity, Fort Knox, Kentucky. In some respects, this was unfortunate, for the general staffs of the first two divisions did not always see eye to eye with the general officers of a different branch background serving over them.

The initial directive of 10 July 1940 charged the Chief of the Armored Force with formulating tactical and training doctrines, as well as assisting in the development



of special transportation, armament and equipment used by armored units. His relationship to armored units (with the exception of the Field Artillery, Engineer, Signal, Ordnance, Quartermaster and Medical Corps elements) under his control was the same as the chief of a combat arm. The Chief of the Armored Force was at first also Commander of the I Armored Corps. This gave him the staff to carry out his administrative functions, but caused the I Armored Corps to lose some of its value as a tactical unit. This condition was corrected in May, 1941. The I Armored Corps was given a separate commander, and a Headquarters and Headquarters Company was set up for the Chief of the Armored Force.

The first General Staff was as follows:

Chief of Staff	Lt. Col. Sereno E. Brett
Assistant Chief of Staff, G-1	Lt. Col. Madison Pearson
Assistant Chief of Staff, G-2	Lt. Col. Percy G. Black
Assistant Chief of Staff, G-3	Lt. Col. Charles H. Unger
Assistant Chief of Staff, G-4	Lt. Col. Ernest N. Harmon

Although the two armored divisions comprised a majority of the troops, the 70th tank battalion (Medium) at Fort Meade, Maryland, under the command of Major Thomas N. Stark, was included in the organization as the first of a series of separate GHQ Reserve Tank Battalions. Initially, General Chaffee was burdened with administrative details growing out of his position as post commander in addition to his duties with the Armored Force. He wrote to the Commanding General of the GHQ Air Force at Langley Field for advice on the subject, and received a comprehensive report, to which General Chaffee replied:[5]

> I am very grateful to you for your prompt reply to my letter requesting information on the coordination of the Air Corps Base and the Wing Command. In it I find a great deal that will help me in establishing the post command

at Fort Knox along similar lines and divorcing the command of the post from the command of the Armored Force and the Armored Divisions, which are part of the Force.

When the Armored Force was established at Fort Knox in 1940, there were 864 buildings on the post. Following the passage of the Selective Service Act, and with the expansion of the Force, new buildings were constructed at the rate of approximately 160 monthly. By 15 August 1943 there were 3,820 buildings on the post. The acreage of Fort Knox more than trebled from about 30,000 acres in 1940 to 106,861 acres as of 15 August 1943.[6]

MAJOR GENERAL ADNA R. CHAFFEE
"Father of the Armored Force"

Effective 1 August 1940, General Chaffee was relieved of his duties as Post Commander, and a separate post staff was established.

The proximity of Fort Knox to such industrial centers as Detroit, Michigan, aided by the personal liaison maintained with private manufacturers in the area, helped the Armored Force considerably in its program of expansion. An even closer relationship was developed with the establishment by the Ordnance Department of the Tank-Automotive Center in Detroit.

The immediate problem of General Chaffee was to procure personnel adequately trained in mechanization. To hope that the Chiefs of arms would transfer everyone with a high efficiency rating and tank or mechanized cavalry experience was to wish for the millennium. In general, the Chief of Cavalry was to provide officer personnel for the units stationed at Fort Knox except for the Sixth Infantry (Armored). The Chief of Infantry was instructed to provide officer personnel for most of the units at Fort Benning, plus the Sixth Infantry (Armored) and the 70th Tank Battalion. At first Cavalry supplied officer personnel for headquarters and headquarters companies of armored brigades, light armored regiments and reconnaissance battalions; Infantry supplied officer personnel for Infantry regiments, medium armored regiments and GHQ Reserve Tank Battalions.

Less than a month after its organization, the Armored Force outlined its initial objective, all units must be prepared to take the field with available personnel and materiel by 1 October 1940.[7] That was an ambitious plan, especially in view of critical shortages in equipment. The Armored Force inherited about 400 more or less obsolescent tanks in 1940,[8] and a small number of armored personnel and weapons carriers. As constituted at that time, the armored division was to be equipped with 3,243 vehicles of which 1,140 were combat vehicles and 2,103 general purpose vehicles. Little difficulty was presented in securing scout cars and general purpose vehicles. But tanks and half-tracks presented a problem which taxed every effort of American industry. The lengthy process of industrial "tooling up" had not started. National defense appropriations were being pared down, and there was still the fear that an all-out industrial production program might find us with too many out of date weapons of war.

In tracing the development of the Armored Force, the contributions of the American automotive and locomotive industry must not be overlooked. The native American aptitude for large-scale manufacture of vehicles and refinement of the internal combustion engine made the transition to a war footing much easier. New methods of refining petroleum products were also an important factor.

When the Armored Force was first established, obsolescent tanks were used for training purposes. The rapidly changing design of the light tank was "frozen" in order to expand production, and M2A4 and M3 light tanks were being manufactured in sufficient numbers by the summer of 1941. There remained an acute shortage of medium tanks, as only 66 existing in June, 1941.[9] By the first anniversary of the Armored Force, the first M3 (General Grant) tanks started to roll off assembly lines, and with the new half-tracks simplified training problems considerably. The necessary diversion of equipment to combat outfits, and into lend-lease channels handicapped the units at home after war had been declared, and it was early 1943 before the Assistant Chief of Staff, G-4, Headquarters Armored Force felt that the equipment problem had been solved.[10]

Chapter III

ORGANIZATION AND TACTICS

General

As previously indicated, the Germans investigated and profited by American experience in mechanization in shaping their armored units. In much the same way, American pioneers adopted combat-tested German organization and doctrine in the original organization of armored force units.[1] There was complete willingness to sacrifice pride of authorship in order to put into effect forms of organization and tactics which were proving their effectiveness on the battle field, and which, consequently, could win acceptance at home. The swiftness and ease displayed by the Armored Force in absorbing German doctrine can be attributed to the fact that it involved no fundamental change of ideas for the men charged with the formulation of plans for American armor. Such men as General Chaffee, General Scott, Colonel Brett and others found only confirmation of their ideas in the German victories.[2] The type of program which they had urged repeatedly could be instituted once resistance at home evaporated before the convincing record of the German armies in Poland, the Low Countries and in France.[3] The basic concepts for the organization of the armored division were: the use of a team of combined arms, organization of armored units in mass to ensure sustained driving power, mobility of all elements, and unity of action.[4]

When they tested their armored units in the Spanish Civil War, the German High Command set up a divisional organization based on these concepts, with the following components:

Reconnaissance Battalion
Tank brigade of two tank regiments, each regiment consisting of two tank battalions, each tank battalion consisting of 79 lught and 18 medium tanks.
Motorized infantry brigade, consisting of two motorized rifle regiments and one motorcycle rifle battalion.
Artillery regiment, armed with 105-mm gun howitzers.
Supply echelon, consisting of medical, quartermaster and other service elements.

As a result of their battle experience, the Germans evolved a very flexible organization patterned in general along the following lines:

Armored Brigade: one or two tank regiments, plus staff, reconnaissance, communications and maintenance elements, (200 to 450 tanks).
Motorized Infantry Brigade: one or two motorized infantry regiments, plus staff, assault, reconnaissance and communications elements.
Artillery Antitank Regiment or Battalion: antitank guns of varying calibers.
Motorized Reconnaissance Regiment or Battalion: Light tanks, armored cars, motorcycles.
Motorized Antiaircraft, Antitank Regiment or Battalion: 15-mm, 20-mm, 37-mm, 88-mm, antiaircraft and antitank guns.
Engineer Battalion: bridge and ferry equipment.
Communications Battalion: telephone and radio equipment.
Supply, Maintenance and Medical Services: motorized equipment.
Attached Aviation: reconnaissance and bombardment units, antiaircraft units.[5]

In the invasion of Poland, attack and bombardment aviation closely supported the Nazi armored units. Although these units operated under army command, they were given missions deep behind the Polish lines and thus were in many cases independent.

Tactically, the Germans employed the principle of fire and movement by the combined arms, including the use of air and the fire power of one element to cover the maneuver of another. This principle, employed since the dawn of warfare, revolutionized the employment of Armored units. Neither the French nor the British practiced this principle when the war started. They clung to the older theory of independent tank or mechanized action, the use of accompanying tanks as support for the Infantry or for reconnaissance.

GENERAL JACOB L. DEVERS
"The Man Primarily Responsible
For Developing and Expanding
the Armored Force"

American tactical doctrine was based on the employment of divisions or larger units under the direction of corps and armies. German doctrine provided for the employment of armored units under the direction of corps and armies organized, equipped, and trained for this specific mission. Armored Force leaders strongly urged a similar method of tactical employment for American armored units, believing that this was the only means of insuring correct tactical employment in view of the highly specialized training, equipment, and technique required. The armored corps form of tactical employment of armored divisions was copied from the Germans and formed the basis of the armored tactical organization. As a result of the adoption of this system, four armored corps were activated under the control of Armored Force Headquarters to supervise and conduct combined training, including the employment of an attached motorized division.

The War Department felt that all higher commanders should be capable of employing armored units and adopted the expedient of attaching armored divisions to standard corps in order to train higher commanders and their staff in the correct employment of Armored units thus rendering the armored corps unnecessary. On 1 October 1943 the War Department directed that the II, III, and IV Armored Corps be reorganized and redesignated as the XVIII, XIX and XX Corps respectively.[6] This action resulted in the elimination of the armored corps from our military establishment. The I Armored Corps had previously been inactivated overseas, and the personnel of the corps used in forming the headquarters of the Seventh Army.

As the Germans profited by combat experience, they increased the proportion of medium tanks and limited the use of light tanks to reconnaissance and liaison. They strengthened the antiaircraft and antitank defenses of the division when they began to meet stiffer resistance than they had encountered in the sweep through Poland. They employed combat teams within their brigade set-up, utilizing a mixture of light and medium tanks in each team.

The Germans used the time-honored principles of aerial and ground reconnaissance, "softening-up" by artillery and dive-bombing, clearance of obstacles by the engineers, a swiftly-moving mass of tanks to a weak spot in the enemy's line or to envelop his flanks, the destruction of the enemy's vital rear installations by the armor, and the infantry clean-up. Superior power at the decisive point was the key to their success. This summary of their tactics does not do justice to the refinements employed to meet varying opposition and terrain. Speed, surprise, mass, and teamwork were the essence of the German Armored attack.[7] It is not a reflection upon, but rather a tribute to leaders of the Armored Force that they took over German organization and tactics and adapted them to American equipment and to the American soldier.

The following units comprised the Armored Force when it was organized on 10 July 1940:

1. <u>I Armored Corps</u>

   a. Hq & Hq Co, I Armored Corps, Fort Knox, Kentucky
   b. (1) 1st Armored Division, Fort Knox, Kentucky

      Hq & Hq Co, 1st Armored Division
      1st Reconnaissance Battalion (Armd)
      1st Armored Brigade:
        Hq & Hq Co, 1st Armored Brigade
        1st Armored Regiment (L)
        13th Armored Regiment (L)
        69th Armored Regiment (M)
        68th Field Artillery (Armd)
        16th Engineer Battalion (Armd)
      6th Infantry (Armd)
      27th Field Artillery Battalion (Armd)
      47th Signal Company (Armd)
      19th Ordnance Company (M Maint) (Armd)
      13th Quartermaster Battalion (Armd)
      47th Medical Battalion (Armd)

      (2) 2nd Armored Division, Fort Benning, Georgia

      Hq & Hq Co, 2nd Armored Division
      2nd Reconnaissance Battalion (Armd)
      2nd Armored Brigade:

Hq & Hq Co, 2nd Armored Brigade
66th Armored Regiment (L)
68th Armored Regiment (L)
67th Armored Regiment (M)
14th Field Artillery (Armd)
17th Engineer Battalion (Armd)
41st Infantry (Armd)
78th Field Artillery Battalion (Armd)
48th Signal Company (Armd)
17th Ordnance Company (Armd)
14th Quartermaster Battalion (Armd)
48th Medical Battalion (Armd)

2. GHQ Reserve Tank Battalion

70th Tank Battalion (M), Fort George G. Meade, Maryland

Basic Tactical Organization

It can be seen that the armored division was the basic element of the Armored Force. In the American division as in the German division, the tank brigade of about 400 tanks at first constituted the principal means of attack, and was the core around which the other elements were built.

The Armored division was designed for rapid offensive action against vital rear installations which were to be reached by breaking through a weak point on the hostile front, or by enveloping an open flank. The Armored division was not to be directed against the strong points of the enemy's line.[9] When a weak point in the enemy's line was penetrated, the flanks were rolled up to permit Armored divisions to pour through.[10]

It was expected that armored units would be used for pursuit and for exploitation of initial breakthroughs. To achieve these ends, surprise, rapidity, teamwork, and sustained striking power were necessary. The organizers of the Armored Force strove to retain the highest mobility and flexibility commensurate with a powerful striking force.

In the early days of the Armored Force, the Infantry-Tank and Mechanized Cavalry tactical schools of thought still struggled for supremacy. As one G-3 officer stated it, it was a case of the Cavalry "raised pistol and charge" versus the Infantry "look before you leap." Brig. Gen. T. J. Camp described the way in which the two doctrines were merged, in the following analogy:

> The army now has a wonderful bird dog that can find and flush birds over a wider area than any dog that has ever been. This new breed of dog is being used both by the cavalry and by the infantry. The cavalry has been unable to keep up with the new dog so they have turned them loose to flush the birds but no one keeps up to shoot the birds when they are flushed. The infantry has adopted a different policy. The bird dog is too fast for them so they have put a heavy chain on the dog and held him back to their usual pace. The real solution for the problem is not to hold the dog down and not to turn him loose but to keep the guns up to him and shoot the birds he can flush with his greater range and speed. This requires new tactics and organization.[11]

Because the first Chief of the Armored Force was a mechanized Cavalryman, as was the commanding general of the 2d Armored Division, a great deal of the early doctrine of the Force stemmed directly from mechanized Cavalry. General Chaffee stated, even

before the Force was formally organized, that the organization, doctrine and employment of the two reconnaissance battalions and the four light armored regiments should be strictly mechanized Cavalry.[12] General Chaffee stated that since the personnel of the 2d Armored Division was to be furnished from Infantry, Tank units, it was essential that the above units "be commanded and leavened initially by mechanized Cavalry officers." When he assumed command of the 2nd Armored Division, Maj. Gen. Charles L. Scott found the Infantry officers ready learners. In fact, he enthusiastically wrote to the Chief of Cavalry that the Infantry officers had been "champing at the bit on being held to limited objectives, and that they were taking readily to the independent missions employed by the Cavalry.[13]

Little attention was given to Field Artillery doctrine and the importance of tank gunnery during the early days of The Armored Force. The assumption of the rightful importance and place which it later came to occupy within The Armored Force came with the assignment of Maj. Gen. (later Gen.) Jacob L. Devers as Chief of The Armored Force on 1 August 1941.

Chapter IV

THE ARMORED FORCE: COMMANDERS AND PRINCIPLES

Under General Devers' command The Armored Force developed and expanded beyond even the dreams of its first chief. When he was succeeded by Maj. Gen. (now Lt. Gen.) Alvan C. Gillem, Jr., 11 May 1943, U. S. armor had been welded into a force comprising sixteen armored divisions and sixty-three separate tank battalions.

General Devers' background was primarily in Field Artillery. He had been an instructor in the Field Artillery School, and later had both instructed and commanded this branch at West Point. As a colonel he had served as Chief of Staff of the Panama Canal Department, returning to the United States in 1940 as a brigadier general to serve as senior Army officer on the Joint Army-Navy (Devers-Greenslade) Board selecting sites for the bases acquired from Great Britain in the overage destroyer deal. Within five months he was promoted to major general and placed in command of the 9th Infantry Division and of Fort Bragg, N. C., which was expanded from a small artillery post of 5,000 troops to the largest cantonment-type post in the world with a capacity of 65,000 troops. General Devers assumed command of the Armored Force on 4 August 1941 when the ailing General Chaffee retired.

The new chief was as bold and aggressive as the tactics of armor. He had no patience with purely administrative delay. The answer to red tape, he once advised a private, is to "Keep going and the tape soon breaks." He had a clear vision of long-range objectives. He believed the best way to promote the combat efficiency of The Armored Force was to concentrate topnotch personnel and equipment into armored units, and to centralize authority at Fort Knox. The spirit of independence and high esprit de corps of armored units may largely be credited to his efforts.

General Devers often told his staff that in this air-gun-tank war, the tank, like the battleship and the airplane, was nothing more than a mechanism to carry fire power to the enemy position, utilizing mobility of the tank for tactical and strategic surprise. The man or mechanism that slowed the achievement of these objectives was soon eliminated. He crushed the branch jealousy between the Infantry-Tank and Mechanized Cavalry elements of The Armored Force and insisted on a new Armored way of thinking. He would not allow anyone to play politics with human lives.

Like the flexibility of his organization, General Devers possesses a flexible and open mind in his approach to new problems in training, tactics, and equipment. His ability to get things done was incomprehensible to those who could not see long-range objectives as clearly. "I still have lots of trouble with the conservatives," he wrote after eighteen months as Chief. "They just can not see the light and are afraid to move."

General Devers built up a tremendous amount of personal support in industry and in the Army. This support proved of great value in an organization like The Armored Force, which depended for its strength upon a wide variety of arms and services, together with American industry for the tools with which to forge the armored thunderbolt.

During the period from the formation of the Armored Force until the establishment of the Army Ground Forces in March, 1942, practically all of the relations with higher headquarters were with the War Department General Staff. The War Department officer mainly concerned with Armored Force matters was Maj. Gen. Richard C. Moore, Deputy Chief of Staff. General Moore, although primarily concerned with equipment matters, was generally charged with preparing the major decisions of the War Department General Staff regarding the Armored Force. On only a few occasions did he find it necessary

to carry these decisions to the Chief of Staff. General Moore maintained frequent contact with the Liaison Officer of the Armored Force, and made it a standing policy that the Liaison Officer bring in to his office all visitors in any way concerned with Armored Force activities. He handled the more complex liaison work with Great Britain and Russia in connection with our armored contributions to the lend-lease program, in order to insure that sufficient equipment was reserved to American armored units.

Largely through the influence and support of General Moore, a spirit of independence was fostered within the Armored Force. The officers at Fort Knox were encouraged to develop direct contacts with other branches of the service, and to short-circuit normal channels in building up armored units. These contacts were particularly effective in the development of equipment with the cooperation of the Ordnance Department. As a result, the Armored Force, although suffering from many shortages of equipment, was perhaps better off in this respect than other branches of the Army.[1]

GHQ was not closely concerned with Armored Force matters,[2] although the primary interest of GHQ in training provided some supervision in this field.[3] GHQ training directives were followed closely but detailed supervision was not as close as was later undertaken by Army Ground Forces.[4]

A Liaison Office in Washington operated from the formation of the Armored Force until the reorganization of the War Department in March, 1942. The Liaison Officer maintained contact with the branches of the War Department, and represented the Armored Force on the committees of the supply branches, congressional committee meetings and budget meetings; passed on new developments, and in general kept the Armored Force and War Department informed about related subjects.

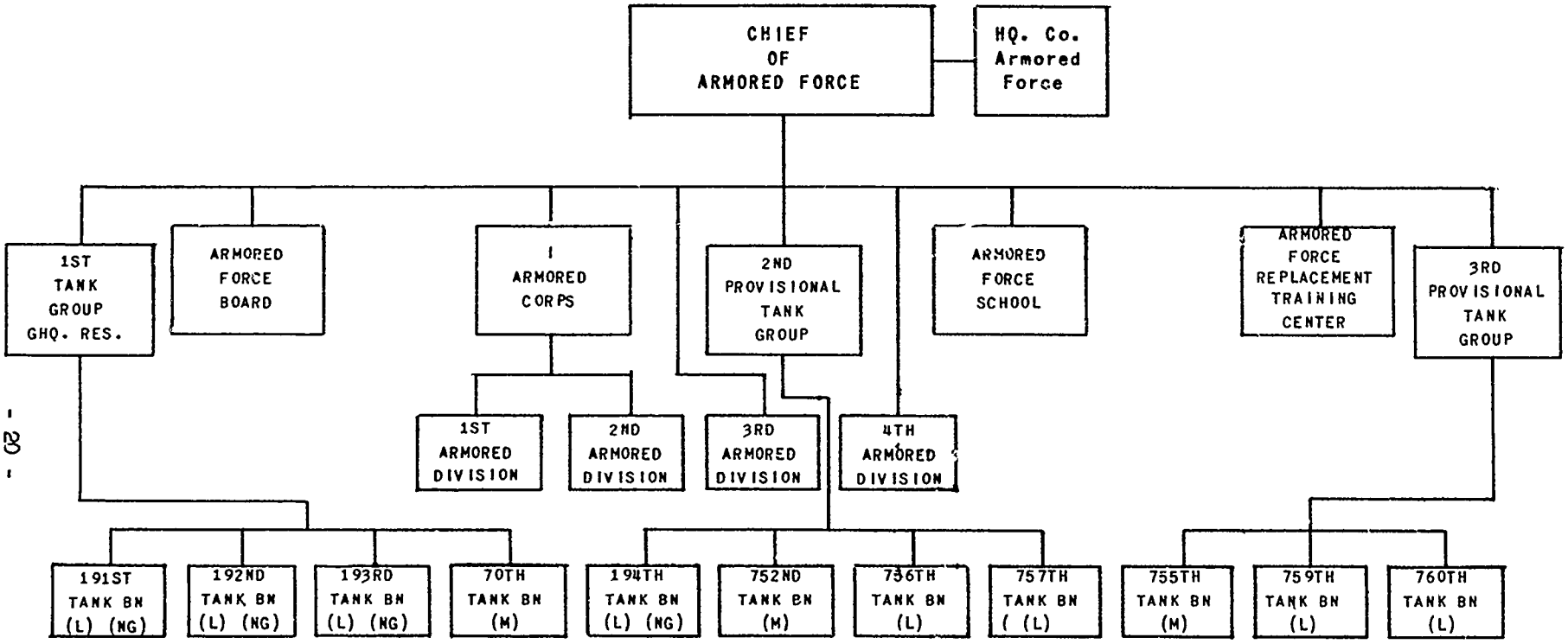
After March 1942, when Army Ground Forces was organized, the chain of command dictated that matters pertaining to the Armored Force should be channeled through Army Ground Forces. Direct contact between the Armored Force and the War Department General Staff practically ceased. This did not preclude the War Department General Staff from dealing with Armored Force matters of basic interest, such as Tables of Organization and redesignation of the Armored Force.

Maj. Gen. Alvan C. Gillem, Jr. was designated as acting Chief of the Armored Force when General Devers departed to take command of the European Theater of Operations. General Gillem maintained personal liaison with General McNair, commanding general Army Ground Forces, and relations between the Armored Force and Army Ground Forces became closer. With its redesignation as the Armored Command on 2 July 1943, the activities of the Armored Force became more closely coordinated with those of Army Ground Forces.

In contrast with the first two chiefs of the Armored Force, whose background had been Cavalry and Field Artillery, General Gillem was a product of the Infantry and Infantry-Tank tradition. He had enlisted as a private in 1910, had commanded a Machine Gun Battalion during World War I, and had later served with Infantry units in Siberia, Hawaii, and the Philippines. A graduate of the Command and General Staff School in 1923, and the Army War College in 1926, General Gillem had served on the General Staff of the Third Corps Area and as Professor of Military Science and Tactics at the University of Maryland. From 1935 to 1940 he was an instructor in Tactics at the Infantry School.

The formation of the Armored Force in 1940 found General Gillem commanding the 66th Infantry (Light Tanks) which he built up to a high state of training and efficiency. Later he served as Executive Officer of the Provisional Tank Brigade commanded by Brig. Gen. Bruce Magruder, the first commanding general of the 1st Armored Division. In April 1941 General Gillem was selected to command the new 3rd Armored Division and

1 July 1941


CHIEF OF ARMORED FORCE
HQ. Co. Armored Force
1ST TANK GROUP GHQ. RES.
ARMORED FORCE BOARD
I ARMORED CORPS
2ND PROVISIONAL TANK GROUP
ARMORED FORCE SCHOOL
ARMORED FORCE REPLACEMENT TRAINING CENTER
3RD PROVISIONAL TANK GROUP
1ST ARMORED DIVISION
2ND ARMORED DIVISION
3RD ARMORED DIVISION
4TH ARMORED DIVISION
191ST TANK BN (L) (NG)
192ND TANK BN (L) (NG)
193RD TANK BN (L) (NG)
70TH TANK BN (M)
194TH TANK BN (L) (NG)
752ND TANK BN (M)
756TH TANK BN (L)
757TH TANK BN ((L)
755TH TANK BN (M)
759TH TANK BN (L)
760TH TANK BN (L)

the following January was given command of the II Armored Corps. In August 1942 General Gillem took his Corps to the Desert Training Center, where, holding joint command of the Corps and the Center, he directed desert maneuvers.

In addition to his interest in tactics and training, General Gillem had been a pioneer in tank gunnery and armament. He was one of the first advocates of scrapping the sponson gun which permitted shooting only to the front, and the substitution of a turret mounted gun with 360° traverse. He fought side by side with General Magruder against the tendency of the Mechanized Cavalry school of thought to overburden the armored division with light tanks, and was instrumental in reversing the ratio in favor or a predominance of medium tanks.

LIEUTENANT GENERAL ALVAN C. GILLEM, JR.
"A Pioneer in Tank Gunnery and Armament."

Shortly after assuming command General Gillem renewed his interest in improving the M-4 medium tank, particularly the suspension system, electrical system, fire control equipment, armor plate, and antiaircraft defense. By conferences with Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance and his Staff, General Gillem carried on the cooperative spirit established by his predecessors.

When he assumed command of the Armored Force, General Gillem quickly took steps to hold officers to the line on training. Mincing no words in a letter to division and battalion commanders, he wrote: "I will hold the senior officer personally responsible

to the end that units will be efficiently officered and carefully trained." General Devers had spent a great part of his time on inspection trips; General Gillem was on the road for an even greater percentage of his time. He took to the field almost every week for thorough observations of the status of training and the development of armored units. He was especially concerned with the adequate training of the separate tank battalions, the armored infantry battalions, and other small armored units which sometime suffered from neglect by higher headquarters.

In the summer of 1943 General Gillem toured the North African and Sicilian battlefronts observing the training, tactics and equipment of armored units at firsthand. This tour confirmed General Gillem's conviction that closer coordination between tank and infantry units was necessary, and that the close infantry-tank collaboration could only be brought about by team training in the smaller units. General Gillem had long been an apostle of coordination and teamwork and his assignment as Commanding General of the Armored Force and Command gave him a rare opportunity to put his theories into practice.

1941 and 1942 were the years of greatest expansion for the Armored Force. On 15 April 1941, the 3rd and 4th Armored Divisions were activated at Camp Polk, Louisiana, and Pine Camp, New York, respectively. After Pearl Harbor, activations were speeded[5] and as the Armored Force expanded, and with the development of four armored corps it was frequently found expedient to release various units from Armored Force control. This procedure was uniformly adopted when units departed for maneuver areas or for the Desert Training Center.[6]

The status of detached units formerly under the jurisdiction of the Armored Force was not clarified until the Commanding Generals of Army Ground Forces and the Armored Force worked them out by conference in October, 1942. At that time General McNair and General Devers decided that Headquarters Armored Force would continue in close touch with the armored corps, divisions, groups and separate tank battalions, except where they were attached to Army Corps.[7] Although stripped of formal supervision over personnel, training and administration, Headquarters Armored Force still maintained sentimental attachment to its former charges, and often secured cadres from them through Army Ground Forces channels.

Attention to Combat Experience

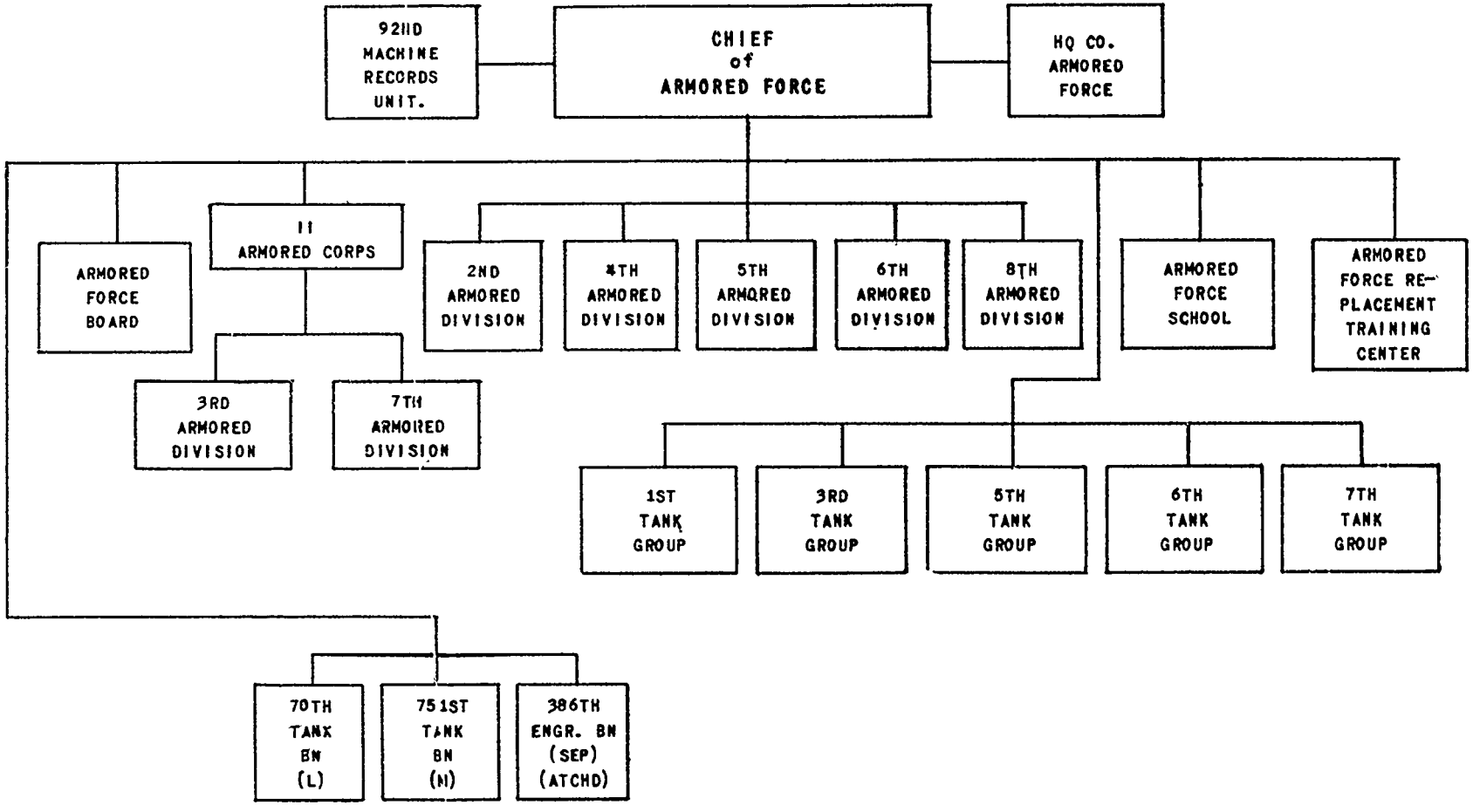
The Armored Force developed its tactics, organization and equipment, not by cloistered inspiration but by the application to its problems of data from the battlefield. Policy-makers on the whole were characterized by a desire for battle-tested information on which to base their doctrine and by a willingness to accept the ideas and experience of enemies and allies. General Chaffee and succeeding commanding generals gave close attention to the combat experience of the Germans, British and Russians.[8] Experience of American armored units first in maneuvers and then in battle were closely studied and the lessons learned translated with all possible speed into improved equipment, training method, and organization.

General Devers said in January, 1942:

> The Armored Force has made a thorough study of mechanized equipment and its tactical use on the battlefield. We have spared no opportunity to send observers to the battlefront; to interview officers from our own and foreign armies who have returned from the scene of action; and to study all available G-2 information on this subject.[9]

As General Devers indicated, the sources of intelligence were many and varied. No single observer's report, no letter, no personal visit can receive the entire credit

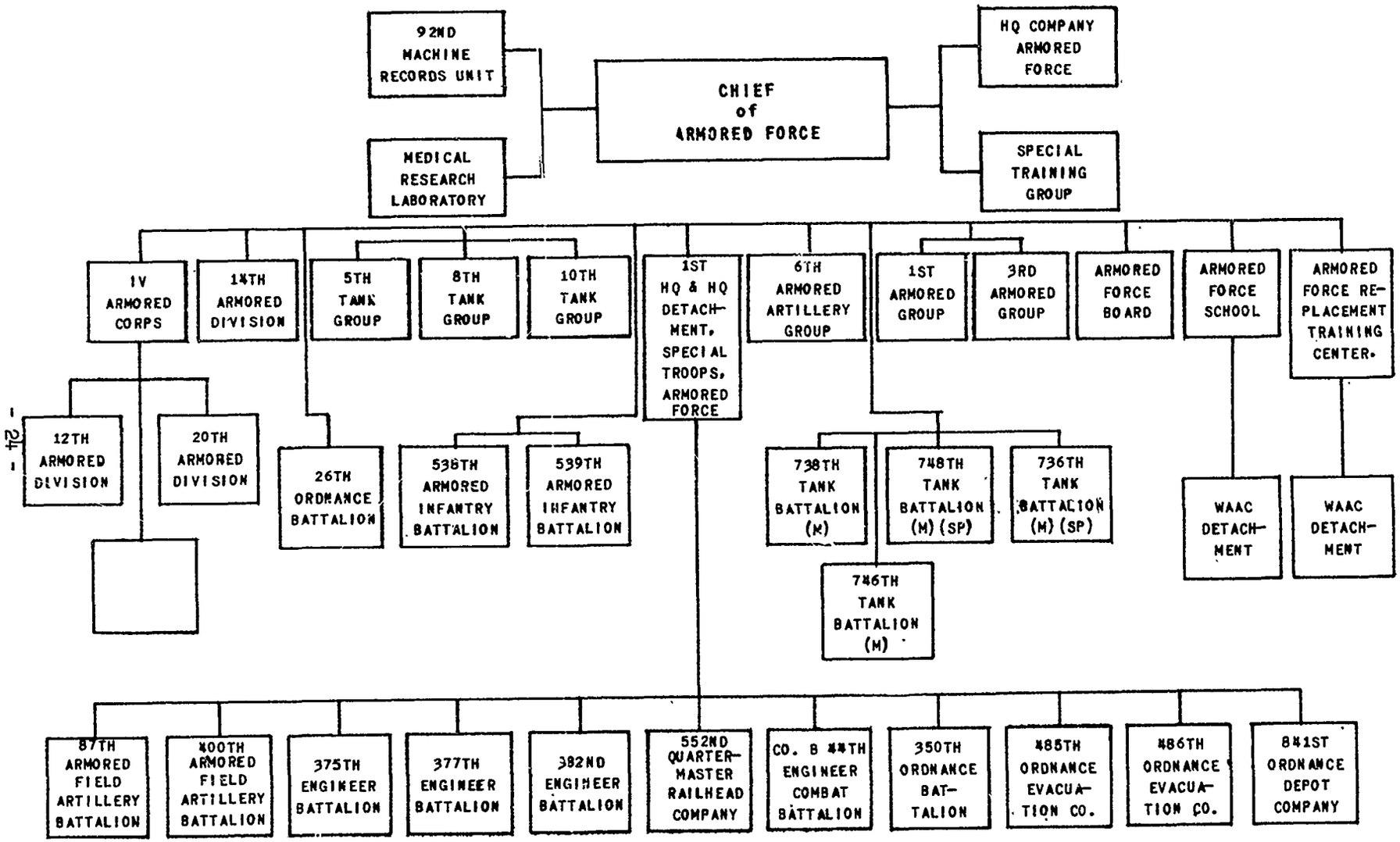
1 JULY 1942



NOTE 1: I Armored Corps was assigned to the Commanding General, Desert Training Center, March 23, 1942.

NOTE 2: II Armored Corps, 2nd Armored Division and 751st Tank Battalion (M), were attached to VI Army Corps, effective July 5, 1942.

1 JULY 1943


92ND MACHINE RECORDS UNIT
MEDICAL RESEARCH LABORATORY
CHIEF of ARMORED FORCE
HQ COMPANY ARMORED FORCE
SPECIAL TRAINING GROUP
IV ARMORED CORPS
14TH ARMORED DIVISION
5TH TANK GROUP
8TH TANK GROUP
10TH TANK GROUP
1ST HQ & HQ DETACHMENT, SPECIAL TROOPS, ARMORED FORCE
6TH ARMORED ARTILLERY GROUP
1ST ARMORED GROUP
3RD ARMORED GROUP
ARMORED FORCE BOARD
ARMORED FORCE SCHOOL
ARMORED FORCE REPLACEMENT TRAINING CENTER.
12TH ARMORED DIVISION
20TH ARMORED DIVISION
26TH ORDNANCE BATTALION
538TH ARMORED INFANTRY BATTALION
539TH ARMORED INFANTRY BATTALION
738TH TANK BATTALION (M)
748TH TANK BATTALION (M) (SP)
736TH TANK BATTALION (M) (SP)
746TH TANK BATTALION (M)
WAAC DETACHMENT
WAAC DETACHMENT
87TH ARMORED FIELD ARTILLERY BATTALION
400TH ARMORED FIELD ARTILLERY BATTALION
375TH ENGINEER BATTALION
377TH ENGINEER BATTALION
382ND ENGINEER BATTALION
552ND QUARTERMASTER RAILHEAD COMPANY
CO. B 44TH ENGINEER COMBAT BATTALION
350TH ORDNANCE BATTALION
485TH ORDNANCE EVACUATION CO.
486TH ORDNANCE EVACUATION CO.
841ST ORDNANCE DEPOT COMPANY

for initiating a major change. Rather was an evaluation of intelligence which gave the men at Fort Knox a full, rounded picture of the tactical situation and the specific deficiencies of current practices.

Armored Force leaders were eager to go to the scene of action and collect information first-hand. In addition to a heavy schedule of inspection trips within the United States, General Devers went to North Africa in December, 1942, for a two-month inspection of armored units in the theater of operations. General Gillem had the same desire for personal observation and traveled to North Africa and Sicily in July, 1943, not merely to confer with military leaders but actually to follow armor into battle. General Scott came to the Armored Force Replacement Training Center after a five-month tour of duty as Senior American Military Observer in North Africa. Brig. Gen. Thomas J. Camp, who succeeded General Scott as commander of the Replacement Training Center in December, 1943, went to North Africa in April, 1943, and, on his return, prepared a book, "Tankers in Tunisia", which was used in the Center's training program.

Maj. Gen. Stephen G. Henry went to the Second and Third Army maneuvers in 1941 "to determine first hand how the Armored Force School is meeting its mission of adequately training the technical specialists of the armored divisions and GHQ tank battalions."[24] His successor, Brig. Gen. Joseph A. Holly, continued the practice of close personal liaison with the divisions to determine the efficacy of School training. Brig. Gen. Williston B. Palmer, Armored Force Artillery officer, who accompanied General Devers on his trip to Africa, based improvements in gunnery technique and training on observers' and military attache reports, conferences with foreign officers, and field experimentation at home, but found that most help came from "personal talks with staff officers of Alexander's and Montgomery's armies down to the buck privates, and also the officers and enlisted men in our own armies fighting abroad."[25]

Armored Force leaders supplemented their own inspections with reports by observers sent from headquarters to maneuvers and theaters of operations. Before the observer set out, all department and unit commanders were invited to submit specific questions to guide his quest for information. On his return, a report was circulated to interested parties or a conference was arranged. As a president of the Armored Force Board described the procedure, "we generally have a session with G-2, and then we may get him over in a corner and milk him until we are sure he is dry."[26]

All military attache and observer reports received at the headquarters were forwarded by G-2 to sections and organizations concerned, and, in addition, all such reports were summarized in the form of G-2 notes which received a wider distribution. A man who found a point of special interest in the notes could then call for the full report.

Every available means was taken to carry the experience of foreign battle to the troops in training at home. For example, notes on the fighting in Tunisia, issued as Training Memorandum No. 4 by Allied Force Headquarters, North Africa, on 28 December 1942, were republished by Army Ground Forces on 27 January 1943, and reproduced again for distribution to armored units by Headquarters Armored Force on 2 February 1943.[27] To preserve uniformity in training and tactical procedures, Army Ground Forces in March, 1943, discontinued distribution of foreign observer reports to divisions and forbade reproduction and distribution to subordinate units. It was pointed out that changes in training doctrine deemed necessary as a result of information contained in observer reports would be promulgated by Army Ground Forces or the War Department.[28] It was still possible, however, for the Armored Force to issue informational memoranda based on the reports of observers dispatched from this headquarters.[29]

Close liaison was maintained with British representatives in the United States and of British officers visited Fort Knox to observe training and tests of new equipment and to share with the Americans the fruits of their battle experience.[30]

It is probable that informal liaison with the battlefield played as important a part in influencing decisions as all the formal intelligence materials. Particularly in the days of the Armored Force's virtual independence; commanders of armored units looked upon Fort Knox as the fountainhead of new equipment design and doctrine for its employment, and maintained personal contact with the policymakers. It mattered little that their units had been removed from formal control of the Armored Force. Men like Generals Patton, Harmon and Ward wrote informally to General Devers and General Gillem, giving their observations on battle and concrete suggestions for the improvement of equipment and training.[31] The feeling prevailed that the Armored Force would start the wheels rolling, circumvent needless delay, and provide the improvements in the shortest possible time.

Another means of bringing the influence of the battlefield to bear upon basic Armored Force problems was to assign officers with combat experience to posts in the Headquarters, the Armored Force School and the Armored Force Replacement Training Center. This devolved into a competitive struggle with other branches of Army Ground Forces for wounded men and other battle-tested officers available for home assignment, and G-1 worked to get Armored Force its share. It was the policy of the Armored Force to place these officers at Fort Knox where they would exert the maximum influence on equipment and training rather than to send them to divisions.[32]

The case of gun sights for the medium tank illustrates the variety of intelligence sources and the response of the Armored Force to the requirements of the battlefield. A military attaches report in June, 1942, told of the need for better sights as demonstrated in the desert fighting from 27 May to 12 June 1942.[33] Another report from Cairo in January, 1943, complained that the sights could not be used for ranges beyond 2500 yards.[34] A report from G-2 of the U. S. Army Forces in the Middle East in November, 1942, called the sights inadequate and asked for higher magnification in the telescope.[35] General Scott discussed in his report from Libya in July, 1942, the British request for an improved telescopic sight.[36] An Armored Force observer returned to Fort Knox to report the need for greater magnification and an improved reticle.[37] General Harmon wrote to General Devers: "Something should be done to improve our sights on the 75mm gun in the medium tank. The Germans have us at tremendous disadvantage. They have a 4-power telescope which gives them approximately twice the sighting range of view that we have."[38]

This was but a small part of a continuing flow of complaints and suggestions which informed Armored Force Headquarters of the deficiencies in existing equipment and the requirements for improvement. General Devers recognized the need for a better sight and the resources of the Armored Force Medical Research Laboratory and the Armored Force Board were called upon to solve the problem. The Armored Force Medical Research laboratory designed a new prismatic periscope which was tested by the Armored Force Board and found to be superior to existing equipment.[39] The Board designed and tested a new reticle which permitted more accurate sighting at longer ranges.[40] A tank commander's gun-sight bar used by the British was improved by the Board and appeared on the new M4 tanks rolling off the production line late in 1943.[41]

The use of smoke by armored units provides a similar illustration. Reports by the War Department Military Intelligence Service, the G-2 of the Air Staff, and the Chemical Warfare Service, issued in 1942 and 1943, described German ideas on the tactical employment of smoke and the actual use of smoke near Modlin in the Polish campaign, against the Maginot line, in the capture of Kiev in September 1941, and in the defense Kiel and Genoa harbors in October and November, 1942.[42] The value of smoke in

protecting Allied tanks from air attack and antitank guns was reported in liaison reports from the Middle East.[43]

An Armored Force observer in Tunisia quoted a British general officer to the effect that: "Smoke is indispensable when caught under antitank fire; and is especially useful when working with infantry, to point out objectives such as antitank guns; to screen their movements; and to cover them while clearing mines. It is also useful for recovery of vehicles."[44] General Gillem, on his return from Sicily, reported: "The Tunisian and Sicilian Campaigns, with particular reference to armored operations, emphasized the value of smoke in covering the advance. Greater stress must be placed on the use of smoke during unit and combined training phases."[45]

Again it should be emphasized that the reports cited were but a small part of a large number of intelligence reports which resulted in increased attention to smoke in Armored Force training. At the end of June, 1943, the Chemical Section of Armored Force Headquarters issued a training memorandum on the operation of vehicles in smoke.[46] Four hundred vehicular smoke generators were obtained from Army Ground Forces to supplement smoke pots in training and allowances of smoke shells were increased. Work was begun on a memorandum on the technique of screening smoke.

The Armored Force utilized the testing ground of maneuvers to the full but recognized its limitations. General Harmon wrote to Generals Chaffee and Scott on May 9, 1941: "Many of our officers are so maneuver-minded and so lacking in realistic battle experience that they mistake common sense and good judgment for undesirable caution."[47] General Devers commented later in that year: "Maneuvers teach us how to march, supply and staff work, but they do not teach us how to fight or how to shoot our guns."[48] As the war progressed, the attention of the men who devised equipment, tactics, organization and training doctrine was focused on the field of battle.

Coordination

In an organization containing so many different and complex units, emphasis on teamwork was essential. In the larger sense, this meant that there had to be a high degree of coordination among the arms and services engaged in a particular operation. Early in its development, leaders of the Armored Force appreciated that the antitank defense was too powerful to permit an unsupported tank attack of the World War I type. Therefore, tanks, infantry, engineers, bombardment aviation, and artillery had to operate as a team to enable the attacking units to deliver an effective blow.

Teamwork was not confined to larger units. To achieve a measure of success it had to be carried on all along the line, and particularly applied to the gunners, drivers and tank commander who composed the tank crew. A great deal of the credit for emphasizing the necessity for teamwork in the Armored Force should go to Maj. Gen. Charles L. Scott.

The Germans taught us a lesson in leadership which the American Armored Force learned well; the necessity for allowing small unit commanders to proceed on their own initiative after orders outlining the battle plan had been issued by higher headquarters.

In order to facilitate coordination of armored activities, General Scott urged the establishment of an Armored Section in the staffs of the War Department, Army Ground Forces, each theater, each Army and Corps, stating that he believed "...the armored sections should have duties comparable to, and equal in importance to, the technical staff sections already provided for the old arms and services."[49]

The proposed armored sections were studied by Army Ground Forces and after conference with representatives from the European Theater of Operations[50] they were approved and later provided for in tables of organization of armies and corps.

Profiting by combat experience the rigid formation of The Armored Brigade was abandoned in the 1942 reorganization of the armored division, and replaced by two combat commands to which the division commander assigned troops on the basis of the mission of the division and the tactical situation. In the theaters a growing tendency developed to organize combat commands as task forces for a particular operation rather than to employ a few stereotyped formations. This was a gradual development, in keeping with the spirit of flexibility which had always accompanied Armored Force activity.

Chapter V

ORGANIZATION AND TACTICS

The Armored Division

The organization of the armored division depended upon its role. As stated in the initial training directive, its role was to conduct highly mobile offensive warfare through a self-contained unit composed of the requisite arms and services.[1] This statement was amplified in the Armored Force Field Manual 17-10, published on 7 March 1942, which stated: "The role of The Armored Force and its components in the conduct of highly mobile ground warfare, primarily offensive in character, by self-sustained units of great power and mobility composed of specially equipped troops of the required arms and services." FM 17-10 was superseded by FM 17-100, The Armored Division, on 15 January 1944. This manual clearly states the role of the armored division as follows: "The armored division is organized primarily to perform missions that require great mobility and fire power. It is given decisive missions. It is capable of engaging in most forms of combat but its primary role is in offensive operations against hostile rear areas." The three statements of the role of the armored division are similar and indicate little change in the concept of the mission of the armored division from 1940 to the present.

The basic doctrines of the Armored Force have changed very little since 1940,[2] but there have been many changes in technique. Maneuverability and gunnery became more essential to success as antitank weapons developed, and the principles of the combined arms and fire and movement were strongly emphasized as a result of combat experience. The combat experience of the British and American armored units had a sobering effect upon the theories of invincibility which some leaders held. They began to appreciate that tanks were not all-powerful and invulnerable, that armored infantry was needed to support them, and that armored tactics could not be based upon the assumption that tanks could force their way through a well organized defense.

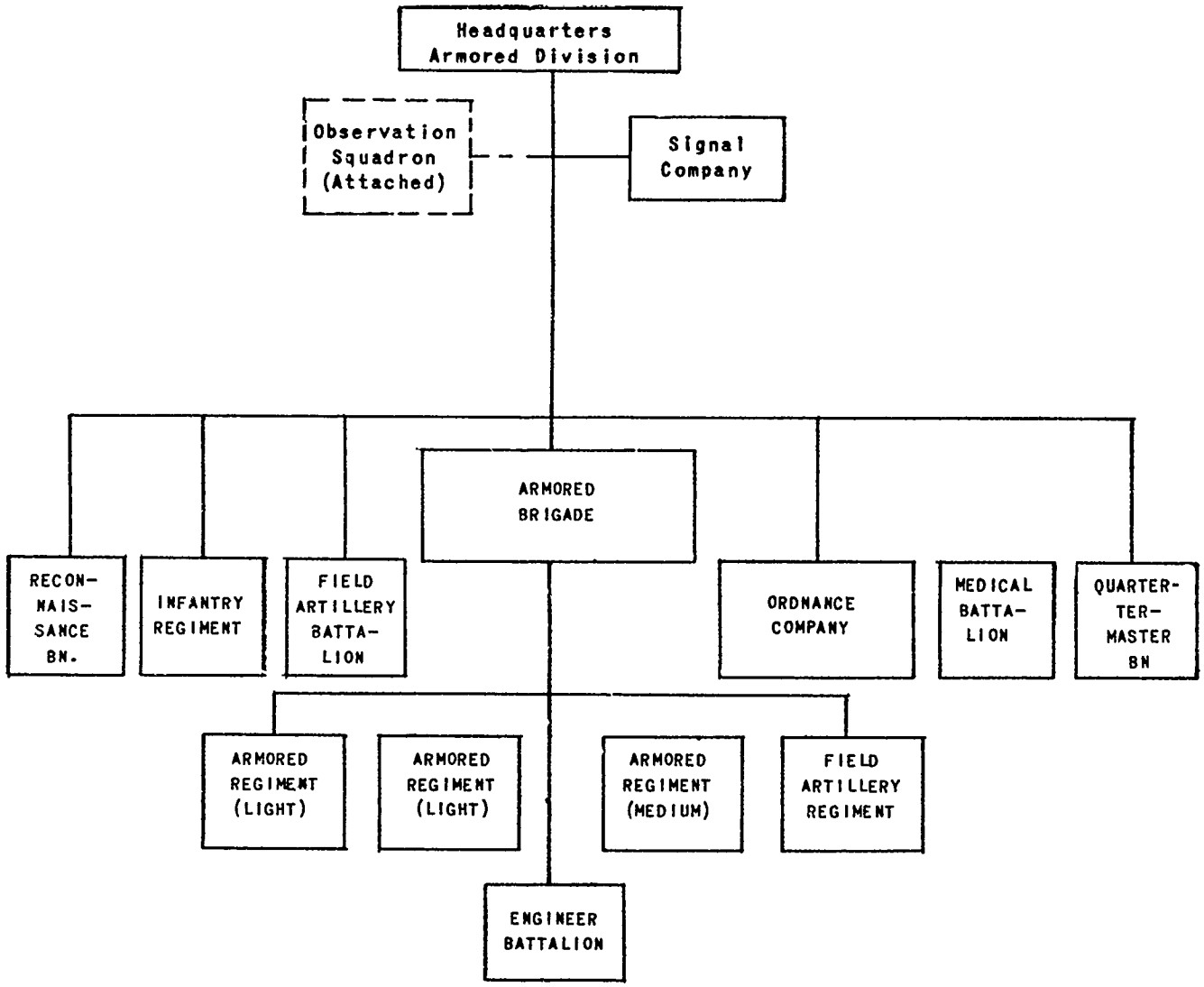
Changes in the organization of the armored division were the result of combat experience, the development of antitank defensive means, and the desire of leaders in armor to exploit to the fullest the characteristics of the armored division -- high mobility, protected fire power, and shock. The strength of the armored division was in its offensive power. It was especially suited for surprise appearance on the battlefield; the rapid concentration of protected firepower; exploitation; deep penetrations into hostile rear areas; and the destruction of hostile supply and communication facilities.

The armored division was sensitive to mine fields, obstacles, unfavorable terrain, darkness, and weather. Continued operation depended upon adequate resupply of fuel, lubricants, and ammunition. The division carried enough fuel for approximately 125 miles of operation. Time had to be made available for maintenance.

Reorganizations

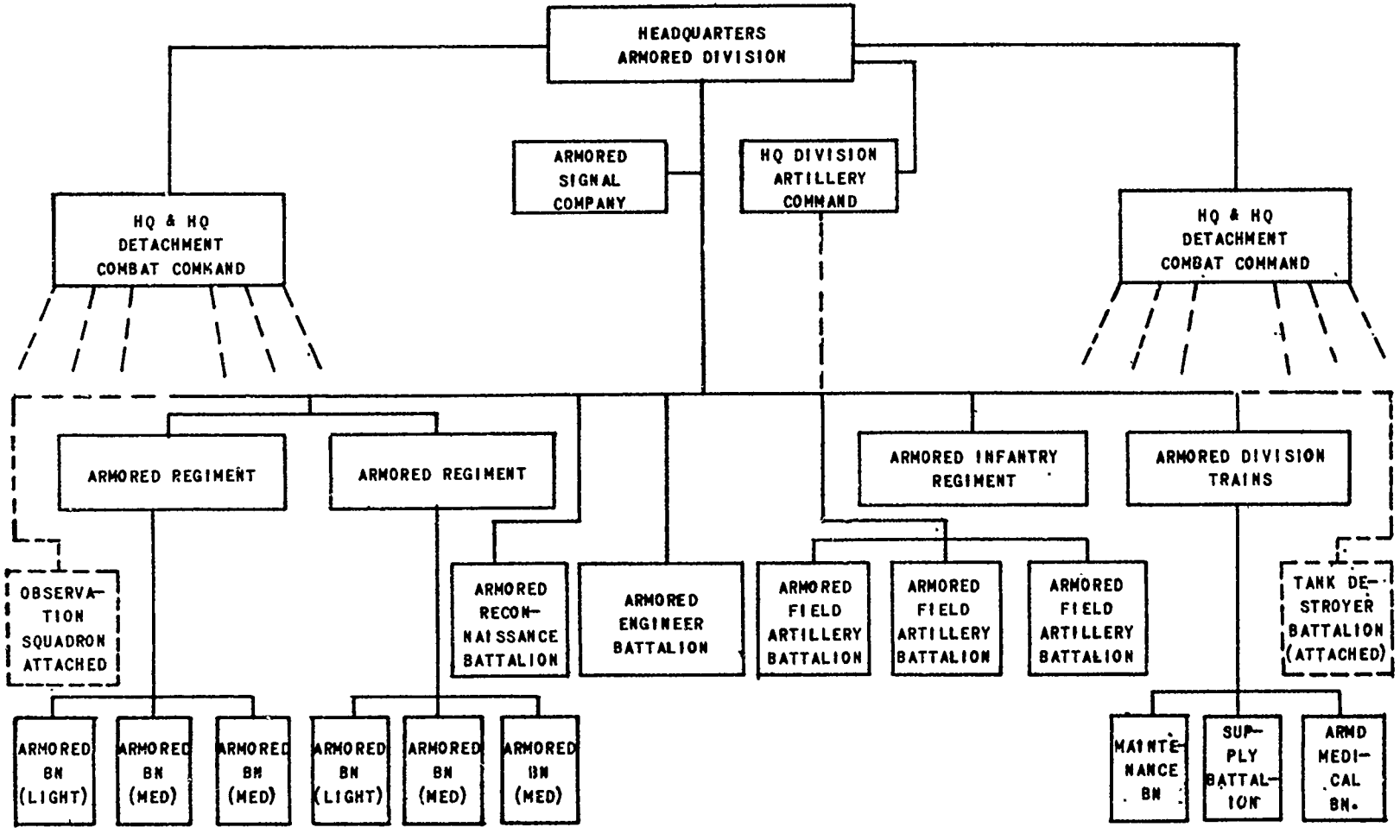
Although the armored division underwent six separate reorganizations, including the original organization, only two of the reorganizations were really significant. These were the one effected on 1 March 1942 which eliminated the armored brigade, provided for two combat commands, and reorganized the artillery into three separate battalions; and that effected on 15 September 1943 which eliminated the regimental organization and substituted the separate battalion in its place. The various reorganizations of the armored division followed four continuous trends: a decrease in light tank strength and increase in medium tank strength; an increase in the relative strength of the infantry element of the division; the elimination of needless command echelons; and the lightening of the service elements.

ARMORED DIVISION - 1940



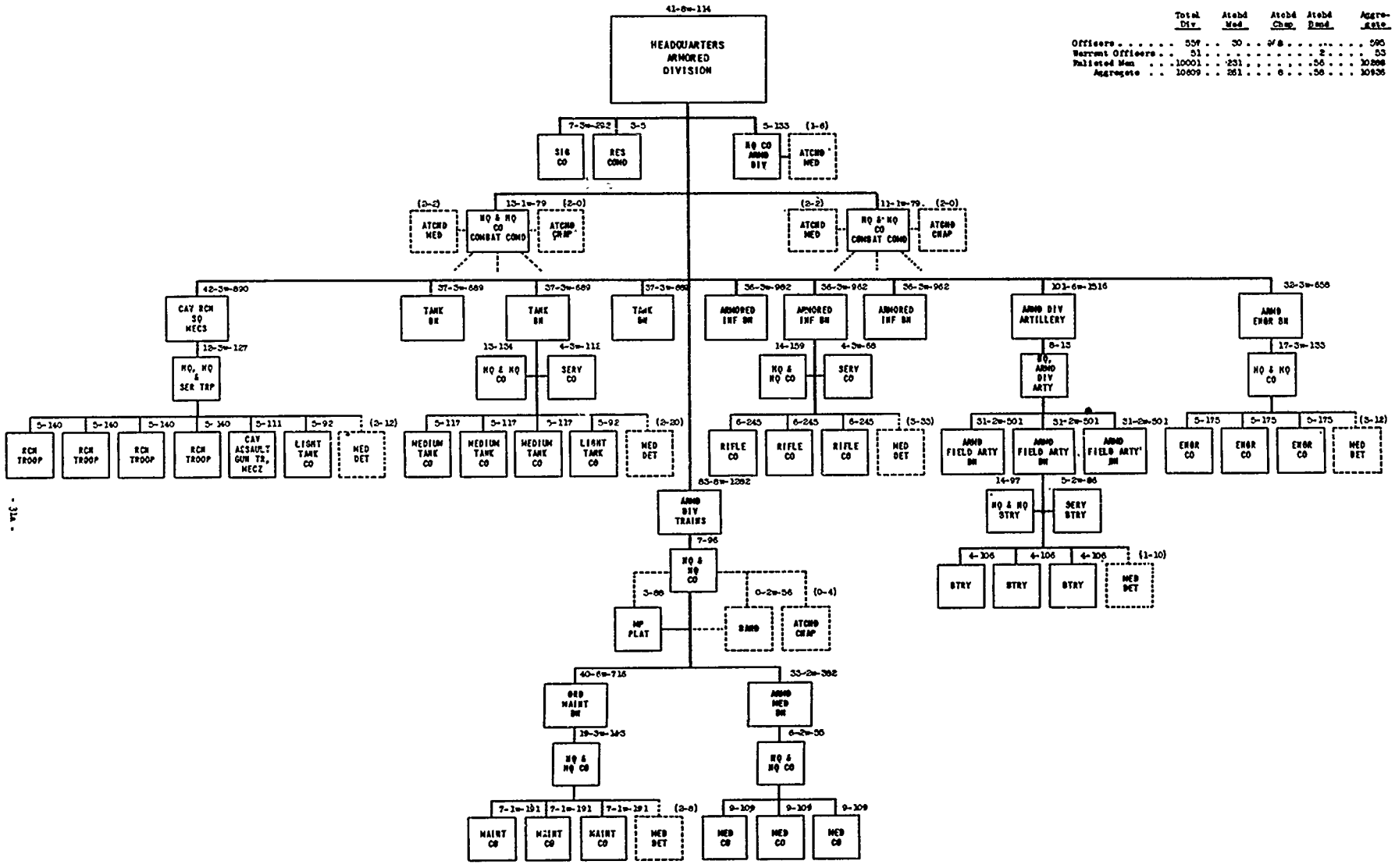
ARMORED DIVISION

1942



ARMORED DIVISION

	Total Div	Atchd Med	Atchd Chap	Atchd Band	Aggregate
Officers	557	30	8		595
Warrant Officers	51			2	53
Enlisted Men	10001	231		56	10288
Aggregate	10609	261	8	58	10936



September 1943 Organization

A basis for the first tables of organization for Armored units was outlined and attached to the directive of 10 July 1940, with the stipulation that they be used pending publication of standard tables of organization.[3] In accordance with the initial directive, work was started almost immediately upon new tables of organization which were published 16 November 1940.[4] The task of preparing and changing Tables of Organization was given to the Armored Force Board until 5 June 1941, when a separate Table of Organization Sub-Section was established in G-3 Section of Headquarters Armored Force.

As originally organized in July 1940, the armored division consisted of a command echelon comprising a headquarters and headquarters company and a signal company; a reconnaissance echelon consisting of an organic armored reconnaissance battalion and an attached observation squadron (aviation); a striking echelon consisting of a headquarters and headquarters company armored brigade, two armored regiments (light) and an artillery regiment (armored); a support echelon of an infantry regiment (armored) an artillery battalion (armored), an armored regiment (medium), and an engineer battalion (armored). The service echelon consisted of an ordnance battalion (armored), a supply battalion (armored), and a medical battalion (armored).

When work started on the new tables of organization, General Chaffee stated that he felt the initial structure was sound and that only minor changes were justified by the brief experience of the Armored Force.[5] The changes in the Armored Force organization announced on 3 April 1941 did not affect the structure of the armored division, which received its first shaking down as of 1 March 1942. At that time the combat command form of organization was established.[6]

The original organization proved unsatisfactory as it complicated the command channels by interposing the armored brigade between the division commander and the task forces organized under the brigade. No means of controlling the service elements of the division was provided, which resulted in loss of control or overburdening of the division headquarters.

When General Devers became Chief of the Armored Force he recommended that the armored division be reorganized along better functional lines, specifically that the armored brigade be eliminated and two combat commands with Headquarters and Headquarters Detachments be set up under the division headquarters, the number of armored regiments be reduced from three to two, the artillery be reorganized into three identical battalions, a division artillery commander and operating personnel be provided, and that a headquarters for controlling the service echelon be provided. The armored division as constituted in March 1942 consisted principally of two armored regiments, an armored infantry regiment of three battalions, and three battalions of armored field artillery, plus reconnaissance, engineer, supply and maintenance elements. The two armored regiments, comprising the striking force of the division, included six tank battalions, two light and four medium.

In accordance with the conception then held of armored units as the spearhead of the attack and the principal striking force, the division was conceived as part of an armored corps. As planned by the Chief of the Armored Force, each armored corps was to have as its striking force two armored divisions and a motorized infantry division as a temporary holding force. The four armored corps then in existence did not include the division of motorized infantry, although Armored Force Headquarters had been urging its inclusion since late in 1941.[7]

Two months after the reorganization of the U. S. armored divisions in March 1942, the British Army in the Middle East was known to have organized small armored divisions comparable to those used by the German General Rommel in North Africa. General McNair in writing the Chief of the Armored Force, requested his views on the advisability of conducting experimental changes of a similar nature with one or more of our armored

divisions. In reply, General Devers stated that our armored divisions had an infantry strength approximately equal to that of German and British light armored divisions; and, in addition, had greater sustained striking power.[8] As a result of British experience and the Army Ground Force insistence, in the summer of 1942, plans were instituted by the Armored Force to set up a division which could move faster, occupy less road space, be subject to more unified control, and include a greater proportion of infantry to support the armored units.

"THE LONG TAIL OF THE DIVISION WAS WAGGING THE DOG."

As a result of the spectacular reversal of the trend of the war in North Africa at El Alamein, and the similar reversal of the war in Russia at Stalingrad, Army Ground Forces began to focus attention upon British and German army trends. A G-2 study of 11 January 1943 on the subject of "Trends in Organization of Armored Forces" again pointed out, as General McNair had done previously, that the new British and German armored divisions were lighter in tanks and heavier in infantry than the United States armored divisions.[9] The doctrinal concepts derived from our experience in North Africa with the 1st Armored Division, the lessons from observation of the British and Russian successes and the insistence of Army Ground Forces, fostered a meeting of the minds in September 1943 when organizational changes were incorporated into new tables of organization published 15 September 1943. (See Study No. 9).

This reorganization eliminated the regimental echelon of command which, like the earlier armored brigade, resulted in complicating the command channels. It increased the ratio of infantry to tanks, and it eliminated the supply battalion.

As reorganized, the division consisted of a headquarters and headquarters company, a signal company, a cavalry reconnaissance squadron (mechanized), two headquarters and headquarters companies combat command, an armored reserve command, headquarters and headquarters battery division artillery, three tank battalions, three armored infantry battalions, three armored field artillery battalions, headquarters and headquarters company armored division trains, an ordnance maintenance battalion, and a medical battalion.

Tank battalions consisted of one light and three medium tank companies. The new armored division included a Cavalry Reconnaissance Squadron consisting of a headquarters and headquarters supply troop, four reconnaissance troops, an assault gun troop, and a light tank company. GHQ Reserve tank battalions were made identical with divisional battalions, rendering them available not only for the support of infantry divisions, but as replacement units for armored divisions as well.

Both the 1942 type of division and the 1943 type were employed in combat. The 1st, 2nd, and 3rd Divisions were employed under the 1942 table of organization, the 1st later being reorganized in Italy to conform with the 1943 table of organization. The 2nd and 3rd ended the war as old type "heavy" divisions. All other divisions were employed as organized under the 1943 table of organization or as "light" divisions. The "heavy" type was capable of longer sustained action than the "light" type. Both types of divisions were successful. Certain weaknesses were found in both. Both were weak in infantry, particularly the "heavy" division with its two armored regiment of six tank battalions and armored infantry regiment of three armored infantry battalions. The "light" division with three tank battalions and three armored infantry battalions fared better, but needed at least one additional rifle company in each armored infantry battalion in order that tank and infantry battalions could be married up -- squad for squad, platoon for platoon, and company for company. The Reserve Command of the "light" division proved inadequate, and it was necessary to attach headquarters and headquarters companies, armored groups, to make up this deficiency.

Elements of The Armored Division

The proper organization of staff functions within the division was vital by reason of the time element under battle conditions. Operating when tactical surprise was gained by speed, and working with little shelter while moving over unknown terrain, staff work in the division was further complicated by the supervision that had to be maintained over large columns of fast moving troops.

The Armored Division Staff

The staff of the armored division operated as two echelons, a forward echelon and a rear echelon. The forward echelon normally consisted of the division commander, the general staff, and the operational and intelligence elements of the chemical warfare section. The division artillery commander and the division engineer or his representative were with the forward echelon. The forward echelon of division headquarters was attached to division headquarters company. Communication facilities and transportation were furnished by the signal company. Radio was the principal means of communication, and the headquarters was organized to operate while on the march.

The rear echelon of division headquarters consisted of necessary representatives of the general staff, and the special staff. This echelon was attached to the train headquarters company. Transportation was furnished by the train headquarters company and communication facilities by the signal company. In operation, the finance section, judge advocate section, postal section, inspector general's section, special services section, and consolidated personnel sections operating under the supervision of the adjutant general might remain at the railhead, truck head, or corps rear echelon. Mess facilities were provided by the train headquarters and headquarters company.

Armored Reconnaissance Battalion (Squadron)

In keeping with the German practice of making reconnaissance battalions powerful enough to ward off light resistance, the divisional armored reconnaissance battalion was initially composed of two companies of scout cars, a company of light tanks and a company of infantry.

The armored reconnaissance battalion was reorganized in March, 1942, to include, in addition to a headquarters company, three armored reconnaissance companies, one light tank company, and a medical detachment. Later it was equipped with fast moving but lightly armored M8 armored cars. Other troops were attached by the division commander when it became essential to brush off resistance in order to accomplish a mission. Under the 1943 reorganization the battalion was renamed "Squadron" in keeping with its Cavalry mission, and reorganized to include four Reconnaissance Troops, an Assault Gun Troop, a Light Tank Company, and Headquarters and Service Troop.

Tank Units

Within the armored brigade was originally a 2-1 ratio of armored regiments (light) to armored regiments (medium). In this can be seen the Cavalry influence of the first Chief of the Armored Force. The arguments for heavier armor won the day when the reorganization of the armored division took effect in March, 1942, and provision was made for 2-1 ration of medium tanks to light tanks. This decision was reached largely as a result of the influence of Generals Bruce Magruder and Alvan C. Gillem, Jr.

The main role of the armored regiment (light) was to attack objectives deep in the hostile rear, and to accomplish rapid envelopments against light resistance.[10] The tactics of the armored regiment (light) stressed speed, maneuver, surprise and the use of initiative by commanders below the regimental level.

The armored regiment (medium) was designed to precede or support the armored regiments (light) in attack, and use its striking power to destroy hostile installations and overcome heavier resistance, as well as being the principal weapon for counterattacks. The organization of the armored regiment (medium) corresponded closely to that of the infantry regiment (tank).[11]

One of the major reasons for having separate light and medium tank regiments at first was that it was believed greater flexibility in employment might be obtained. It was thought that training problems and problems of supply and maintenance would be simplified by organizing separate light and medium units. Unfortunately, no provisions were made for reconnaissance elements in the original armored regiments (medium) in the belief that units supporting it would be able to supply the required reconnaissance. This often left the medium regiment without eyes and ears when operating alone.

The Armored Brigade, Combat Commands, and Reserve Command

As soon as the single brigade organization was tested in divisional problems and maneuvers, commanders discovered its weaknesses. In practice, the division commander issued his orders to the brigade commander, who in turn set up the combat teams.[12] An unnecessary link was added to the chain of command.

Shortly after General Devers took office, he advocated abolition of the brigade system as it was too unwieldy.[13] In setting up two combat commands in 1942, each headed by a brigadier general, greater flexibility was restored to the division. No troops were placed under the permanent command of either brigadier general, but rather the division commander gave each of the two a task force suitable for the particular mission at hand. This left the division commander free to plan over-all strategy, as well as to command the reserve and rear echelon. In the 1943 reorganization the combat commands were enlarged from a headquarters and headquarters detachment to a headquarters and headquarters company. A reserve command, consisting of three officers and five enlisted men, augmented by nine enlisted men from the division headquarters company, was provided for control of the division reserve. It was commanded by an infantry colonel who was charged with supervision of infantry training. The reserve command was not intended to be used as a combat command headquarters but rather as a means of controlling the division reserve while on the march.

In the European Theater of Operations, tactical employment of the armored division organized under Tables of Organization and Equipment 12 February 1944, habitually utilized the division in three combat commands. But there was insufficient personnel and equipment in headquarters reserve command to enable the reserve command to function as a combat command. A survey was conducted throughout the armies and corps under the jurisdiction of 12th Army Group and, based upon their comments, the inactivation of all headquarters and headquarters companies of armored groups was recommended to Theater Headquarters in order to supply the necessary personnel.[14] As an expedient to activate a Third Combat Command in each division, the 12th Army Group arranged the attachment of Headquarters and Headquarters Companies, Armored Groups to armored division where they functioned as a third combat command headquarters.[15]

Armored Infantry

As a result of combat experience the infantry element in the armored division grew in importance. The organizers of the Armored Force recognized that there were some missions which could be performed only by infantry troops including security measures at night, mopping up, organization for defense, relief of tank units that were in need of fuel and maintenance, and reconnaissance in force. In the initial reorganization of the armored division on 1 March 1942 a third battalion was added to the infantry regiment (armored) while at the same time the number of tank battalions was reduced from 8 to 6 by the inactivation of the armored regiment (medium) and the inclusion of medium tanks in the remaining armored regiments (light) which were redesignated as armored regiments. In the reorganization of 15 September 1943 the regimental organization was dropped and the separate battalion system substituted. Under this reorganization, by reducing the number of tank battalions from six to three, the ratio of infantry battalions was changed from one infantry battalion per two tank battalions, to one infantry battalion per each tank battalion. The increase in the ratio of infantry to tanks was the result of combat experience plus the development of antitank weapons such as the rocket launcher, the antitank rifle grenade, the panzer faust, and the extensive use of mines. The British Eighth Army which breached the German line at El Alamein in October, 1942, spotlighted the value of infantry. General Montgomery used his infantry to probe the German defenses and to open the gap through which armored units could then pour.

The growing importance of the infantry element of the armored division is perhaps best illustrated by the recommendations of Gen. George S. Patton, a former Cavalryman, regarding armor in the postwar army. He stated: "that Armored Divisions should have at least two armored infantry battalions for each tank battalion. This infantry must be wholly transported in full-track vehicles, each capable of carrying one infantry squad."[16]

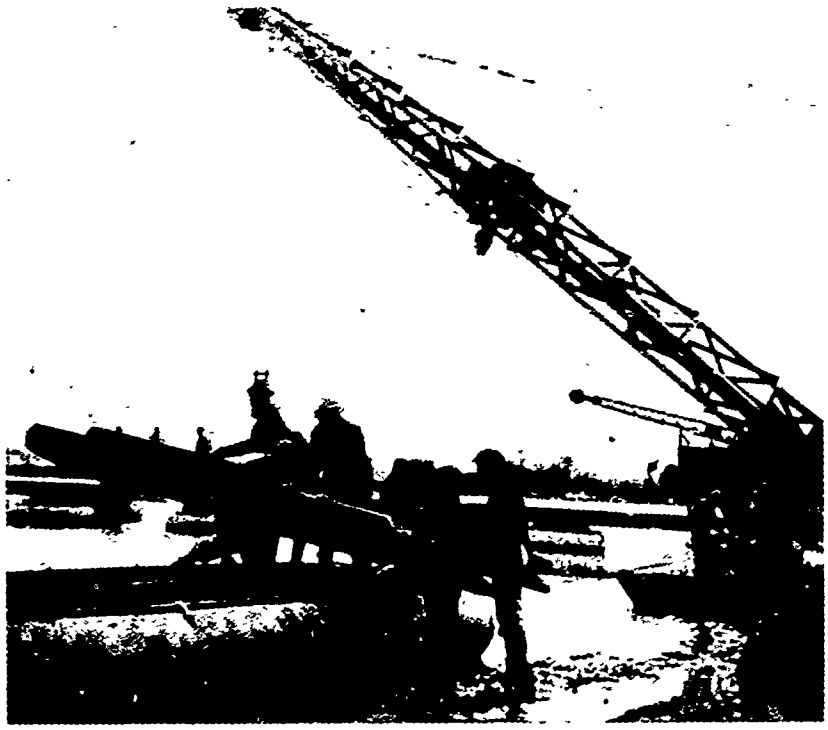
As employed in the European Theater of Operations, armored infantry, tanks, and armored artillery were organized as teams of combined arms for specific missions in which each element was necessary to the other in order to achieve success.

Armored Artillery

"The armored division is really a cannon division," stated an instructor in the Command and General Staff School.[17]

Armored artillery in the original organization occupied two places: as a support regiment of two battalions for the armored brigade, and a separate battalion of 75-mm guns for the infantry regiment (armored). The theory behind having the separate battalion of 75-mm guns[18] was that the division commander could use it with the infantry regiment as a combat team or in a general reinforcement role wherever needed.[19] Tests indicated that the 105-mm howitzer was a superior weapon and it replaced the 75-mm guns in both the support regiment and the separate battalion.

The original armored artillery organization never proved very satisfactory. Although division headquarters originally contained an artillery section of two officers and four enlisted men to assist the division commander in technical employment and control of the artillery, there was no centralized command for the artillery of the armored division.



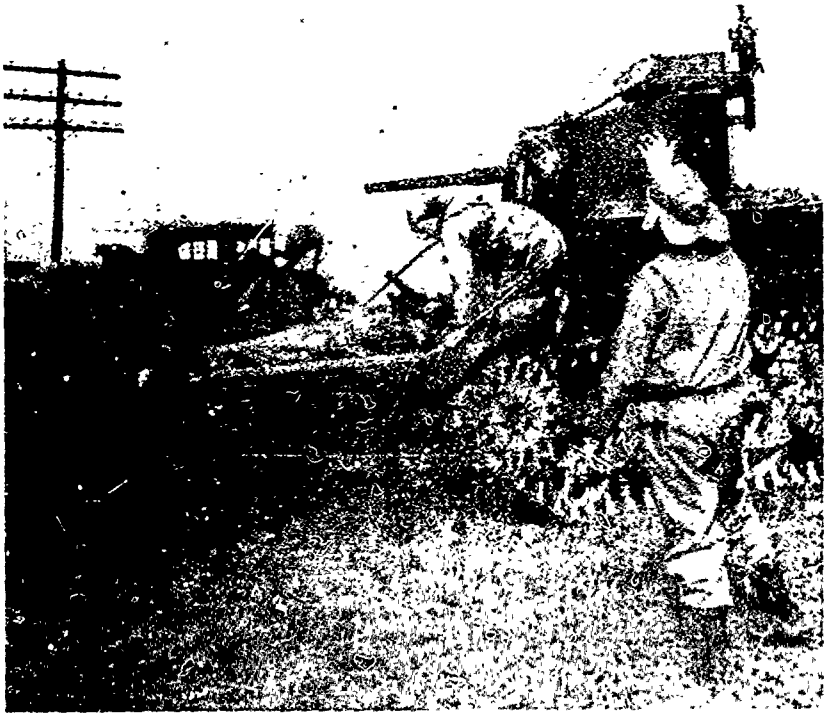
ENGINEERS BUILDING PONTON BRIDGE
"Keeping the Armored Units Rolling Irresistibly Forward"

The Chief of Field Artillery became interested in the faulty structure of the artillery element in the armored division as early as November 1940, and strongly urged that the three artillery regiment and battalion be formed into a single regiment, as was the practice in the triangular divisions; and that a single unified command be established.[20]

When General Devers assumed command of the Armored Force he speeded measures to simplify the artillery of the armored division by eliminating the regimental organization, and reorganizing the separate battalion. The result was three identical artillery battalions.[21] Two artillery officers and four enlisted men were included in the division staff to act in an advisory capacity. In the September 1943 reorganization of the armored division an artillery commander and an operating section were included in division headquarters for control of the artillery. Combat experience demonstrated the inadequacy of this organization, and it was soon expanded to a Headquarters and Headquarters Battery, Armored Division Artillery, organized similarly to the Headquarters and Headquarters Battery Division Artillery of the Infantry Division. The importance of rapidly moving observers to keep pace with the speed of the armored units was stressed throughout. These observers were mounted in tanks or $\frac{1}{4}$ton trucks and operated with the advance elements of the division to call for fire when needed to reduce resistance, particularly from antitank guns.[22]

Armored Engineer Battalion

The sensitivity of armored vehicles to weak bridges, minefields and other obstacles gave great importance to the engineer element. Its mission was to insure the uninterrupted advance of the division by the traditional means used by engineers: construction and demolition, and the clearance of minefields and obstacles. Combat engineers of the regular infantry and cavalry division were, for best results, centralized under the immediate control of the division engineer, but the necessity for speed and the danger of obstacles made it necessary to attach armored engineer companies to march columns, combat commands, or other elements of the division. The armored engineer battalion was originally organized into a headquarters and headquarters company, four line companies and a treadway bridge company. The treadway bridge company and one line company was deleted from the tables of organization when the armored division was reorganized on 20 September 1943.



"REMOVAL OF THE WOUNDED"
From M2-A3, Light Tank

Armored Signal Company

To maintain control without reducing speed, adequate signal communications were vital and General Chaffee early recognized the importance of signal troops. The organization for signal troops was changed very little during the development of the armored division. It consisted of a signal company in division headquarters, which originally comprised a headquarters, and an operating platoon; later a radio platoon was added. Its mission was to provide signal equipment and parts; perform maintenance; operate message centers, install, maintain and operate radio, telephone, and telegraph facilities.

Functionally, the signal company set up a system of operating teams which included: administration, supply, motor and weapon maintenance, radio repair, wire construction,

mobile signal, vehicular signal, and armored signal teams. For example, the vehicular signal teams were most frequently used to set up and maintain signal channels between the various echelons of division headquarters while on the march.[23]

"THERE MUST BE A COMPLETE AND THOROUGH UNDERSTANDING BETWEEN GROUND AND AIR UNITS."

Armored Medical Units

Medical detachments provided for by tables of organization were an organic part of the units, and operated the battalion and regimental aid stations. In addition, the medical battalion was set up as a "second echelon," to handle the clearing and collecting needs of the division.

No divisional hospitalization was provided and casualties were evacuated to the rear to evacuation hospitals. Perhaps the greatest error in the initial structure was the failure to provide medical detachments for the reconnaissance, field artillery, engineer and quartermaster battalions; this deficiency was corrected with the adoption of the new tables of organization in the fall of 1940.

Three medical companies were included in the organization of the medical battalion. Each company was a complete unit, consisting of a collecting and clearing platoon, equipped for first aid, emergency surgery, and evacuation, together with the necessary personnel and equipment for its own maintenance, administration, and supply.

Among the outstanding medical contributions of the Armored Force were special arrangements for removal of the wounded through tank turrets and escape ports; the successful application of sulfa drugs on the battlefield and the design of a mobile surgical truck which contained an operating table, hot and cold running water, sterilization cabinets and other necessary equipment to perform emergency surgery.[24]

Attached Antiaircraft Battalion

The vulnerability of armored units to attacks by low-flying bombardment or strafing aircraft resulted in repeated recommendations that an antiaircraft battalion be made an integral part of each division. Although General Devers proposed that these battalions be organized, trained and equipped by the Antiaircraft Command and later made an organic part of the division, it was felt by Army Ground Forces that it was more expedient to attach antiaircraft units when needed.[25] (See Study No. 9) The normal attachment to an armored division in combat was an antiaircraft automatic weapons battalion self-propelled.

Observation and Combat Aviation

The Armored Force suffered a series of discouraging liaison troubles when it came to observation and combat aviation. With teamwork between aviation and armored units essential for battle success, it was unfortunate that neither the Air Forces nor the Armored Force seemed to have a clear objective, nor an overall conception of the problems involved. Up to the end of the Tunisian Campaign, even combat experience failed to provide the final answers, except to emphasize the fact that the system did not work.

In the first organization of the division, observation squadrons were attached, and by 21 August 1940, the 12th Observation Squadron was operating with the 1st Armored Division and the 16th Observation Squadron with 2nd Armored.[26] Combat aviation was made subject to call. Reports from theaters of operation indicated that at first air support to ground troops was predicated too much on the "push button" type in that it was initiated by a hurried call without deliberate planning.

The system outlined in Field Manual 31-35, "Aviation in Support of Ground Forces," went into effect in April, 1942. Under this system, the Air Request Party (Battalion S-3 plus attached communication facilities) transmitted request for air support to G-3 Air at division headquarters. After consultation between G-3 Air and Air Force representative (known as the Air Support Officer), the number of necessary bombers was determined by the Air Support Control. The request then went up to armored corps headquarters, where another consultation was held between the Corps G-3 Air Forces representative at Corps Headquarters. When approved, the request went to the airdrome. A conference to determine methods of speeding the transmission of air requests from front line units to the airdromes concluded that the bottleneck was in the several headquarters through which the air requests passed.[27] Regardless of where the bottlenecks were, they added to the delay in providing air support.

The emphasis began to be upon the use of more pre-planned missions rather than the use of air power against "targets of opportunity." In 1943, the trend was toward the mass employment of air power and the application of mass operations to successive areas without piecemeal employment.

Observation aviation developed in a different direction. Under the original plan of attaching squadrons to each armored division, an inflexible system had been established. Further, the number of planes actually attached was never adequate. In March, 1943, "reconnaissance groups" were set up by the Air Forces, and several methods of supporting armored units were tested.

The necessity for rapid fire adjustment by division artillery made the need for artillery liaison planes imperative. General Devers pushed the use of liaison type planes in the positive belief that they were vitally important in observation of artillery fire, for messenger service, route reconnaissance in friendly positions, and for command and staff liaison. By directive of 19 June 1942, the Armored Force was authorized to include eight liaison planes as an organic part of the armored artillery of the division.[28]

Coordination between the air arm and the armored forces was not a matter of not knowing "what," but rather an issue of learning just "how" to go about the problems confronting both arms. As a result of combat experience, various methods of air-ground cooperation were developed. From the battle experience of the 12th Army Group a few simple expedients were used which resulted in excellent cooperation between combat commands and supporting air. An officer from Air Support Party of the Air Corps and S-3 Air, rode in the same tank in the leading echelon. The tank was equipped with very high frequency radio equipment for communication to planes and also had a crypton light to permit the pilot to identify the tank with which he was talking. One radio per battalion listened to the air frequency and served as a means in relaying air information to the ground commander. Colored panel systems for identification were used, and the planes served as excellent means of reconnaissance.[29]

Small unit coordination with air was made possible for platoons on up. The platoon merely call through its company and battalion requesting air support, giving the location of the target. The Air Support Party Officer contacting the air cover was able to get an air strike in a matter of a few minutes.[30] In the case of close coordination of support with moving armored columns, the air support party officer rode in a tank immediately in rear of the attacking wave of tanks with control of his radio and within vision of the attacking tanks.

Air-tank teams usually of four dive bombers accompanying each armored column gave good results in minimizing losses in armor. In order to coordinate the team properly, an Air Force officer accompanied each column. The Armor, confident that it would be immediately notified of any enemy threat, was able to move with confidence toward its objective. The close coordination of air support greatly improved the morale of the armored troops on the ground.

Ground cooperation in target designation by the use of colored smoke shells enabled the air to score more effectively on targets, and tactical reconnaissance planes furnished fighter-bombers with target information thus inaugurating new answers to the old problem of "how."[31] Visits of air crews to ground units and ground personnel to air installations gave the two arms a distinct advantage in their ability to understand and subsequently coordinate their activities with regard to the problems of each.

Armored Division Supply

The supply of an armored division was complicated by the speed of movement in combat, the depth to which the division penetrated into enemy territory, and by the enormous quantities of fuel and ammunition used by the division when operational.

In the original organization of the armored division supply functions were complicated by lack of an operating headquarters to carry on the supply functions. This deficiency was corrected in March 1942 by the establishment of headquarters and headquarters company, armored division trains, to control the supply, maintenance, and medical battalions of the division. The supply battalion, primarily a quartermaster unit, was eliminated in the 1943 organization, supply functions being carried on by the battalions under combat command supervision and by attached quartermaster truck companies under the command of headquarters division trains.

Supply functions were exercised by the following special staff officers: ordnance, quartermaster, engineer, chemical, signal, and the division surgeon. The supply activities of the special staff officers were coordinated by G-4.[32]

In operation, only a minimum number of supply and maintenance vehicles accompany the fighting elements of the combat commands, the bulk of the supply and maintenance personnel and vehicles operating in a combat command service center, under supervision

of the combat command S-4 or in a division service center, under the supervision of the train commander. These service centers remained in position until beyond supporting distance; then displaced forward again and resumed operation.

Armored Division Maintenance

Maintenance within the armored division was regarded as a function of command. Division, combat command, battalion, and company commanders were held personally responsible for the maintenance of the vehicles and weapons assigned to their units. As a means of enabling commanders to meet their responsibilities with respect to maintenance, each vehicle was provided with a kit of tools with which the vehicular crew performed first echelon maintenance, including lubrication, inspection, and minor adjustments such as the replacement of spark plugs. Companies were provided with a maintenance section which performed second echelon maintenance of a minor character. Battalions were provided with a maintenance platoon in the service company which was able to perform all second echelon maintenance including all minor repairs, recovery of disabled vehicles by use of armored recovery vehicles, which are actually modified tanks, and the replacement of certain unit assemblies. The maintenance platoon operated under the supervision of the battalion motor officer, who was often used as an inspector of company maintenance by the battalion commander.

The division had an ordnance maintenance battalion consisting of a headquarters and headquarters company and three maintenance companies. The maintenance battalion performed third echelon maintenance on all ordnance and engineer equipment, including the replacement of major unit assemblies. Personnel of the ordnance battalion were often used by the division commander for the inspection of maintenance within the units of the division. In combat, maintenance companies might be attached to or placed in direct support of combat commands. The maintenance battalion was equipped for the evacuation of disabled vehicles and equipment.

Future Organization of the Armored Division

By the early part of 1945 it was evident that the armored division needed minor changes in organization in order to conform to the lessons learned in war in Europe. The proposed changes were based on a cross section of views held by the outstanding armored field commanders. Perhaps the most significant trend of thought was the feeling that a larger armored division was needed. Evidence of this feeling was expressed in a study of the subject by General Robert W. Grow and General Hugh Gaffey in February 1945.[33] This study on reorganization of the armored division was considered by General Patton, who forwarded it to AGF 23 April 1945 with the following comment: "I consider Grow, Gaffey and Wood the three outstanding armor commanders of this war, and I believe that if Wood could referee the suggestions contained in the notes by Grow and Gaffey, we would get a pretty solid solution."[34]

General Wood's comments on the study by Grow and Gaffey made 30 April 1945 stressed the need for a larger armored division: "...the additions recommended will add about four thousand to the present strength of the division. I have found it necessary to get these additional elements in one way or another -- begging, borrowing, stealing, and reorganizing as required to meet the imperative and inescapable needs of combat ..."[35]

By June 1945 organizational changes were being solidified by the War Department for a new type armored division based on the concepts of our armored commanders. It was realized that there was a definite place in our armored organization for the heavy type division which had performed missions beyond the capabilities of the light armored divisions.[36] This was substantiated further by the experience of the 2nd and 3rd Armored Divisions which operated as a heavy type armored division through two and one half years of combat. Maj. Gen. I. D. White, commanding the 2nd Armored Division, recommended:

"... that the heavy type armored division be retained. In my observations of the 2nd Armored Division I have seen it perform missions which due to limitations of organization, the light division could not be expected to perform."[37]

One of the outstanding features of the heavy type division was, as General White pointed out, its capability of more powerful and sustained action.

Accompanying General White's recommendations for the heavy type armored division were the following comments of General Jacob L. Devers, then commanding the 6th Army Group:

> There is no doubt in my mind that the heavy armored division has proven itself. But, so has the light armored division for all of the armored divisions in this war have excellent records, particularly the 4th.
>
> a. Keep the regimental organization both in the tanks and in the infantry.
> b. Increase the infantry by either another regiment of three battalions or increase the present regiment to six battalions.
> c. A treadway bridge company should be an integral part of the engineer battalion.
> d. There should be an organic supply battalion in each armored division.
> e. The field artillery should be increased by one battalion of 155mm Howitzers (SP) of three batteries of six guns each.
> f. In addition there should be as an organic part of the division one antiaircraft battalion and also one antitank battalion.
>
> I agree thoroughly that in the armored division the infantry supports the tanks whereas in the infantry division the tanks and artillery support the infantry. 38

While basic doctrinal concepts remained substantially unchanged, the passing of time and the war emphasized several important organizational trends in future armored organization. Gen. Omar Bradley felt that the post-war army needed two types of divisions. One, the infantry division, with about the present proportion of infantry, with a minimum of one or preferably two organic tank battalions. The other, an armored division, having about the present tank strength but more infantry. Virtually all armored commanders clamored for two to three times the infantry strength presently authorized in the armored division, and the infantry divisions badly needed more tanks. Many opinions at the close of the war pointed to the organic tank battalion in infantry divisions as an eventual answer, and in the same light, an increase in infantry for the armored division.[39]

While the composition of the post-war armored division remained conjectural, much study was being devoted to the individual merits of proposed organization, and every eye was more clearly focused upon the requirements dictated by combat experience.

Chapter VI

ORGANIZATION AND TACTICS OF SEPARATE TANK BATTALIONS, TANK GROUPS, ARMORED GROUPS, AND OTHER ARMORED UNITS

When the Armored Force was organized it had only one separate tank battalion under its jurisdiction -- the 70th GHQ Reserve Tank Battalion (medium) at Fort Meade, Maryland. The principal use of the GHQ reserve tank battalions (renamed "Separate Tank Battalions" after the reorganization of the Army in March, 1942) was to give added striking strength to the infantry divisions and for possible attachment to the armored division to provide additional power for the striking echelon. When attached, the tank units were commanded and controlled by the commander of the combined-arms team. They were originally termed "GHQ Reserve" because they were allotted by General Headquarters to various armies, army corps, or divisions.

The 70th Tank Battalion labored under extreme personnel difficulties during the early stages of its existence. Organized with a cadre of 18 officers and 582 enlisted men, at the end of July, 1940, the 70th and 319 men absent from training on detached service, special duty, at the Summer Training Camp at Fort Meade, sick, etc.,[1] and in later months, it was plagued by administrative entanglements.

The initial drive was for the formation and equipping of two Armored divisions. But it was soon appreciated that a rapid expansion of GHQ reserve tank battalions was necessary to have them available for task forces in accordance with war plans. Renewed speed was applied as General Chaffee realized that without the trained tank battalions, the Armored divisions might be split up and frittered away into small task forces.[2]

Four additional tank battalions were organized from the 18 scattered National Guard companies, and inducted as follows:

UNIT	DATE OF INDUCTION	STATION
191st Tank Battalion	3 February 1941	Fort Meade, Maryland
192nd Tank Battalion	25 November 1940	Fort Knox, Kentucky
193rd Tank Battalion	6 January 1941	Fort Benning, Georgia
194th Tank Battalion	22 January 1941	Fort Lewis, Washington

The administration, supply and training of these four battalions were facilitated by Armored Force liaison officers stationed at Fort Meade and Fort Lewis, while the 1st and 2nd Armored Divisions assisted in putting the battalions at Fort Knox and Fort Benning on their feet administratively.[3]

Inasmuch as the four National Guard tank battalions were formed by assembling individual tank companies of the various National Guard Divisions, and it was expected at the time of induction that they would remain only a year in the federal service, no standardization of the units was attempted. The same day that war was declared, action was taken to regroup the companies within the battalions and to organize them in conformity with established tables of organization and tables of basic equipment.[4] The previous organization had complicated the supply of equipment, providing loss replacements, and the allotment of grades and ratings.

Even the most ardent Cavalry officers admitted that the tactical doctrine and organization of the GHQ Reserve Tank Battalions under the Armored Force should be Infantry (Tank) in character. The initial organization of the 70th GHQ Reserve Tank Battalion was completed under the pressure of time, and was largely copied from the structure of

the Infantry tank battalions. This necessitated later changes in order to make it correspond to the tank battalion organization within the armored division.

The Chief of Infantry and the Chief of the Armored Force were held jointly responsible for establishing the tactical doctrine for the employment of GHQ tank elements as Infantry supporting units.[5] Pursuant to this directive, a special board of officers representing the Chief of Infantry and the Chief of Armored Force met during early May, 1941, to formulate the tactical doctrine for the separate tank battalions. The board recommended that War Department Training Circular No. 4 be amended to state that primary use of GHQ tank battalions and groups should be in support of Infantry divisions.

The early plans of General Chaffee for organizing and training the tank battalions were almost nullified in late March, 1941. At that time, a directive was written, cleared in the War Department, and awaited only the concurrence of General Chaffee and the Secretary of War to remove all the GHQ tank battalions from control and supervision of the Armored Force; place them under GHQ for supervision of training and attach them to field armies for combined training; and give the Chief of Infantry authority to supervise their personnel, training and inspection. The function of the Chief of the Armored Force was to be an "advisory agent" in the cooperative development of materiel.[6]

General Chaffee immediately objected to the Chief of Staff,[7] pointing out that the proposed regrouping of the GHQ tank battalions would result in confusion, competition for supplies in the development of equipment; in the procurement of materiel, and for experienced personnel; duplication in schools, personnel, equipment, and facilities; and confusion in manuals and doctrine as a result of divided responsibility. Subsequently it was decided to modify the directive and merely make the tank battalions "subject to attachment" to field armies for combined training, and to hold the Chief of Infantry and Chief of Armored Force jointly responsible for the development of tactical doctrine regarding their employment.[8]

The need for group headquarters to coordinate training of the tank battalions soon became apparent. In addition such headquarters were needed to help in developing the technique and tactics of GHQ Tank Group employment, and to be available as command agencies when required in the theaters of operations.[9]

Accordingly, the battalions were grouped on the basis of three to five battalions per group, and the 1st Tank Group, GHQ Reserve, was activated on 10 February 1941 to supervise the five battalions then existent. As new tank battalions were formed, additional tank groups became necessary for supervisory purposes. The 2nd and 3rd Provisional Tank Groups were organized, for training only, on 26 May 1941.[10] The senior battalion commanders in these new group organizations were designated as provisional group commanders. Their main duties included the conduct of monthly training inspections and tests of each battalion in the group, and a comprehensive report of the status of training, organization and supply was submitted monthly to Headquarters Armored Force. Directives made it clear that the group was not to engage in administrative matters, other than forwarding reports, and it was stated that all administrative and supply matters were to be handled directly between the battalion commanders and Headquarters Armored Force, except for routine supply matters which could be handled direct with post commanders.[11] It was soon found that tank groups and battalions became too widely scattered,[12] so they were re-formed and re-grouped into three battalions per group, with the group headquarters and all three battalions being located at one station. More efficient supervision resulted from the change.

The provisional tank groups were re-formed and made permanent in February, 1942, with the exception of the concentration of three tank battalions planned for Fort Lewis, Washington. Action on this was deferred because the 757th Tank Battalion at Fort Ord, California, was at the time undergoing valuable combined arms training in the Fourth Army, with infantry divisions and tank destroyer battalions.[13]

The mission of the tank group became supervision of the training and the development of combat efficiency in the battalions under its control. The tank group was also to be utilized for specific tactical missions. Like the battalion, it was originally allotted by GHQ to corps or armies. Group liaison officers were always maintained at the headquarters of the unit being supported, and special liaison officers were provided for contact with reconnaissance agencies, combat aviation and artillery. The liaison officers were effective in exchanging information, making tactical recommendations, and keeping the commander abreast of the capabilities and the situation of the tank units.

The internal organization of the tank battalions, both light and medium, was changed in February, 1942, to bring it into conformity with the battalions in the armored regiments of the new armored division. It became the ideal of the Armored Force to organize and equip the separate tank battalions and the divisional battalions exactly alike, "to be completely interchangeable."[14] At the same time more supporting weapons such as mortars and assault guns were provided for the battalion, and the Headquarters Company was relieved of administrative and service functions so it could concentrate upon tactical control. A "Service Company" was established to provide the service, administrative and maintenance elements necessary to make the battalion self-sufficient.[15]

In 1943, the tank battalion was again reorganized to bring it into harmony with the concurrent reorganization of the armored division. The distinction between light and medium tank battalions was wiped out, and, as in the division, the battalion was organized with a headquarters and service company, a light tank company, and three medium companies. It was contemplated that the light tank company would provide a fast, mobile element to exploit the success of the medium tank, for reconnaissance, and as a covering force for the battalion. The three medium tank companies were designed to be the striking element of the battalion.

The renewed activity on behalf of the tank battalions and tank groups was due not only to the concurrent reorganization of the armored division structure, but also to the conviction of General Devers that the separate battalions had been more or less out in the cold. General Devers felt, in early 1942, "that the tank battalions are now in the category of lost children and that we must take prompt action to bring them into the fold and be in closer touch with their needs and problems."[16]

Although the separate tank battalions were self-contained for short periods and had sufficient administrative staff to operate without outside assistance, it was necessary to attach ordnance and quartermaster companies to assure continuity of supply and maintenance facilities over long periods of time.

Amplified doctrine on the employment of tank battalions in conjunction with Infantry was written during May and June 1943 by representatives of the Armored Force in collaboration with Army Ground Forces and the Command and General Staff School. Publication of Field Manual 17-36 Employment of Tanks with Infantry was suspended until revised Tables of Organization for Armored Units were approved on 15 August 1943.

In this re-statement the doctrine was emphasized that tanks supported by foot infantry should attack successive objectives, with the initial objective close enough to the line of departure so that the infantry could advance rapidly behind the tanks and promptly occupy it. This infantry-tank attack was divided into six phases: reconnaissance, preliminary coordination, preparatory fire support, the tank assault, the infantry assault, and consolidation and continuation of the attack.

General McNair recognized the importance of tank battalions to support and reinforce armored and infantry divisions. "It is believed that our 1943 troop basis has

entirely too many armored divisions, considering their proper tactical employment, and too few GHQ tank battalions," he suggested in January, 1943.[17] As a result of this decision the rate of activation of armored divisions was slowed down, and the rate of tank battalion activation was increased.

The importance of tank battalions was confirmed by General Gillem during his extensive tour of the Sicilian battlefront in July, 1943.[18] Immediately after his return he wrote his tank group and battalion commanders:

> Both the Tunisian and the current Sicilian campaigns have proven the power of properly conducted combined infantry-tank operations. This combination may consist of an attack in which tanks precede the infantry, in which the infantry precedes the tanks, or in which both elements attack simultaneously. 19

Other features of tank group employment were substantially represented in the following excerpts by Major General Scott, 21 March 1945:

> From the very beginning, the importance of providing a number of separate tank battalions for use of infantry divisions was given earnest consideration. The infantry viewpoint was that the separate tank battalion was more important than the armored division. However, the Armored Force held a different idea and put the tank battalions of the armored division ahead of the tank battalion for infantry division, at least in number. As I remember it, the ratio of separate tank battalions to infantry divisions was about 2 to 1.
>
> The Armored Force, in the beginning, was very insistent that it retain control of these separate tank battalions and organize them into Groups with a Group Headquarters and Headquarters Company in order that they might be employed en masse as a Group consisting, normally, of three tank battalions. This group use has never occurred so far in any theater.... 20

Throughout the war, particular stress was placed upon the role played by the tank-infantry combination. General Scott emphasizes this point in the same memorandum:

> All experience on maneuvers and combat shows that failure to provide each infantry division with an organic separate tank battalion has lead to dispersion of tank battalions in the armored division for support of infantry divisions, thus tending to defeat the principle for maximum employment of tanks en masse with the armored divisions so correctly stressed in our tactical doctrines. 21

Much consideration was given the subject of tank-infantry training by both Infantry and Armored Schools, and on March 23, 1945, a board of officers was appointed "to study and analyze instructional matter pertaining to tank-infantry tactics and technique at the Infantry and Armored Schools with a view towards determining whether such instruction conforms to prescribed doctrines and to make recommendations for such revision of instruction at the two installations as may be desirable and necessary."[22] The Board was reconvened on 11 June 1945, with a view to making recommendations for the revision of FM 17-36 which would specify clearly and concisely 'infantry-tank tactics and technique.'[23]

Airborne Tank Units

The need for airborne tank units was emphasized when the Germans surprised the Allies by using approximately fifty tanks to stop the initial Allied attack on Bizerte. It was felt that "had an airborne tank battalion been available, it would have been sufficient to turn the battle in favor of the Allies."[24] On 2 February 1943, Army Ground Forces designated the Armored Force as the agency to initiate the organization of an airborne tank battalion,[25] to be equipped with the T-9 airborne tank. The Airborne Command sent a liaison representative to Fort Knox for the purpose of assisting in drawing up tables of organization and detailed training plans for an airborne tank company.[26] The Armored Force was authorized to develop equipment, furnish cadre, organize, activate and supervise the Mobilization Training Plan and unit training of the airborne tank company. It was contemplated that after the unit training was completed the company would be transferred to the Airborne Command for specialized unit air training, combined training and maneuver training.[27]

Tables of Organization were prepared and forwarded to Army Ground Forces 28 March 1943,[28] and approved on 24 June 1943. The 151st Airborne Tank Company was activated at Fort Knox on 15 August 1943.[29] This organization was the first of its kind to be organized by the Army of the United States and marked the first step toward development of airborne tank units. Officer and enlisted personnel for the new unit were furnished by the 20th Armored Division, being picked for their physical fitness, desire to serve with air-borne troops, and "unquestionable loyalty."[30]

For reasons both tactical and mechanical, the T-9 tank used by the airborne units was found to have many limitations by the Armored Force Board[31] and the failure to develop a suitable tank for this purpose was the greatest reason for the decline in the airborne tank program. The 151st Airborne Tank Company was assigned to the 2nd Army and subsequently transferred to Camp Mackall, North Carolina.[32] The 28th Airborne Tank Battalion was organized but later converted into a separate tank battalion.

Armored and Armored Artillery Groups

As the importance of armored infantry and armored artillery increased the need for readily-attachable groups and battalions became apparent. The group form of organization as applied to armored artillery and armored infantry was designed for the same purpose as the tank group; supervision and coordination of training to bring separate battalions to a high state of training and tactical efficiency. In the theaters of operation these groups would be highly trained teams that could be used to reinforce armored or infantry divisions.

Tank groups were expanded to include armored infantry battalions and were eventually redesignated as armored groups. The tactical employment of the group was to be the same as that of an armored division but on a smaller scale. The group constituted, in effect, a separate combat command, the separate armored infantry battalions assigned to the armored groups being organized in the same way as the organic armored division battalions. Three armored groups were activated during March 1943.[33]

By directive of Army Ground Forces, the 5th and 6th Armored Artillery Groups were activated on 5 September 1942, with stations at Camp Cooke, California, and Camp Chaffee, Arkansas, and attached to the 5th and 6th Armored Divisions, respectively.[34] Three armored field artillery battalions were attached to the 6th Group and one battalion to the 5th Group. Army Ground Forces directed that "the groups so authorized are to be tactical units only."[35]

Commenting on observations made in the North African campaign in 1944, an AGF Board Report stated that at no time were the two armored groups in that theatre

employed as tactically with their respective battalions under the command of the groups. It pointed out that the battalions were detached to Corps and to divisions so that the functioning of the group headquarters was to a great extent advisory and to some degree administrative. Group commanders in close touch with corps and divisions, advised concerning the best employment of the tank battalions, but at no time was any group employed tactically.[35]

Commanders of the tank battalions felt that although there had been no opportunity for them to function tactically under the command of groups, groups could serve a very useful purpose. A number of tank battalion commanders stated that perhaps if there could be a tank representative with the corps and division it might result in better understanding by higher headquarters of the proper employment of armor.

Chapter VII

TRAINING

General

In the Armored Force, training was of particular importance because of the necessity for closely coordinated teamwork between the combined arms represented, and the wide variety of weapons and vehicles which were employed in armored units.

Initially, the Armored Force developed its training doctrines mainly from the experience of the Infantry and the mechanized Cavalry. A week after the Force was organized, Training Memorandum No. 1 announced that the existent training field manuals of the various arms would apply in the training of similar units in the Armored Force. No specific procedure was at first outlined for the training of medium armored regiments, and other primarily infantry portions of the Armored Force. Light armored regiments and reconnaissance battalions were directed to conform to the provisions of Cavalry Field Manual, Volume II.[1]

The first comprehensive training directive was published on 6 August 1940.[2] The directive specified that the 1st and 2nd Armored Divisions be ready to take the field by 1 October 1940 and also would be prepared to train cadres up to 25% overstrength in order to activate two new divisions the following spring. It was decided to conduct individual training concurrently with unit training, and prepare for combined training in maneuvers with larger units in the spring of 1941. Aside from the time-honored principles of leadership, physical fitness, and other basic training aims, development of cross-country mobility, combined-arms teamwork "with particular attention to coordinated action with the Air Corps," antiaircraft defense and fire and maneuver by small units were emphasized.

On 4 November 1940 the Armored Force School started training specialists for the divisions and tank battalions.[3] As selectees started to arrive, new problems of training arose. These selectees were given basic training by the 1st and 2nd Armored Divisions, and by unit replacement centers maintained by the GHQ Reserve and National Guard tank battalions. In February, 1941, the Armored Force Replacement Training Center started training selectees as filler replacements relieving tactical organizations of this responsibility.

The problem of providing trained personnel for the newly-activated divisions and tank battalions placed a huge burden upon the units which were first activated. The 1st and 2nd Armored Divisions provided cadre for the formation of the Replacement Training Center, and the 3rd and 4th Armored Divisions, and then these four divisions in turn provided cadres for newly activated divisions. On 19 May 1941, it was directed that "each organization of the Armored Force will maintain an enlisted cadre for a like organization ... This system will include selected privates and non-commissioned officers attending NCO school, understudying administrative and technical specialists and performing the duties of the next higher grade during daily training."[4]

General Chaffee was satisfied by October, 1940, that the initial training objectives announced in the directive of 6 August were being achieved. He specified that for the remainder of the calendar year "special emphasis be placed on the training of the individual, the vehicular crew, the platoon, the company and the battalion."[5]

Throughout its history, one of the most perplexing problems confronted by the Armored Force was the training of junior officers and non-commissioned officers. As late as 3 July 1943, the Executive Officer of Headquarters Armored Force G-3 stated:

"Reports from combat units in active theaters unanimously indicated lack of strong leadership among junior officers and NOC's."[6] A comprehensive program was started in 1941 by inaugurating "Newton's College" in the Armored Replacement Training Center to train newly assigned junior officers.[7 8]

A school for Air Corps pilots and observers was established under the supervision of the I Armored Corps at Fort Knox, commencing 1 February 1941 to aid in a better Air Corps understanding of Armored Force problems. In a one month course, training was given in cooperation between Air Corps and armored units, methods of signal communication between air and armored units, and subjects of related nature.[9]

During the first three months of 1941, the Armored Force emphasized five objectives in training:[10]

1. Training of the regiment, brigade and division in preparation for spring maneuvers.
2. Training in the functioning of headquarters of all echelons.
3. Coordinated action of all components.
4. Coordinated action with other troops with particular attention to supporting combat aviation.
5. Training of selectees.

For the second quarter of 1941, these objectives were supplemented by directives placing emphasis upon combat firing and service practice, combat intelligence, camouflage, field maintenance, supply and evacuation.[11]

The somewhat haphazard practice of getting trained cadres to start a new division on its training program was finally replaced in April, 1942, when the 8th Armored Division was activated at Fort Knox, Kentucky. The 8th Division was from the start a cadre training division exclusively. This system worked more smoothly than the former practice of robbing well-trained units when they were approaching combat efficiency. The role of the 8th Armored Division was replaced in March, 1943, with the activation of the 20th Armored Division. The 20th was also given the responsibility of training battle loss replacements to be sent overseas. This role was continued by the 20th Armored Division until July, 1943, when Army Ground Forces directed that the 20th train, like the other divisions, as a combat division.

In the training directive for the year 1941-1942, a new program of unit training tests was announced. These tests were to be unrehearsed and not be made known to participating troops prior to the actual beginning of the test.[12]

At the same time the 1st and 2nd Armored Divisions were on maneuvers; the 191st, 192nd, 193rd and 194th National Guard Tank Battalions and the 1st Tank Group were participating in maneuvers from 11 August to 30 November 1942 with corps and divisions at various posts throughout the United States.

Observers at the Louisiana maneuvers during August and September, 1941, noted a number of deficiencies in the performance of troops. Nearly all of these deficiencies concerned basic military principles (such as lack of camouflage discipline) and were applicable to non-armored as well as armored units. In forwarding these criticisms to armored units, Headquarters Armored Force announced:

> In general, the omissions are attributable to the inexperience or lack of training of company officers ... The aggressive spirit shown by Armored Force units as a whole was most gratifying and is to be encouraged. 13

One of the most significant of General Headquarters training directives was "Post-Maneuver Training," dated 30 October 1941.[14] On 24 November 1941, the Armored Force directed that "the period 5 January - 30 April 1942, will be devoted to the training prescribed in GHQ letter."[15] In its training directive for the first quarter of 1942, the Armored Force applied the principles contained therein, and supplemented them with particulars pertaining to armored units.[16] GHQ had noted the deficiencies in basic and small unit training, and advised that "Small unit training will be conducted progressively beginning with the squad and extending up to the regimental combat team." The Armored Force outlined a four-phase program, as follows:

1. Crew, Squad, Section and Platoon Training.
2. Company and Battery Training.
3. The Battalion.
4. The Regiment.

Training Tests for infantry and field artillery units were prescribed in general accordance with the GHQ tests in these two subjects. In addition, at least one division and one combat command CPX were prescribed monthly.

In January 1942, a new series of air-ground training exercises was planned, to facilitate the direct support of an armored division by bombardment aviation. In general, the program was divided into six phases:[17]

1. Presentation of air request procedure to G-3 and S-3 air and communication personnel.
2. Communication exercise employing runners instead of signal equipment.
3. Communication exercises with all equipment at reduced distances.
4. Duplication of third phase at full distances.
5. CPX with full tactical situation requiring complete use of air support system.
6. Field exercise, same as fifth phase, but with troops, outlined enemy, and planes.

The first two phases were planned for indoors, the next four in the field.

Col. Edwin K. Wright, who guided the destinies of Armored Force training in his eighteen months as Assistant Chief of Staff, G-3, started in early 1942 to emphasize the need for Infantry-Tank training. Colonel Wright asked Army Ground Forces to take positive action to require combined infantry division-tank battalion training, emphasizing the tank support of infantry divisions in the attack. Army Ground Forces replied with a supplement to its initial training directive, stating that "combined infantry division-tank unit training will be emphasized," and that problems for the maneuver period should include infantry-tank unit operations.[18] An Armored Force representative was detailed to assist the infantry division staffs in the preparation of the demonstrations and exercises.

During 1942, General Devers pushed the training of armored units, and directed their activities toward participation in maneuvers. The Commanding General of the 5th Armored Division entered a plea that his troops were not sufficiently trained to go to the Desert Training Center, and that at Camp Cooke he had rocky soil and blown sand "that is equal, for maneuver purposes, to the Sahara Desert."[19] General Devers replied that "while you may feel that you need more time for training and might do it better at Cooke, we know by experience that such is not the case and that the only way to get real training is to get into the field with the equipment and men and meet the problems as they occur from day to day."[20]

In commenting upon the experience of various ground force units in the 1942 maneuvers, General McNair noted in particular, with respect to units, that the large units showed a lack of combined training. He was pleased with most aspects of armored operations, except the fact that tank units still failed to carry out established tactical principles in advancing with infantry. For example, it has always been appreciated that infantry should precede tanks against serious resistance, and General McNair noted that armored divisions were frequently used abreast of infantry divisions to force crossing of rivers - "probably the acme of unsoundness."[21]

The training memorandum was the medium employed to disseminate to Armored units the various Army Ground Forces directives, maneuver and observer reports and findings of special staff officers. The usual training memorandum dealt with a single subject, such as the adjustment of tank sights. Every few months a general memorandum, covering a variety of subjects, was published.

When one of the larger training directives was about to be published, the latest Army Ground Force directives would be studied, staff sections would be asked for suggestions derived from their experiences or reports, and defects made evident by recent maneuvers or combat reports would form the basis for supplementary material. To give an example of the source material for some of these more comprehensive training directives, "Training Memorandum Number 37," which was a training directive for the period 1 November to 28 February 1943, was a guide to implement the procedure directed in the latest Army Ground Forces directive.[22]

In line with Ground Forces directive of 19 October, various training tests were prescribed for artillery battalions; physical training tests and platoon tactical and combat firing proficiency tests were scheduled. At the suggestion of the Ordnance Officer, Headquarters Armored Force and G-4, additional first echelon maintenance training was incorporated. Heavy maintenance units were directed to comply with the provisions of a recent War Department letter specifying the functioning and training of fourth echelon units.[23] The Artillery Section contributed a section on training tests and standards for armored field artillery. G-2 provided some comments on combat intelligence. The Adjutant General secured the inclusion of a plan to have the Adjutant General or Adjutant conduct instruction in administrative procedure within unit personnel sections, and in classification and postal sections where applicable.

The Armored Force School had already been conducting tests in village fighting and the assault of permanent fortifications when the Army Ground Forces letter of 5 January 1943 stimulated new activity along these lines.[24] The Ground Forces letter started immediate moves in the armored divisions to construct pill boxes and other fortifications as a prelude to starting assault training. On 20 January 1943, Ground Forces sent out a supplementary letter, noting that "in conformity with a personal directive given by General Marshal to General McNair," training in combat in cities and street fighting should be initiated.[25] This type of training was very much akin to the comprehensive program of battle training which was devised and developed in the Armored Force Replacement Training Center by Major General Scott.[26]

Throughout 1943, the Armored Force stressed battle realism. General Devers and General Scott were the leaders in driving home the necessity for realism in training. General Devers, after returning from his African tour, noted: "We must instil in our soldier the killing spirit, the desire to kill Germans and Japs; you must go after their training in a tough, fearless, but intelligent way, asking no quarter, giving none."[27]

In early 1943, the length of the training program for armored divisions was changed from 26 to 38 weeks, because of "battle experience and certain additional training required for future operations." As a result of this move, the phases of Armored Force training were outlined as follows:[28]

1. Preparation; intensive schooling of instructors.
2. Basic individual and technical training (7 weeks).
3. Individual crew, squad, section and platoon basic training (8 weeks).
4. Tactical training to include the platoon (3 weeks).
5. Tactical training to include the company (2 weeks).
6. Tactical training to include the battalion (4 weeks).
7. Tactical training to include the regiment (3 weeks).
8. Combined training to include the field training of the combat command and division (11 weeks).
9. Maneuver and field training under direction of higher headquarters.

As reports from the battlefront still indicated a need for more infantry-tank training, Colonel Wright, in May 1943, analyzed the situation as follows:[29]

> In spite of constant attempt to provide infantry division-tank battalion cooperative training in this country, practically no success has been obtained. All infantry division commanders, whether contacted direct or through Army Ground Forces, have indicated the desirability of such training but fend it off on the excuse that "Time is not available," "After we complete our unit training," "After we finish maneuvers," etc. Army Ground Forces has been of no assistance to us in forcing this training.
>
> The results of this failure to provide cooperative infantry-tank training is being reflected in the combat zone. For example, Lieutenant Colonel Lou Hammack's very fine 751st Tank Battalion (M) was practically wiped out because in four successive attacks the infantry refused to follow him. Four times he took the objective and each time had to pull back, trying to pull the infantry forward, the Germans in the meantime re-obtaining the position.

As a result of Colonel Wright's plea, a letter to Army Ground Forces suggested that on completion of unit training under Armored Force control, each tank battalion should be attached to an infantry division; or that tank battalions should be activated at the same station as infantry divisions and be directly attached on completion of unit training. It was further recommended that authority to contact infantry divisions direct be granted, to exchange information and instruction on the use of tanks with infantry.[30] Further impetus to a greater amount of tank-infantry training was supplied by General Gillem, long an exponent of combined training. Following his return from Africa and Sicily, in a letter to the commanding officers of his tank groups and tank battalions, General Gillem stated:[31]

> I intend to initiate, without delay, a series of training inspection designed to accelerate your training along the lines indicated ....
>
> While the staff here at Fort Knox will assist you in providing an opportunity for combined training, it is vital that you take steps to arrange such training with near-by troop units whenever possible and to provide instruction acquainting all your personnel with the technique of combined infantry-tank operation.

Measures were immediately taken by the 1st Armored Group and the Eighth Tank Group to arrange for tank-infantry combined problems in September 1943 following the publication of FM 17-36 Employment of Tanks with Infantry.

The Cassock Project

The most secret training project undertaken by the Armored Force was the training of units in the use of CDL[32] equipment for which the codeword 'Cassock' was prescribed.[33] The basic CDL equipment is the M3 Medium Tank modified to provide a light capable of illuminating the ground at night to a range of 800 yards sufficiently well for individual enemy movements to be detected. The source of the illumination is adequately protected by armor against small arms fire and shell fragments and will produce in the eyes of the enemy a dazzling effect which serves to create temporary blindness. Also provided was a screen of light giving effective concealment for accompanying tanks from aimed fire of antitank guns and, in addition, offered partial concealment for infantry. The modification did not involve the removal of the 75mm gun. The codeword 'Leaflets' was prescribed for these tanks.[34] CDL equipment was developed by the British and demonstrated to a select group of U. S. officers at Lowther Castle, near Carlisle, England, in the fall of 1942. Among the American officers present were Generals Eisenhower, Clark and Major General G. M. Barnes. The project, having been further investigated by staff officers from Headquarters, European Theater of Operations General Eisenhower recommended to the War Department that a similar project be considered for our Army.[35]

A board of officers consisting of General Devers, Major General Barnes, Colonel Frederick M. Thompson, and Captain John Savage met in Detroit on 19 February 1943 to make recommendations to the Chief of Staff as to whether CDL equipment should be produced in the U. S. and, if so, in what quantities. The manufacture of 825 Leaflets and the designation of ten tank battalions to receive Cassock training was recommended.[36]

On 9 March 1943 the Army Ground Forces directed that the Chief of the Armored Force establish a training center at Fort Knox, Kentucky, "for the purpose of conducting mechanical, theoretical, and small unit (platoon) tactical training with Cassock equipment.[37] The Special Training Group, Armored Force, was organized for this purpose. To provide unit training of battalion size, an additional training area was established in a remote section of the California-Arizona Maneuver Area. Eventually, two tank groups, six tank battalions, one armored infantry battalion and two ordnance heavy maintenance companies underwent extensive training in this area.

Extraordinary security measures were taken in England to safeguard this equipment and it was agreed that the same degree of security would be taken in this country. In order to achieve strategical success it was agreed that the weapon would not be utilized for the first time except by mutual agreement between the two powers.[38] The security measures adopted in this country resulted in the individuals connected with the training being almost completely isolated. They were required to execute an oath of secrecy and could only go on pass in pairs. If anyone was hospitalized, a buddy went along to "keep him company" and discharge from the service for any reason was not permitted until secrecy was no longer essential. Those who became incapacitated for full military duty were utilized in housekeeping duties at one of the two areas where training was conducted, and those who became totally disabled were held in designated hospitals. Closed liaison was maintained with the CDL School in England and two British officers were placed on duty at the Special Training Group, Armored Force.

On 10 August 1944, the Supreme Allied Commander directed that CDL equipment could not be used in action nor taken within twenty miles of forward positions without prior approval of Supreme Headquarters.[39] While the American CDL units were never in the combat role for which trained, they were used to provide light for the bridges over the Rhine River in the sectors of the First, Third and Ninth Armies. The light thus provided resulted in the detection of swimmers sent down the river by the enemy to destroy the bridges. Although Cassock units were often fired upon, they suffered no casualties in men or equipment. The CDL equipment was stored and the tank battalions

were either converted to regular tank battalions or to medium tank battalions, special (mine exploder).[40]

Training Literature and Films

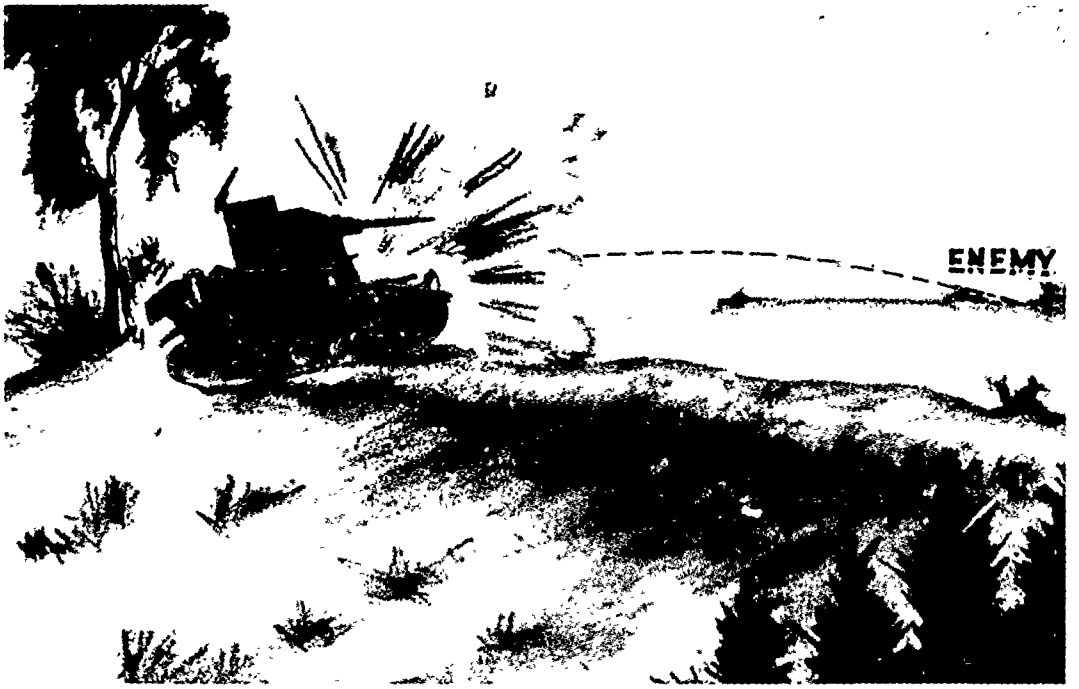
> To be effective in our greatly expanded Army in which relatively few are familiar with the military vernacular, manuals must be written in clear, everyday language, with an emphasis on brevity and the use of illustrations. These principles are exemplified to the highest degree in Armored Force training literature, thereby setting a standard which is being reflected in the training literature and visual aid program of the entire Army. 41

The Armored Force has made an outstanding contribution in the field of training literature. This has been achieved by steering clear of the pet military phrases which, although usually understood by a regular army man, cause the recruit to throw up his hands in despair.

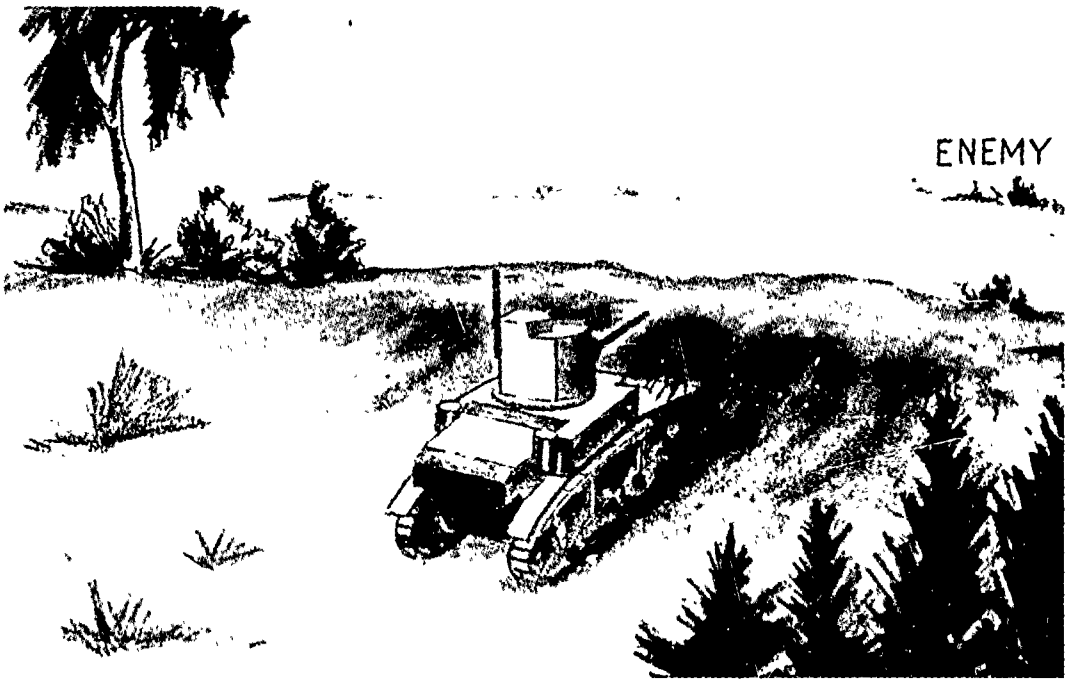
In the early days of the Armored Force, the Tactical Section of the Armored Force Board handled training literature and films. Inasmuch as this same section worked on the first tables of organization for the Armored Force, there was a close tie-up between tactical and organizational doctrine and the training literature. The sources of information were: Cavalry Field Manual, Vol. II (Mechanized Cavalry), along with ideas developed and taught by former instructors at the Cavalry School; Infantry School literature on employment and maintenance of Infantry tanks; G-2 reports and observer conclusions on the German armored successes in Europe; personal experiences of officers in command of armored units; and particularly at the beginning, the organizational and tactical doctrine expounded by General Chaffee to the officers of the Armored Force on 13 September 1940.

Subsequently the matter of training literature and films was placed under the supervision of the Armored Force School and later under G-3 of Headquarters Armored Force. On 3 March 1943, a separate Training Literature Department was established in the Armored Force School to supervise both functions. The procedure for writing the manuals insured the complete use of available information. Officers went to maneuvers and to the troops to get new ideas and to try out their own. The tentative manuals were reviewed by boards of officers in the armored divisions, the G-3 Section of Headquarters Armored Force, and in the War Department. Comments and criticisms were weighed against existing ground rules and tables of organization until the final draft was approved.

A significant innovation in field manual technique was devised by Lt. Col. (later Brig. Gen.) James C. Crockett. Colonel Crockett secured a copy of a German field manual on tank platoon employment, which had been revised as a result of Nazi experiences in the Battle of France. He translated the manual, Americanized it by the substitution of U. S. Armored vehicles and captions, and it later formed the basis for Field Manual 17-30, "Tank Platoon." The striking thing about this manual was its liberal use of pictures depicting the right and wrong way to deploy armored units, fire from defilade, and approach the enemy.



(1) Do not take position on top of a hill.



(2) Take position on the slope, giving defilade to the tank hull.

"A SIGNIFICANT INNOVATION IN FIELD MANUAL TECHNIQUE"

General Devers was highly pleased with the results achieved in training literature. "It was just a case of cutting out gadgets and words, and using pictures and horse sense," he explained to General Patton. "I found many fine officers here on my staff who believed the same, so we gave them the green light, stole everyone's ideas in the world that we could find and went to work. Some day they may put me in the penitentiary for getting them printed, but I am not worried."

In line with the newer techniques in the preparation of field manuals, the author of a training manual prepared, in addition to his manuscript, a "word picture" of the illustrations to be included. This was then turned over to a staff of artists and draftsmen, whose experience and study of this technique enabled them to perfect their art to a high degree.

On the 30th of August, 1944, the Artillery Officer of the XIII Corps wrote General Scott, "Armored Divisions have been employed in accordance with the principles laid down in FM 100-5 and 17-100. The results which have been obtained point to the soundness of the doctrines in the field manuals mentioned."[42]

Although their reputation did not spread as far and wide as the Armored Force field manuals, training films and film strips proved to be among the most valuable training aids used. In addition to the use of Signal Corps films on general subjects, troops were shown specialized films on Armored Force tactics and equipment. They proved of particular value in training with new equipment and in teaching new techniques. Among the most valuable films produced by the Armored Force was "Firepower," a 16mm film describing the operation of the gyrostabilizer in a tank.

Four complete scenarios and four sets of film strip material were usually produced every six weeks. Three civilian scenario writers worked in conjunction with the officers, who served as technical advisors. The film strip plans were written by officers of the department. Photographers took still pictures, which were developed into 8 x 10 prints. Each print was retouched by a staff of artists, edited, and the photographs printed on 35mm strip.

Effect of Combat Operations on Training

With the successes, failures and problems of armored warfare against Germany came the incessant demand for modification in equipment, revision of training text, and overall planning that would insure the successful conclusion of the war. As an example of efforts to meet demands from theaters of operation, young officers graduating from Armored Force OCS spent 'transition' periods in battle training programs that supplied training second only to actual combat.

In carrying out the primary function of training inspections of armored units as specified in the 1943-44 redesignations, inspection teams observed armored units undergo tests specified by Army Ground Forces as POM training requirements, including the Tank Crew Gunnery Test, Physical Test, Infantry and Cavalry Platoon Combat Firing Proficiency Test, Tank Platoon Combat Firing Proficiency Test, Reconnaissance Platoon Combat Firing Proficiency Test, Mortar Platoon Combat Firing Proficiency Test (armored battalion), Mortar Platoon Combat Firing Proficiency Test (armored infantry battalion), Assault Gun Platoon Combat Firing Proficiency Test, Machine Gun Platoon Combat Firing Proficiency Test, Field Artillery Battery Test, Field Artillery Battalion Test, Infantry Battalion Field Exercise Test, Infantry Battalion Combat Firing Test, Tank Battalion Field Exercise Test, Reinforced Tank Battalion Combat Firing Test, and the Combat Intelligence Training Test. Reports of these inspections and observations as to the state of training and the ability of the unit to perform its primary function in combat were submitted to Army Ground Forces.

In reporting on the progress of the Armored Force in training in September 1943, Major General Gillem stated that although the Armored School was improving in certain respects such as in the development of equipment and technique of gunnery, and in the high standards of instruction, there was still considerable room for improvement. He went to the core of the problem in a frank and enlightening report to General McNair:

> I am stressing the courses in tactics. In my inspections of some units I find that officers have been promoted into the field grades without the necessary background in fundamentals. I hope to improve the battalion commanders' course to the extent that it may do much to correct this situation. I feel also that in view of the necessity for closer relationship of Armored and Infantry units, it would not be unwise to make this course available to officers of other branches. This matter warrants consideration because the infantry battalion commander of today is the combat team commander of tomorrow. He will have to handle tanks. Therefore, now is the time to inculcate in those commanders and staff officers of infantry elements in a knowledge of armored units and their power and limitations. 43

Throughout the campaign in Europe the course of study in armored training was constantly being altered to fit the pattern of changing combat requirements. In the theater of operation units were developing and using tank-infantry teams that were successful in combating the German defense. In rest areas these systems were improved and new battle-proven tactical ideas became operational procedure.

The reports from overseas theatres were reflected in the Armored Command's stress on training in tank-infantry tactics. As early as 16 February 1944, General Scott was emphasizing this point:

> Numerous reports from overseas and maneuvers stress the necessity of training tank battalions with infantry units. Inspections by this headquarters indicate that the attachment of tank battalions to infantry units for combined training is not receiving enough emphasis and results from maneuvers indicate that this training has not reached the desired standard. 44

Focusing all efforts toward the elimination of this problem, the Armored Center reported satisfactory progress along lines of infantry-tank training in September 1944.[45] General Scott later directed that attention be given to teaching the theoretical and practical work of the tank-infantry team in all field training in the ARTC and the TAS -- "and that every possible effort and planning be instituted to improve field training by the introduction of more realism."[46]

Along with the latter phase of the European War our armored leaders began to look to the Far East and the requirements of concentrated armor in this new theater. In 1943, General Gillem wrote General McNair:

> ...It is entirely possible that when operations begin in China, there will be a call for a much lighter armor than we have now. While this is problematical, I feel that we must be prepared to provide types of equipment for various theaters. 47

As redeployment plans for armor took the spotlight, in face of the imminent victory in Europe, a comprehensive study of the lessons learned in the Pacific theater began and before the complete and total victory, plans were well under way. Again the need for even closer coordination of infantry and tanks seemed apparent and necessitated further treatment in training. In 1945 the Chief of the Armored Section of Headquarters, 12th Army Group in a memorandum to General Bradley wrote:

Fighting in the Pacific area is likely to call for even closer cooperation between tanks and infantry than has been the case in the ETO. The system of attaching first one tank battalion and then another to an infantry division has not uniformly provided the degree of cooperation needed in ETO. 48

Sphinx Project

On the 25th of May, 1945, Col. G. M. Dean, Headquarters Army Ground Forces, called a conference for the discussion of a project to be conducted to determine the effectiveness of the present weapons and ammunition against installations similar to Japanese field fortification found on the islands in the Pacific. General Marshall, Army Chief of Staff, directed that Army Ground Forces, Army Service Forces, and Army Air Forces get together and find the proper technique for attacking Japanese field fortifications. This project was to receive first priority and be completed in approximately thirty days.[49]

Army Ground Forces installations at Fort Knox, Kentucky, Fort Bragg, North Carolina, Fort Sill, Oklahoma, Fort Benning, Georgia, and Camp Hood, Texas, were to build field fortifications and test the weapons and ammunition which were peculiar to each installation (such as Fort Knox - tank, Fort Benning - infantry, etc.). Headquarters, Armored Center was held directly responsible for the project at Fort Knox. Direct liaison was maintained between each project. Results of projects were exchanged and weekly reports were submitted to Army Ground Forces on the progress being made.

Many projects were conducted with officers and labor working in shifts to lay out the necessary tactical requirements. While many interesting facts were determined pertaining to the number of rounds of ammunition needed to penetrate certain thicknesses of rock and how caves should be attacked by flame throwers, no new technique was discovered. Upon conclusion of all tests conducted by Army Ground Force installations, a combined test by all arms was held at Camp Hood, Texas. A composite tank company from the Armored Board was sent to participate. As a result of this test, War Department Training Circular No. 34, dated 11 August 1945, was published as a guide for future training in this type of fighting.

While the victory over Japan came too soon to see further reorganization of armor needed to meet combat requirements in the Far East, the enviable records of the armored divisions and tank battalions throughout the war demonstrated the adequacy of their training and the soundness of the doctrine developed for the employment of armor.

Chapter VIII

TRAINING

Armored Force School

Plans for the Armored Force School were carefully laid even before the organization of the Armored Force. As General Chaffee realized the need for skilled technicians in mechanized warfare,[1] he considered the available talent for a military educator with progressive ideas and organizational ability to head the School. His choice, Lieutenant Colonel Stephen G. Henry, came to the Armored Force from the 34th Infantry Regiment at Fort Meade, Maryland. He had been a tank instructor at Fort Meade and Fort Benning and possessed traits far more valuable than a thorough knowledge of armored vehicles; including a keen appreciation of teaching techniques, unusual administrative ability, and a zeal for accomplishment.

BRIGADIER GENERAL STEPHEN G. HENRY
"He Had a Certain Zeal for Accomplishment"

On 25 July 1940, Colonel Henry was designated as Commandant. Two days later he was directed to "plan, organize and operate" the new institution.[2] Second in command to Colonel Henry was Maj. Robert G. Howie, whom General Chaffee selected from the Infantry School at Fort Benning to become Executive Officer of the new organization.

On 19 September 1940, the Secretary of War approved the establishment of the Armored Force School and Replacement Center,[3] and on 1 October 1940, the new organization was authorized.[4] The School was originally combined with the Replacement Training Center, but on 25 October 1940, before either had developed very far, the Armored School was redesignated as a separate installation.[5]

Some of the literature and personnel of the Tank School at Fort Benning and the Communication and Motor School of the former 7th Cavalry Brigade (Mechanized) at Fort Knox, became available to Colonel Henry. But for the most part his job was to prepare plans for expansion. One of his first steps was to survey various trade schools within 400 miles of Fort Knox, studying their equipment and curricula in relation to the needs of the Armored Force. It was General Marshall's idea that until the School became soundly established, the facilities of civilian trade schools should be fully utilized.[6] As a result of Colonel Henry's survey, five schools in Chicago, St. Louis, Cincinnati, and Valparaiso, Indiana, were selected. On 9 October 1940, 731 enlisted men from the 1st and 2nd Armored Divisions were enrolled in these schools as automotive and diesel mechanics, radio electricians, welders and machinists.[7]

The experience of the Armored Force School with training specialists at civilian institutions was varied.[8] There were differences in equipment which made it sounder to train Armored Force men on the same vehicles they would use. Savings in transportation and a unified tactical doctrine were possible only when specialists were trained at Fort Knox. Thereafter, the Armored Force School continued to send its graduates for post-graduate work at specialized trade and industrial schools, but in smaller proportions.

Approximately 200 officers and 2000 enlisted men were enrolled in the first classes which started on 4 November 1940 while carpenters were still hammering on the walls. The original curriculum covered instruction in eight departments: tank, wheeled vehicle, motorcycle, communication, tactics, gunnery, field engineering, and clerical. The original plans called for operation in four cycles in order to equip the armored divisions and tank battalions with the required number of specialists.

The preparation of plans to increase the Armored Force to six armored divisions and 15 GHQ tank battalions meant that new methods had to be devised to take care of the student load. Expansion of the physical plant to take care of these added quotas was impracticable in the time allotted. This problem was solved by teaching on a shift system. On 3 February 1941, the two-shift day was started, with the first shift using the classrooms and workshops from 0600 until 1200 and the second shift taking its place at 1300 and staying until 1900. On 13 March 1942, these shifts were lengthened to seven hours apiece.

Since the entire plant was not being utilized all the time, the major courses were subdivided into phases. The Tank Department, for example, was divided into ten phases of six working days each. Thus, by introducing each week a new increment of students, some 1,440 soldier-students could be given training at the same time.

Instruction, following a lecture and discussion, was generally conducted by small groups with demonstrations followed by practical work. The value of visual aids was recognized. Many of the visual aids were brought to Fort Knox from the tank Section of The Infantry School and from the Communication and Motor School of the 7th Cavalry Brigade (Mechanized). Huge charts explained such subjects as the electrical system of a 1/4-ton truck, the functioning of a tommy-gun, the lubrication system of a motorcycle. Working models, cutaway sections and film strips were devised to give the students a clearer conception of operations. Only one difficulty was experienced with visual aids: it was discovered that some officers after graduating from Armored Force School courses found difficulty in teaching similar courses in the field where visual aids were not available.[9]

The school was organized in three main divisions, the Training Group, the Demonstration Regiment, and the Academic Division. The Training Group housed, fed, paid and gave basic military training to students attending the school. In addition departments concerned with Training Literature, Reproduction, Supply, a library, and book ship were included in the school's organization.

The Demonstration Regiment was established on 24 January 1942[10] as a miniature armored division to present tactical, maintenance and logistical demonstrations and furnish such troops and materiel as were needed for practical training of students in the academic departments. It has participated in scores of "firepower" demonstrations at "OP 6" for the benefit of officers and officer candidates, and domestic and foreign dignitaries, including President Roosevelt, Secretary of War Stimson, and President Edouard Benes of Czechoslovakia.

The nine academic departments offered a variety of courses for training both officers and enlisted men in various specialties. Some courses were conducted in their entirety within one department, but many courses were conducted in several of the departments. The Officers Advanced Tactics Course, for example, included instruction in the gunnery and communications departments as well as in the tactics department.

The Clerical Department offered courses for training administrative personnel for armored units. Only qualified typists were accepted, and they were given a brief review in typing. Instructions in military correspondence forms, reports, and filing were included. (See Appendix A for courses.)

Working closely with the Artillery Section of Headquarters, Armored Force, the Gunnery Department instructed in the care, operation, mechanical functioning, marksmanship, and combat firing of all weapons used in the Armored Force. To assist in teaching the best methods of firing from a moving tank with the aid of a gyrostabilizer, a "wobble plate" was used to imitate the cross country movement of a tank. The "wobble plate" was replaced in June 1943, by the cutaway tank turret, which more nearly approximated firing conditions. (See Appendix A for courses.)

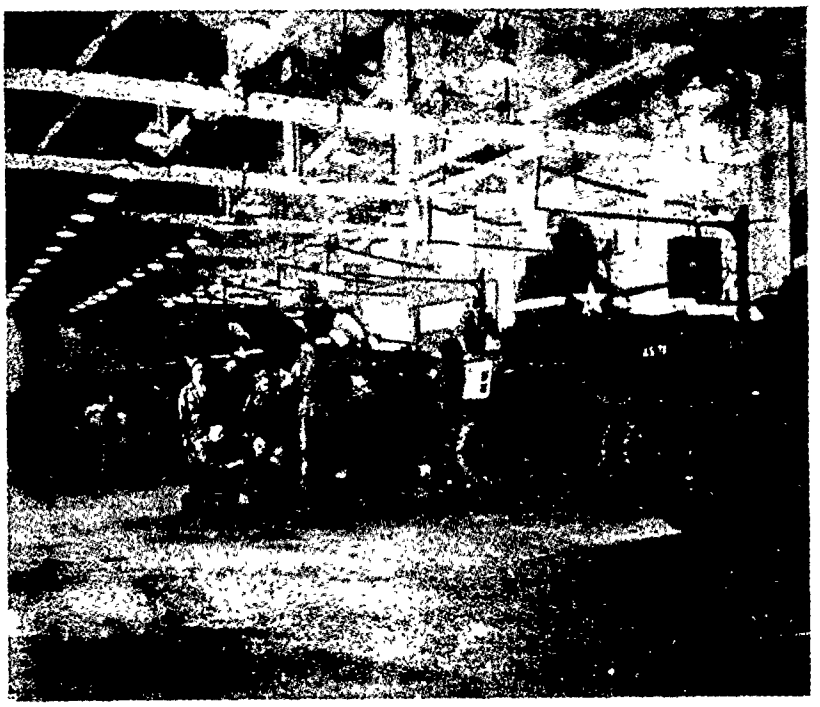
The Tank Department was the largest in The Armored School, its teaching and administrative personnel totaling 386, and its equipment valued at $7,000,000.00. Courses for both officers and enlisted men were conducted. These courses were originally divided into eight phases of eight working days each, which was later changed to ten phases of six working days each. (See Appendix A for courses.)

The Wheeled-Vehicle Department offered courses for officers and enlisted men in the maintenance of wheeled and half-track vehicles used by armored units, and in addition offered such special courses as a radiator, body, and fender course, and instruction in blacksmithing and welding. (See Appendix A for courses.)

The Motorcycle Department offered courses in motorcycle maintenance and operation. The Department was inactivated 26 July 1943 when the motorcycle was replaced in Armored Force units by the 1/4-ton truck 4x4. The personnel and equipment were integrated with that of the Wheeled-Vehicle Department. (See Appendix A for courses.)

The Communications Department trained communications officers, radio operators, and radio maintenance personnel. Its staff of 30 officers and 257 enlisted men handled up to 1,800 students at a time. (See Appendix A for courses.)

The Tactics Department offered courses generally on two levels; the company officer level for platoon leaders and company commanders, and the field officer level for battalion commanders and staff officers. In addition to the courses for officers, the Tactics Department was responsible for eight weeks of the instruction in the



"THE TANK DEPARTMENT WAS THE LARGEST IN THE SCHOOL"

Officer Candidate School, and in April 1943 took over the operation of the Battle Training Course from the Demonstration Regiment. (See Appendix A for courses.)

The Teacher Training Department was the last department to be added to the School, being established on 6 February 1942. It was developed by Dr. Verne Fryklund, former Associate Professor of Industrial Education at the University of Minnesota. Dr. Fryklund was commissioned a lieutenant colonel to become the first head of the Department. The Teacher Training Department was responsible for instructing the school's commissioned, enlisted, and civilian personnel in teaching methods. (See Appendix A for courses.)

Training ARTC Specialists

On 12 June 1944 the Armored Replacement Training Center desired to have its specialists trained at the Armored School. Due to the decline of attendance from units, a plan was evolved consisting of the following courses: Enlisted Replacement Clerical, Enlisted Replacement Communications, Enlisted Radio Repairman, Enlisted Armored and Artillery Mechanics, Enlisted Replacement Motor, and Enlisted Tank Mechanics. Detailed outlines of these courses may be found under the outlines for the various departments.

Reduction in Specialist Training

The reduction in the number of personnel from armies, divisions, and separate units taking specialist training at The Armored School caused the frequency of specialist courses to be reduced in most instances from one new course beginning each week to one new course every two weeks, with the exception of the Enlisted Replacement Communications Course.[11]

Officer Candidate School

Outstanding enlisted men, meeting the standard requirement of a 110 score on the Army General Classification Test as well as being recommended by their company commanders and an examining board were recommended for Officer Candidate School. The School was established on 12 May 1941 and enrolled 250 men in its first class on 1 July 1941. During 1942, approximately 450 second lieutenants were graduated every three weeks and commissioned arbitrarily either in the Infantry or the Cavalry according to varying percentages. Starting in December, 1942, production was stepped up so that a class graduated weekly, while, commencing in April, 1943, classes were cut in size to approximately 70 graduates per week. This was further cut in August, 1943, to 100 graduates per month. Classes were lengthened from 13 to 17 weeks in accordance with War Department orders, on 1 July 1943.

The central mission of the Officer Candidate School has been to train officers to be tank platoon commanders. The School has stressed the formation and development of characteristics of successful leadership. Instruction was given to the candidates in every department of the Armored Force School, with the exception of the Motorcycle and Teacher Training Departments. The two main subjects were tactics and gunnery, with tactics occupying over half the course and gunnery almost half. With the lengthening of the course from 13 to 17 weeks, hours devoted to tactics were increased from 129 to 228 per class.[12]

On 1 November 1944, the Tank Destroyer, Mechanized Cavalry and Armored Officer Candidate Schools were combined.[13] Further changes necessary to meet the demands of changing trends in text and field instruction were inaugurated by General Robinett on 9 September 1944 when he recommended that the course of study at Officer Candidate School be revised. As a result the mechanical phase of instruction received twenty-six more hours, the Teacher Training course experienced minor deductions in allotment of time along with the gunnery course and tank crew drill.[14] In October 1944 Army Ground Forces approved the recommendations for a complete revision of the instruction program to be given the combined armored, tank destroyer and mechanized cavalry students. This revision was subject to a qualification that required all tank destroyer candidates upon completion of the seventeen week course, to attend a four weeks course in indirect fire at the Tank Destroyer School. This course of study included, indirect fire, fire direction center work and simple survey as prescribed in War Department Training Circular No. 2, 1944.[15]

During the period from 12 May 1941 to 31 August 1945 The Armored Officer Candidate School had a net enrollment of 14,385 candidates of whom 11,852, or over 75 percent, were commissioned. Causes for failure among officer candidates were: miscellaneous reasons, 11.6 percent; academic failure, 11.1 percent; lack of leadership ability, 2.5 percent; conduct, 1.0 percent. After the mechanized cavalry, tank destroyer, and armored officer candidate schools were combined 733 officers were commissioned, the majority of whom were armored officers. The combined output of the school is included in the total given above. A detailed compilation of Armored Officer Candidate School production is contained in Studies in the History of Army Ground Forces No. 30, Wartime Training in the Schools of the Army Ground Forces.

Battle Training

British Commando training inspired the idea of battle training in this country, where it was first given to armored units by Major General (later Lieutenant General) Willis D. Crittenberger during the time he commanded the 2nd Armored Division in the early part of 1942. The units was disguised as the "Pioneer and Demolition Regiment" to ward off publicity. The purpose of this training was to develop within the individual fighter a high degree of self-confidence, courage and aggressiveness in battle;

to train him in the tactics of close combat; and to coordinate both mental and physical conditioning.

On 17 June 1942, the Demonstration Regiment of the Armored Force School was directed to prepare to present demonstrations involving the conduct and training of a detachment similar to the one developed in the 2nd Armored Division.[16] Lt. (later Maj.) Charles R. Williams was sent to the 2nd Armored Division and later to the Tank Destroyer Center to study the commando methods and tank-hunting techniques developed and planned. A Commando Platoon was then established within the Demonstration Regiment. The construction of a battle training course was completed on 15 November 1942, at Easy Gap on the Fort Knox reservation.

The course included practical instruction in street and woods fighting, techniques of fighting from roof-top to roof-top, methods of entering and searching building, and detonating booby traps. Hand-to-hand fighting was taught to develop body muscles and coordination. In the "infiltration" portion of the training, soldiers were accustomed to the noise of battle and the sensation of advancing under fire, and taught to visualize cover and concealment afforded by terrain. Small arms firing at ranges of under fifty yards was practiced, to develop quick-thinking action when there were surprise targets and poor visibility. Soldiers were taught to fire the tommy gun, rifle and other weapons from the hip. The training course was given to all officer candidates and students in the basic tactical or company officers' course. In April, 1943, its operation was taken over by the Tactics Department, and the cadre unit was renamed the "Assault Detachment."

As the battle training courses in the Replacement Training Center and the armored divisions were developed in 1943, the need for the School battle training course no longer existed. In July, 1943, battle training for officer candidates was abolished during the regular course and instead, the newly-graduated second lieutenants were sent to the Armored Force Replacement Training Center for four weeks of battle training work. In August 1943, the entire School battle training program was curtailed and then abolished, leaving the School free to concentrate upon training specialists and technicians.

Administrative and Special Problems

In the early days of School operation, considerable trouble was experienced with the caliber of students being sent from the field. Often a commanding officer looked upon his quota as a beautiful opportunity to exile his undesirables to a "reform school." Company commanders were anxious to retain their best personnel. Therefore, educational and aptitude requirements were instituted for the various School courses.[17] These requirements were supplemented by an explanatory personal letter from General Devers to his divisional and separate tank battalion commanders.[18] These measures resulted in a measurable improvement in the quality of students. No further difficulty was experienced in securing capable tactics instructors who had had either troop duty or combat experience. The demands of the theaters of operations were primary, and the School suffered at first as a result. This problem was solved by assigning to the School wounded and limited service officers with combat duty.

One of the valuable contributions to tactical knowledge made by the School was the development of a traveling tactical team, which presented tactical problems and their solutions to the various field units of the Armored Force by means of map exercises. A team of officers presented an armored division situation and applied the problem from the standpoint of the combat commander, the commander of a reinforced battalion, and the various supply and administrative agencies of the division. As a result, closer coordination was established with the field units, and unit commanders and their staffs became indoctrinated with current changes in the technique of armored operations.

It is no exaggeration to state that General Henry built the Armored Force School into an institution which gained a world-wide reputation. Other branches of the armed services and friendly foreign nations made frequent use of its facilities. Included in the first class which entered on 4 November 1942, were ten enlisted men of the United States Marine Corps. Marine officers and enlisted men have taken tactics and tank maintenance courses regularly since that time, as have men from other branches of the armed services. Groups of Canadian officers and enlisted men have been represented in many of the courses of the Tank Department.[19] Chinese, British and Australian officers, as well as officers from many South American nations, also studied at the School.

Close liaison was maintained between the School and private industry. In addition to the occasional courses students take at industrial plants, a limited number of civilian specialists have been employed in the various departments. General Henry visited Dearborn, Michigan, in late August 1942, to discuss the training of fifty school instructors in the maintenance of Ford engines for the Medium Tank M4A3. Ford equipment was subsequently shipped to Fort Knox, and the Ford Motor Company furnished instructors for the special task.[20]

By January, 1943, the operating personnel of the School had expanded from the original cadre of some 155 officers and men to 9,081 officers and enlisted men. Of the School's more than 500 buildings, 67 are used for instructional purposes alone. As of 31 August 1945, the School had received, trained and graduated 77,353 officer and enlisted students.

Col. Joseph A. Holly of the Armored Force Board was promoted to brigadier general on 18 March 1943, and succeeded General Henry, who became Commanding General of the 20th Armored Division, as Commandant. His background as an instructor at the Infantry Tank Schools at Fort Meade and Fort Benning, and the intimate knowledge of armored vehicles he gained while working with the Armored Force Board qualified the new Commandant for his post. General Holly had previously served as Director of the Tank Department of the Armored Force School. Shortly after the new Commandant took office, his predecessor said of him: "He knows as much about tanks and tank engines as any living American."[21]

General Holly's background and experience as instructor in other service schools and his ability to learn and understand the mechanical side of things, aided in requiring instructors to perfect their lectures and improve their teaching technique. The mechanical ability of General Holly kept the Armored School continually studying new modifications and new means of perfecting maintenance procedures. His personality and knowledge of training methods improved the School as a place to work and learn. Much of the credit for perfecting the Armored School's instruction and promoting better relations with armored units in other armies should be given to General Holly.

The administrative structure of the School was reorganized and the position of Assistant Commandant created. This post, initially filled by Colonel Charles S. Johnson, had charge of instruction in the Academic Group; supervised testing, reference books, and instructional matter, including the instructional departments, and Training Literature Department.

Following General Holly's assumption of command of the School, the Gunnery Department was reorganized and Col. Andrew P. O'Meara assigned as director, together with several other officers who formerly served with the Artillery Section of Armored Force Headquarters who were assigned as assistant instructors. This reorganization was effected in order to develop standardized methods of tank gunnery, which had become one of the most important aspects of tank warfare, and to provide high quality instruction in this subject in the School. It was primarily through the efforts of Colonel O'Meara and Major Ruth (later Lieutenant Colonel) that Tank Gunnery Manual 17-12 was revised

and published on 10 July 1944, and the development of a tank crew gunnery test published by AGF and specified as a POM requirement. This tank crew gunnery test proved to be invaluable from the tank gunnery standpoint. For the splendid results achieved in the development of the gunnery phase, both Colonel O'Meara and Major Ruth were awarded the Legion of Merit.[22]

The question of training tank crewmen in what was called a secondary mission for tanks as artillery was highly controversial. General Gillem and General Shugg, the Artillery Officer of Armored Command, were very much opposed to this training on the basis that first of all there was not sufficient time to completely train a tank gunner in his primary mission; secondly, that training tanks as artillery was exceedingly complicated and lastly, it would tend to shorten the life of the gun tubes and consequently make direct fire gunnery inaccurate. The Army Ground Forces nevertheless directed that all tank crewmen would be trained in their secondary mission as artillery after completing their training in their primary mission as tanks. This training proved to be beneficial as tanks were sometimes used as artillery in combat, although it was pointed out by many officers that emphasis on this type of training tended to make the tankers less aggressive and less desirous of closing with the enemy.[23] As combat experience with this training became available, General Shugg wrote: "Two situations have been reported when tank companies of separate tank battalions were employed as artillery on an artillery mission. Both mission were under the supervision of artillery observers and were successful."[24]

Successor to General Holly as Commandant of the Armored School was Brig. Gen. Paul M. Robinett, assigned February 27, 1944. General Robinett had been previously stationed at Fort Knox as commander of an armored regiment in the 8th Armored Division and later commanded the 13th Armored Regiment of the 1st Armored Division overseas. His military background included participation in the expedition to North Africa. During the operations incident to that expedition, he commanded a sub-task force of Combat Command "B", which landed at Mersa Bou Zedjar and captured the important air field of La Senia. In coordination with another task force, General Robinett's command then assaulted Oran and captured the city. It was through his headquarters that the surrender of the French fleet was effected.[25]

As a result of a severe wound in the leg by artillery fire, General Robinett was evacuated to hospitals in North Africa and eventually by way of England returned to America and his assignment as commandant of the Armored School. For his distinguished combat service he was awarded the Distinguished Service Medal, French Legion of Honor, and his second French Croix de Guerre with Palms.

General Robinett's combat experience and personal command of combat troops with the 1st Armored Division gave him a background for giving the students the background of combat experience which they needed to perfect their ability as armored personnel. He injected into the courses, through his instructors, the benefits derived from actual combat and practical experience which made the courses more interesting and gave all students first hand information concerning combat. He required the students to spend additional time in learning other weapons and other things which the School had to offer while they were present for a given course. His interest in publishing new field manuals and training memorandums based upon his experience without a doubt saved the lives of many of our soldiers and enriched the teaching of the School.

During General Robinett's administration of the Armored School it was deemed necessary by Army Ground Forces to shorten the length of courses at service schools and a revision of the courses offered to both enlisted and officer personnel of the School was initiated.[26] At the time, (August 1944), the status of training units in the United States required that personnel from tactical units not be absent from their units for an extended period of time to attend service schools. Accordingly

recommendations for the reduction in the length of courses was submitted by the Armored School to include a three week reduction in the gunnery subcourse for officers' advanced courses and reduced the tactics subcourse for officers to a period of five weeks.[27]

The problem of creating better coordination in tank-infantry operations was a matter given serious thought and constant attention at the Armored School. Reports from all theatres indicated that more and concentrated effort was needed in training to equip troops with these essentials. The commanding general of the 84th Infantry Division wrote: "We have worked constantly with armor, and with no training in the U. S., it was hard to receive our training on the battlefield. I cannot stress too much the absolute necessity for combined tank-infantry training even in replacement training centers. We have worked with the 2nd, 3rd, 5th and 7th Armored Divisions. They are all excellent units, but it is difficult to teach infantry-tank tactics actually on the battlefield. We now have our own tank battalion, and I spend every available minute in training my infantry to operate with tanks."[28]

As a result of such reports and the evident need for training in this specialized teamwork, a board of officers (members of the Armored and the Infantry Schools) was appointed on 23 March 1945 to study and analyze instructional matter pertaining to tank-infantry tactics.[29] This board was reconvened on 11 June 1945 with a view to making recommendations for the revision of FM 17-36 which would clearly and concisely specify infantry-tank tactics and technique.[30] The board of officers found that there existed at the Armored School and the Infantry School a different interpretation of small unit attachment and employment of tanks and recommended: "that FM 17-36 and its Supplement No. 1 should be immediately revised, clarifying the fundamentals of small units infantry-tank cooperation and coordination." Also recommended was a change in Tables of Organization to include a battalion of tanks organically in each infantry division and a company of tanks organically in each infantry regiment. No other point of disagreement was discovered by the Board.[31]

Probably the greatest reflection of ever changing doctrine was seen in the Tactics Department in the constant addition to its courses of study of new and varied techniques of warfare. The demonstrated successes in the Pacific area of the 713th Tank Battalion with the armored flame thrower made mandatory the inclusion of a course to train teams in the operation of these devices. Lack of ample information, except in a very technical sense, made early effort of dubious value. This was corrected as instructors learned from reports the methods being employed successfully in the Pacific.[32]

Reflecting a need disclosed by combat reports, an Air Support course was added in May 1945. Since air support is predicated upon close cooperation between the air and ground units, it was obviously necessary that ground units have a thorough understanding of the capabilities and limitations of the air arm. Direction of aircraft to targets by air officers on the ground did not limit the ground forces responsibility in marking targets and identifying their lines and flanks by panel markers and other prearranged signals. All OCS and officer classes were instructed in air-ground operations and plans were made for augmentation of this type course.[33]

A 60", 800 million candlepower General Electric Searchlight was added to the Tactics Department Night Operation Demonstration during February 1945. Effects were demonstrated by placing the searchlight in defilade in order not to expose the light source while giving a horizontal beam of not more than 3 degrees elevation and measured illumination equal to one-half moonlight. This light could provide direction for attacking troops, and immunity to enemy observation because of the brilliant horizon they faced. Another practicable use of searchlights was gained by their reflection off low clouds resulting in full moonlight for work projects, movement of supplies, removal of mines, etc. Though of limited application, the use of searchlights merited further study.[34]

Every effort was made to present tactical instruction to students of the Tactics Department in such a manner as to clearly point out sound tank and infantry tactical principles. A final phase of tactical training in tactics department courses included emphasis on total integration of the tank-infantry-artillery team, supported by air and naval bombardment under the subject: "Combined Arms." With the end of the war in Europe, the Tactics Department undertook a major changeover in all of its units of instruction. Every unit of instruction was re-written, redrafted, and studied from the viewpoint of fitting students going through the School to perform effectively in combat against the Japanese.[35]

With the end of the war against Japan, specialized instruction in Japanese tactics was eliminated, and units of instruction were being revised to incorporate the tactical lessons learned by both American and foreign armies in all theaters of the current war.

At the time of the introduction of the new tank, the M26, courses were conducted at the Armored School by the Armored Force Board, and members of the instructional staff attended the courses making available to the school a trained staff of instructors when courses of study opened.[36] The intricacy of the torqmatic transmission was vividly diagrammed to students through the use of plastic running models thus reducing the difficulty of grasping the fundamentals of the transmission. The success obtained with plastic aids proved the value of the plastic aid section, and at the end of the war the section was busy designing additional aids.

On 2 September 1945, Maj. Gen. Hugh J. Gaffey replaced General Robinett as the fourth Commandant of The Armored School. General Gaffey's experience in armor, first with General Van Voorhis and General Chaffee, as Combat Commander, 2nd Armored Division in the invasion of French Morocco; Chief of Staff, II Corps under General Patton in Tunisia; Commander of the 2nd Armored Division through the Sicilian Campaign; Chief of Staff, 3rd Army under General Patton during the march across France; Commander of the 4th Armored Division during the famous breakthrough to relieve Bastogne in the Battle of the Bulge and Commander of the XXIII Corps gave him battle experience unsurpassed by any previous commandant. General Gaffey's ability and combat experience left nothing to be desired in the qualifications of a new commandant to reorganize the Armored School, re-drafting the courses and preparing for peace-time operation.

To represent fairly the breadth and scope of problems solved by the tactics and other departments of the Armored School would be an undertaking difficult within the cover of one volume, but it can be stated with assurance that the Armored School, in its production of armored and mechanical minded troops well schooled in the basic and advanced lessons of battle, took second place to no other service school in its requirements of efficiency and the standard of training demanded of its students. Geared to roll some 35,000 students off its human assembly lines each year, the Armored Force School was constructed and equipped at a cost of some $20,000,000.00. At the end of hostilities of War War II, the School had seen 79,290 enlisted men and 581 foreign students pass through its shops and classrooms, and from its OCS had commissioned 11,852 second lieutenants.

Chapter IX

TRAINING

Armored Force Replacement Training Center

The Armored Force School and Replacement Center was established on 1 October 1940.[1] Brig. Gen. Jack W. Heard[2] became its first commanding officer of 15 November 1940[3] and the first trainees started arriving in February 1941. In line with the War Department policy, it was redesignated the "Armored Force Replacement Training Center" in April 1941.[4]

These simple, factual statements do not reveal the worries and struggles accompanying the establishment of the Replacement Center. A mechanism had to be set up to provide replacements for armored divisions and GHQ tank battalions; studies had to be made in personnel, battle loss replacements and technical specialists; officers had to pore over tables of organization and equipment; the training program had to be mapped, and competent noncommissioned and commissioned personnel assigned to administer it; and above all, the bulldozers had to get busy on the terrain for there was the problem of literally building from the ground up.[5]

The construction and engineering problems which delay most new organizations, seemed even more complex in the Center. The training areas and drill fields alternated betweeen ankle-deep mud and choking dust. It was with a great measure of truth that General Devers later said that troops and vehicles that could master the terrain of Kentucky "will be able to take it anywhere under any conditions."[6]

Before the first selectees had come in, trained cadres of officers and noncommissioned officers had been assigned from the existing divisions, supplemented by regular army and reserve officers. The biggest mass movement of cadre was authorized on 15 January 1941, when the 1st and 2nd Armored Divisions were directed to transfer 60 reserve officers (48 of whom were captains) and approximately 1,000 enlisted men to the Replacement Center.[7]

The initial training schedule called for a 12-week basic course (later extended to 13 weeks, and then to 17 weeks) and for 36 companies of 220 trainees each. Three companies constituted a battalion, and four battalions composed a group. The groups were originally made up as follows:

First Group

10 light tank companies
2 machine gun companies

Second Group

4 medium tank companies
2 reconnaissance companies
5½ field artillery companies
¼ field artillery company (antitank)

Provisional Third Group (Discontinued 9 June 1941)

4½ Armored infantry companies (rifle)
½ Armored infantry company (antitank)
1 Armored infantry company (heavy weapons)

Provisional Third Group (Discontinued 9 June 1941)

2 Armored engineer companies
1 Armored signal company
1 Armored ordnance company
1 Armored quartermaster company
1 Armored medical company

Within 11 weeks after the arrival of the first selectees, General Heard was supervising the preparation of 5,431 enlisted men for service in existing armored units and those yet to be activated. By 3 September 1941, when General Heard relinquished command of the Armored Force Replacement Training Center to become Commanding General of the Fifth Armored Division, there were 7,469 trainees in the Center.

The original training program was divided into two phases. The first phase was devoted to basic subjects such as infantry drill, calisthenics, tent pitching and other fundamentals. The second phase, which started about midway in the trainee's cycle, was spent in more specialized training with reference to the needs of the Armored Force. For example, it was originally computed that 31 percent of the men were needed as light tankers, 3 percent were needed as medical personnel, etc.; and they received the requisite training to fit them for their duties when they graduated to their divisions or tank battalions. After the completion of the training period, specialists often went to the Armored Force School for additional training; with the establishment of the Officer Candidate School in mid-1941, exceptional trainees often went directly to OCS; other were retained at the Center as cadre instructors; and the remainder of the graduates of the Replacement Training Center went out to take their places in the armored divisions or tank battalions.

Because of the highly technical nature of the work performed by specialists in the armored divisions, repeated efforts were made to restrict incoming selectees to high school graduates. Although the Army Air Forces was successful in getting a large percentage of Group I selectees (those with Army General Classification Test scores of over 130), the Armored Force could never guarantee that their selectees would be that high in mental caliber. Quotas of particular types of specialists were evolved with the reception centers, yet the Replacement Training Center never solved the problem of securing a minimum mental standard. In view of these facts, the success of the Armored Force training program is even more remarkable.

In the summer of 1941 several changes were made in the original training program. Over the strenuous protests of General Chaffee and General Scott, training of Armored Force replacements for infantry, quartermaster, signal, medical, ordnance and engineer components was assigned to the replacement centers of those arms and services. Originally all of these recruits had been trained at Fort Knox in the provisional Third Group. Theoretically, the Armored Force could marshal some powerful arguments for the continuance of this system. Training all replacements under Armored Force supervision gave selectees a certain esprit de corps from the start. Many weapons and vehicles which were the organic equipment of Armored Force units were not used by non-armored units, and General Heard contended that many of the branch replacement centers could not adequately train in the care, use and maintenance of such equipment.[8] General Heard argued that reallocation of weapons and equipment peculiar to the Armored Force to the other centers would violate principles of economy of equipment. It was urged that, with instructors at the Fort Knox Center having intimate contact with Armored Force doctrines and procedures, training in the Center was based on actual field needs rather than academic principles. Delays and additional administrative load were predicted if the new system went into effect. It was pointed out that coordination and teamwork, featured by day and night exercises of the combined arms during the last week of training, would have to be discontinued.

The telephone wires to Washington hummed with protests. General Scott, a life-long exponent of combined arms training, went to bat for training of all replacements by the Armored Force.[9] General Chaffee sent his staff members to visit each of the replacement centers of the other arms, and with one exception they reported that training would be superior if conducted at Fort Knox. The Chief rose from his sick bed to make a personal appeal to General Marshall, urging that replacements should be prepared to join Armored Force units ready for duty without further training.[10]

It was directed on 26 August 1941 that the Armored Force hence-forth train only "strictly armored elements" (tank and armored reconnaissance units).[11] Despite strong arguments mustered by Armored Force leaders, the new plan proved superior from an over-all standpoint. Highly technical equipment was needed for Ordnance and signal trainees, for example, and it was not sound to duplicate the work of other training centers.

Battalion by battalion, the new method was put into practice in the last three months of 1941, and beginning early in 1942, field artillery units were withdrawn from the Armored Replacement Training Center. The new system worked more smoothly, and its operation was aided by frequent visits from representatives of the replacement training centers of other branches, as well as inspection trips by Armored Force officers. Frequent correspondence and suggestions also aided the other replacement training centers with their task of meeting Armored Force needs.[12]

Throughout 1941, all phases of training were hampered by the lack of equipment. In the opening months, the Center did not possess a single tank; the only available vehicles were those borrowed from the 1st Armored Division. When the loan was made, there were never enough vehicles to go around, and morale sagged as scores of men waited their turn to get at the controls. As late as July 1941, although the Center had been authorized 32 medium and 100 light tanks, none of the former and only 27 of the latter were on hand. There were few training aids. Obstacle courses, sand tables, range estimation courses, charts and posters had not yet been provided.

Col. (later Brig. Gen.) Thompson Lawrence assumed command of the Center on 3 September 1941,[13] and on 27 October the new Third Group was activated. The First and Second Groups, comprising a total of 12 battalions consisted primarily of light and medium tank companies, while the Third Group of six additional battalions trained replacements for reconnaissance companies and platoons, assault gun troops and platoons, and mortar platoons. A year later the groups were reorganized, the First Group becoming a reconnaissance and support weapons group, the Second and Third being devoted to tank training.[14] In September 1943, training of replacements for mechanized Cavalry reconnaissance units was dicontinued at the Center. Thereafter, all groups concentrated their energies upon light and medium tank training, with a proper proportion of Mortar and Assault Gun training in each battalion.[15]

One of the most successful programs instituted after General Lawrence took over control of the Center was the Officers' Orientation School, to introduce newly-assigned officers to the tactics and technique of the Armored Force. Lt. Col. Henry C. Newton (later Brig. Gen.) inaugurated and directed the school which was familiarly known as "Newton's College." The first class was graduated 27 November 1941. During 1942, as the number of reserve officers decreased, OCS alumni stationed at the Center also took the course. It was not until February 1943 that virtually all newly-assigned officers had Armored Force backgrounds at the time of their assignment. In that month, therefore, having completed its mission, the Officers' Orientation School was disbanded.

A second program in 1942 was less successful. After the attack on Pearl Harbor the War Department considered it necessary to send replacements to divisions more rapidly than had been possible under the 13-week system. On 5 January 1942, it was

directed that the cycle be reduced to 8 weeks.[16] Almost immediately it was seen that the shift was a serious mistake in cutting valuable training, and the experiment was abandoned three weeks later in favor of the 13-week cycle.

On 5 August 1942 command of The Armored Replacement Training Center was given to an officer who was presently to become the fourth commanding general of the central armored headquarters at Fort Knox. This was Maj. Gen. Charles L. Scott.[17] Commissioned in 1905 in Cavalry, General Scott served with various Cavalry units and as an instructor in The Cavalry School, in the office of the Chief of Cavalry. Promoted to permanent Brigadier General on 1 May 1940 and to temporary Major General on 1 October 1940, by 1942 he was a senior in armored experience, as well as in length of service. Since 1936, when he assumed command of the 13th Cavalry (Mechanized) at Fort Knox, he had been continuously associated with armor, with the exception of a tour of duty on the War Department General Staff from 1 October 1939 to 2 July 1940. After the formation of the Armored Force in 1940 he had successively commanded the 2nd Armored Division and the I Armored Corps, and had been designated as an observer of British armor in North Africa. General Scott therefore brought to the Center a wide variety of experience.

MAJOR GENERAL CHARLES L. SCOTT
"Discipline and Teamwork"

With a lively appreciation of the tempo and strain of modern warfare, General Scott emphasized in training that "... to survive in battle against a highly trained and physically fit enemy who revels in killing, our men must learn to endure great hardship, hunger, thirst, loss of sleep, and still remain physically and mentally alert ..." He concluded this statement of his views with a maxim that became legendary: "...Kill first or be killed."

Discipline and teamwork were two ideals which General Scott constantly preached and enforced in the Center. He demanded alertness in training and secured it by daily unannounced trips through the training areas. One of the early improvements he secured was the training of a tank crew to be interchangeable, so that if one man became a casualty the team could continue to function smoothly. He stopped hundreds of trainees and asked two questions: "What can you shoot? What can you drive?" If the answers showed a lack of training, nightfall might see a new company commander. General Scott insisted immediately that training should toughen the recruits to a greater extent, both physically and mentally. "Our soldiers must learn to kill without compunction, and if possible even get a little fun out of doing it," he said on several occasions. He cracked down on AWOL and venereal disease, imposed stringent penalties, and encouraged the cooperation of the trainees in reducing them; during his regime he cut these evils to infinitesimally low percentages.[18] He instituted the regular 25-mile hike with pack as part of the regimen of both officers and enlisted men.

Before General Scott arrived, 12 July 1942, specialist schools had been established to prepare soldiers with marked ability or aptitude for particular Armored Force responsibilities. The Clerical, Supply, Radio Operator, Auto Mechanic and Tank Mechanic Schools, and later the Motorcycle Mechanic and Armorer Artificer Schools, were set up generally for five week courses coming in the closing phases of a trainee's basic training. A second echelon motor maintenance school opened at the Center on 5 April 1943. These schools were not intended to supplant courses in the Armored Force School, but successful students became eligible for more advanced training in the Armored Force School.

General Scott wanted to develop supporting troops that could fight if necessary, and above all, be accustomed to battle conditions and know how combat troops actually functioned. Therefore, commencing in March 1943, all specialists with the exception of cooks and mess sergeants were given a minimum of six week's basic training, plus two weeks of vehicular and driving instruction and two weeks of battle training. Cooks and mess sergeants were given six weeks of basic training, along with one week of vehicular and driving instructions and one week of battle training.[19] This was further changed in May 1943 to a categorical ruling that seven full weeks of basic training became necessary for <u>all</u> soldiers before they were placed in the specialist class. In addition, all specialists were required to complete driving instructions, weapons instructions, firing for record, and completion of the battle training course.[20]

One of the noteworthy changes instigated by General Scott was the inauguration of centralized instruction. Prior to November 1942, all types of training -- with the notable exception of the specialist courses -- had been directed by the officers and noncommissioned officers of the several companies under the supervision of battalion commanders. After 12 November, instructions were given by teams of experts in each group. The centralized plan had the great merit of improving standards of instruction at the Armored Force Replacement Training Center in view of the fact that teachers perfected their knowledge of weapons, vehicles or general subjects, instead of disseminating scattered information on many topics.

The able Plans and Training Officer of the Center pointed out that "The Army is the only educational institution where a student 'goes to school' under one instructor who is supposed to train him in all subjects." He pointed out that a team system

would insure the selection of qualified instructors before they were put on the team, provide a more uniform method of instruction, economize instructors, be easier to control, and allow the use of more limited service officers as company commanders to teach the "organizational subjects" -- such as tent-pitching, display of equipment, inspections, etc.

The original plan of centralized training went too far in one direction in that it did not take into account the basic training of the individual soldiers. There was a crying need for closer contact between the cadre personnel and the trainees, so that recruits could be checked on fundamentals in the early stages of their training. Col. Ralph I. Sasse suggested a plan which combined centralized training with the advantages of early personal attention to the trainees. Upon Colonel Sasse's recommendation, the first five weeks of basic training were decentralized to the companies and battalions, and for the balance of the cycle a centralized system was put into effect.[21]

In October 1943, the best features of the centralized and decentralized systems were combined; and training in the Center, exclusive of battle training, was divided into five major categories: subjects taught under company or battalion direction, small arms taught by the Weapons Department; heavy weapons, by the Center Gunnery Department; driving and maintenance, by the Vehicle Department; and map reading, sanitation, first aid, communications, and tactical training of the individual soldier including special battle courses, by the General Subject Department. With the reduction of specialist training in the Center, instruction of radio operators was taken over by the General Subjects Department, and that of auto and tank mechanics by the Vehicle Department. The separate specialist schools were eliminated, with the exception of the Bakers and Cooks School which operated under supervision of the Fifth Service Command, Army Service Forces.[22]

Battle Training

The value of seasoning green troops to the sounds and excitement of actual battle has long been recognized. General Scott thought of the idea during World War I while in command of troops of the Philippines. Using methods which were primitive, according to modern standards, he tried to accustom his troops to noise and nervous shock prior to being subjected to live ammunition. On several occasions the War Department urged a similar program.[23] In August, 1941, a "Battle Noise Area" was in operation in the Center, with eighteen explosive charges controlled and fired from central points as troops advanced through the areas.[24] The effect of machine gun fire was simulated by phonograph records. The experience of the British in training their commandos, and his North African observations, convinced General Scott that he should develop and expand the idea he had used in the Philippines twenty-five years before. The drive to organize battle training was started by General Scott in September, 1942.[25]

General Devers gave the Center the green light on its scheme on 15 February 1943, and battle training was started a month later for training classes in their thirteenth week. The entire program was built around subjecting the soldier to conditions of physical and psychological tension. Whistle bombs, smoke, tear gas, barbed wire, demolitions and overhead fire all played their part in teaching coordination, alertness and presence of mind. The original battle training program was one week in length, consisting of six phases, as follows:

a. Combat Driving. Over various types of terrain, the crew functioned as though in combat, with the vehicle commander designating targets to be taken under simulated fire by the various weapons.

b. Tank Crew Training. To stress coordination, special emphasis was placed upon crew drill, inter-phone communication, dismounted action, turret control and fire control.

"SEASONING GREEN TROOPS TO THE SOUNDS
AND EXCITEMENT OF ACTUAL BATTLE."

c. Tank Crew Firing. Tanks moved on an irregular course at varying ranges and speed, and they were brought under fire by crews in stationary tanks, using subcaliber firing devices to save ammunition. This type of firing was designed to emphasize driver-gunner cooperation and the necessity for fire and movement from either hull or turret defilade. Prepared demolitions were employed to simulate antitank mines and artillery fire.

d. Close Combat Firing. With silhouette targets exposed for only a few seconds at a time, men were taught to fire small arms at close range, without use of sights.

e. Booby Traps, Grenades, Reconnaissance. In the first part of this phase, booby traps were constructed, installed and camouflaged by two platoons, which then changed areas and attempted to detect and neutralize the traps constructed. In the second part, small groups were directed to travel by map and compass over selected routes, reconnoitering and sketching their observations.

f. Miscellaneous Training Area. This phase included field expedients; loading and unloading armored vehicles from flat cars for transportation; the negotiation of a gassed area through barbed wire, brush and water holes; the "infiltration course" to teach men the correct methods of advancing through barbed wire and over normal battle field obstacles with bullets whizzing over their heads; and the twenty minute obstacle course with the usual 9-foot walls, rope-swinging, ditches and embankments. Each night the troops undergoing battle training went into bivouac, providing their own local security and patrols. One night during the period they went on a vehicular march, going into bivouac during hours of darkness and moving out before daybreak.

With characteristic vigor, General Scott took a personal interest in the success of the program and soon became convinced that it should be expanded. On 10 March 1943, he recommended that a seventeen week schedule be established at the Center, the last two weeks of which would be devoted exclusively to battle training.[26] Col. Harvie R. Matthews, Executive Officer of the Center, took the plan to Washington in May 1943 and secured approval to extend the cycle to 17 weeks.[27]

A further addition to the battle training program was made when it was directed that officer candidates graduating after 22 May 1943 be assigned for a month's duty in the battle training area. This not only gave the new second lieutenants additional battle seasoning,[28] but it also enabled them to become adjusted to their new responsibilities.

After the battle training program had been extended to two weeks, the following phases were instituted:[29]

		Hours
1.	Field Expedients	5
2.	Infiltration, Close Combat and Street Fighting Courses	10
	Carbine firing concurrent	(5)
3.	Dismounted reconnaissance problem; terrain appreciation	10
4.	Demolitions, Mines, Obstacles	10
5.	Individual Tank Crew Problems	10
6.	Self-Preservation	10
7.	Decontamination	5
8.	Camouflage	5
9.	Battle Firing	20
10.	Crew Drill (Concurrent)	(5)
11.	Anti-Aircraft Firing	5
12.	Sub-Caliber Firing; 37mm and 75mm Sub-Caliber .30 (Concurrent with Anti-Aircraft Firing)	(5)
13.	First Echelon Maintenance of Vehicles Used in Battle Training	20
14.	Tactical Distribution of Supplies (Concurrent)	(10)
15.	Use of "C", "D", and "K" Rations (Concurrent)	(15)
16.	Bivouacs, Night Security, Night Movements	(Night Hours)

Among the sidelights of the training at the Center was the institution of a "Nazi Platoon" to stimulate alertness among the trainees. This group wore German uniforms and insignia and operated as the enemy. They conducted frequent day and night raids on bivouac areas, assembly positions, disabled vehicles, patrols and combat groups. They practiced battlefield deceit and trickery to demonstrate the false actions American soldiers might confront. Led by German-speaking officers, they shouted commands and instructions to each other in German to familiarize trainees with the German expressions common to the battlefield. Using flares, explosives and booby traps, the raids by the "Nazi platoon," and the wired concentration camp they maintained for prisoners, constituted a form of battle inoculation in itself.[30]

Despite the increase in the training cycle secured during May 1943, General Scott was convinced that trainees needed more squad, platoon and crew training before being ready for battle. Whereas individual training was stressed at the Center, he felt that they

were not fully equipped for combat unless they had a chance to operate as members of armored vehicle crews, platoons and even larger units.

Inasmuch as the 20th Armored Division had been training cadres and battle loss replacements, General Scott recommended that its work be coordinated with that of the A.F.R.T.C. through additional training by the 20th Armored Division in platoon and company operations and cooperation with other arms.[31] Feeling that combat divisions should not be slowed down by training replacements, Army Ground Forces concluded that the replacement training centers should bear this burden.

The Armored Replacement Training Center was authorized a 22-week cycle and an expansion of about 50 percent up to a maximum capacity of 22,500 trainees. The 22 weeks was designed to include 17 of actual training, one week each at the beginning and end of the cycle for filling companies and shipment, two weeks for processing, and one week for completion of furloughs.[32] The new program authorized five training groups, four tank and one reconnaissance.

Revision of War Department estimates for output of all replacement training centers, however, called a halt to expansion plans. In September the Armored Command was informed that the Armored Replacement Training Center's total authorized capacity was to become 12,300 trainees instead of the 22,500 envisioned in July. Curtailment, rather than expansion, became the order of the day, and this revision resulted in the Center's returning to a three-group system. The increase in the training cycle to 17 weeks of actual training, however, was in no way affected by the new directive.[33]

A new Mobilization Training Program was completed on 24 July and sent forward to Army Ground Forces on 3 August for approval.[34] In November 1943 the Center was operating in accordance with a subsequent revision, designed to incorporate these changes, which was submitted for approval on 1 October.[35]

The new training program comprised eight weeks of basic training, seven weeks of technical and tactical training, and two weeks of battle training. In the old MTP it was explicitly stated that unit tactical training would not extend beyond the platoon except for marches, bivouacs and demonstrations. The new program provided for 16 hours of company training in the technical and tactical phase; instruction of the tank crew within the crew, section and platoon; and in battle training the duties of the platoon within the company were stressed. Combat principles formerly taught and practiced "up to and including the platoon" were extended to include the company. Battle training was revised to cover larger unit and team problems.

Throughout its development, the Replacement Training Center operated under the general guidance and direction of higher headquarters. Prior to the organization of Army Ground Forces, most of this general direction came from G-3 of the War Department General Staff, which passed on the mobilization training programs for the Center. This task was later taken over by Army Ground Forces. In keeping with general policy, the Center Mobilization Training Programs were drawn up in accordance with the general training directives of the Army Ground Forces and the Armored Command G-3.[36]

Among the problems of the Center were a lack of sufficient ammunition, a shortage in personnel overhead, and, when equipment started to come in greater quantities, a lack of adequate maintenance facilities. The maintenance problem was always more acute in the Center than in an armored division, as equipment was driven constantly by inexperienced personnel.[37] It became even more acute after November 1942, when instead of training one driver and one gunner per combat vehicle, all members of the car crew were trained to operate the vehicle and weapons. Following an investigation in December 1942, the Inspector General of the War Department reported that the delay in repairs was due to a shortage of shop space and personnel, and that the average percentage of disabilities was in excess of the average of the army as a whole.[38] Three

additional ordnance companies were provided for the Center in May 1943, to alleviate the problem of maintenance.

The Armored Force Replacement Training Center up to 1 September 1945 had received, trained and processed close to 168,228 recruits, exclusive of discharges and transfers. Slow in getting under way, and laboring under many difficulties, the Center went through many changes in organization, in training programs, and in supervisory personnel. During early 1943 a new spirit started to pervade the Center, as General Scott started to drive home to the trainees the "kill or be killed" psychology. With the inauguration of battle training and the lengthening of the training cycle, the Center passed into a new state of development.

When General Scott left the Armored Replacement Training Center on 1 December 1943 to assume command of The Armored Command, his assistant, Brig. Gen. Thomas J. Camp, succeeded him as Commanding General.

A Yale graduate and an honor graduate of the Command and General Staff School in 1926, General Camp had a rich background of military experience and command. In 1918 he served in France in command of a battalion of infantry and previously had served with the 2nd Infantry in Hawaii. During the experimental stages of motorization, General Camp commanded the first heavy weapon experimental motorized battalion of the 29th Infantry at Fort Benning, Georgia, 1935-37. In 1941 he commanded the 51st Infantry Regiment (Armored) of the Fourth Armored Division. In February of 1943 he went to North Africa as a representative of General Devers.

During General Camp's command of the Armored Replacement Training Center, the question of reduction in overhead and the decentralization of training arose as a result of a directive of the Replacement and School Command headquarters.[39] This proposed decentralization of training would have caused a large share of the instructional phase of training to be assumed by the Armored Center's limited cadre. It was the opinion of both General Scott and General Camp that this would seriously impair the standard of training at the Center under the system of centralized instruction and would not substantially reduce overhead.[40] General Scott emphasized strongly the necessity of adhering to the policy of centralized training, especially during the later phases of instruction. In a letter to the Commanding General of Replacement and School Command General Scott pointed out:

> The ninth to seventeenth weeks of training is the very training which distinguished "the tanker" from the trainee of other arms. It covers the very subjects which, if neglected, will not produce a battle trained tanker. During this period we cover vehicle instruction, gunnery, and the field work and combat firing to produce tank crewmen. It is the most important part of the MTP pertaining to tankers. This phase of training is entirely dependent upon keeping vehicles running and in ranks, and this in turn is entirely dependent upon sufficient supervisory and maintenance personnel.[41]

General Scott and General Camp both vigorously opposed any radical decentralization in their training and instructional organization, and the outcome was retention of the committee system insofar as it affected the gunnery and driving-maintenance instruction. All other subjects were relegated to the battalions and companies for administration and instruction. While the issue remained a controversial subject, it was the general opinion that subsequent trainees graduated from the center under this decentralized system of instruction, were not as well trained as they were when instructional matter was carried on by means of the centralized committee system.[42]

By the middle of July, reports from combat theatres indicated that replacements trained at the Armored Replacement Training Center were often placed in units which

could not utilize their training in armor. General Camp reviewed the problem as it was reflected at the Center in a letter, 12 July 1944:

> Although experience has shown that men trained at this Center are acceptable in other arms, nevertheless, there are disadvantages to the Army in transferring tank-trained men to other activities. At this Center there is a shortage of operative tanks with which to train men. To train in tanks any more men than are needed to serve in tanks reduced the amount of tank training which can be given the men who are to be used as tank crewmen. Of course, to train on tanks men who are not to serve in them is a waste of tanks, fuel, maintenance and manpower. This waste runs into large amounts.[43]

That this subject was one which vitally affected the efficiency of front line fighting units was unquestionable as verified by the numerous reports that streamed in from armored units overseas. They stressed the fact that personnel trained for tank units frequently did not reach the units where they could be used to the best advantage, and that replacements who were not specifically trained for use in tank units were seldom, if ever, satisfactory. General Scott took up the issue in a frank analysis of the problem:

> First of all, the tank replacement was not a separate arm such as the infantry, artillery and cavalry. Instead the basic arm for tank replacements was either infantry or cavalry, and the man could only reach a tank unit when special attention was given to his MOS. Unfortunately, too, the MOS number assigned to tank replacements fitted the requirement of many other arms and overhead installations and tank personnel got diverted thereto.[44]

He further pointed out that there was no responsible agency which could carry a replacement in the U. S. through to an assignment to an arm in combat. Instead, each replacement after leaving the Replacement Depot in the U. S. passed through many hands, suffered many delays, frequent changes in the system for handling replacements, and finally wound up being issued like "sheep out of a chute." Because armored replacements had received extensive training in driving motor vehicles, and because many of the replacements in the other arms did not have this training, and in view of the subsequent need for drivers, many armored replacements found themselves utilized as truck drivers.

After a study of the problem General Scott made the following comprehensive recommendation:

a. Separate tank replacements from infantry and other arms, and put them in a definite category such as "tankers."

b. Require the Replacement and School Command to carry replacements through a proper organization from his training in the US to include a replacement battalion setup on the battle front, such as was done for horses and mules in World War I.

c. Have all arms and services in this motorized and mechanized age give more training to vehicle operators.

d. Provide a definite replacement setup for the tremendous amount of manpower involved in the overhead of higher headquarters.[45]

Conclusively reflecting the thorough training given each armored replacement were reports from all arms stating their high reward for the utility of the armored replacement. Conversely, it was noted that in many instances replacements trained for service in other arms were unsatisfactory to commanders of armored units.[46]

During the early months of 1944 when our troops stormed the gates of Cassino by way of Anzio, the reaction upon training methods and tactical teaching at the Armored Replacement Training Center was almost negligible. Teachings were still based fundamentally upon the experiences in Africa. There was, however, one important phase of training that received stress with the stabilization of our lines in Italy and subsequent revival of increased patrol action. Major General Hazlett, Commander, Replacement and School Command, ordered on 5 May 1944 an increase in the hours of night training.[47]

After the invasion in Normandy, reports from the European Theater resulted in changes of tank tactics from those which had proved unsuccessful in Italy. Emphasis was now on closer fighting, and the use of greater amounts of armor closely supported by infantry. The subject of tank-infantry coordination, which had been a source of continual study from the outset, now arrived in its practical combat application. On 22 August 1944, the Armored Replacement Training Center received an order from the Replacement and School Command to institute a Branch Immaterial Training Course covering the first six weeks of training. Effective with the first increment starting after 1 September 1944, Branch Immaterial Training soon proved its worth.[48] In substance, this training gave each trainee the basic fundamentals of all branches of service, thus enabling him to go into any branch with some degree of the knowledge needed for that branch of service.

The 1st Advanced Armored Training Battalion was established on 30 October 1944 providing two six-week programs, including two weeks of gunnery. This group, referred to as The Advanced Training Group, was to give advanced training to graduates of the Armored Replacement Training Center while awaiting shipment and to convert specialists to tank crewmen.[49] The program was never carried through as originally set up for the Ardennes offensive created an immediate need for replacements. Actually, the training program was much shorter and varied with the demands of combat.

During the latter part of 1944, training at the Armored Replacement Training Center deteriorated for reasons summarized by General Scott as: "... replacement of high class personnel by limited service personnel, shortage of spare parts, reduction of overhead, etc." He believed that some of the correctible causes for this deterioration were as follows:

> ... there is an over-emphasis on standardization of training which seeks to bring the ARTC in line with training centers of other arms. The first six weeks of basic training can and should be the same as other arms. However, the tank training in the last 11 weeks cannot and should not be brought exactly or too closely in line with other centers.
>
> The second cause for deterioration is in the fact that much of the training given replacements now will be outmoded before they get to combat. This arises because the Center has not been supplied with new items of equipment as promptly as it should be. There is only one armored RTC in AGF. Its past MTP centralized training method and procedure to meet the needs of tank training was built up slowly and carefully not on guess work, but by advice and experience of officers who have seen and commanded armored units in action. Its product until recently has been high class in active theatre and in the US. To maintain this standard should, with the means available to us, be our objective, and not a hidebound rule to operate it like the infantry, the cavalry, the artillery, or the tank destroyer centers in order to attain standardization is not effective.[50]

Climaxing a year replete with many changes in organization, policy and procedure, the closing months of 1944 witnessed a major change when the Armored Replacement Training Center undertook an expansion program designed to add two regiments, seven battalions and twenty-seven companies.[51]

On the 24th of January 1945, Maj. Gen. John S. Wood, former Commanding General of the 4th Armored Division, succeeded General Camp as Armored Replacement Training Center commander. 'Tiger Jack,' as General Wood was known to his troops, commanded the 4th Armored Division from the hedgerows of Normandy to the Lorraine in one of the most spectacular drives of General Patton's Third Army.

General Wood brought from Europe an invaluable knowledge of combat needs and immediately placed heavy emphasis on practical training to assure trainees technically, physically, and mentally prepared for combat.

Shortly after General Wood assumed command the demand for armored replacements in Europe made it advisable to convert personnel of other branches into armored replacements. Initially, plans were to convert six battalions of infantry, trainees who had completed their first six weeks of training at an Infantry Replacement Training Center, but on 27 January 1945 the Center received notification that tank destroyer, airborne and cavalry reconnaissance units were being shipped to Fort Knox for inactivation and training of their personnel as tank crewmen. Over 5,000 additional men were thus given conversion training.

During the week of 19 February 1945, the Armored Replacement Training Center graduated its 150,000th trainee and sent him on his way to join comrades engaged in breaking the vaunted Seigfried Line in Germany.

When in May 1945 Germany's beaten army surrendered, the ARTC was already concentrating its efforts towards the training of men for action in the Far East. Gunnery practice was altered to fit the requisite shorter ranges of 300 to 500 yards and close combat and village fighting courses changed to meet the altered tactical conditions. Victory in Europe, while reducing the training load somewhat, also reduced the number of men per company at the Center to about 200 men. For training purposes the smaller companies were considered much more desirable in view of the reduction in overhead and increased efficiency in utilization of ranges and training aids.

June 1945 found the Center engaged in the training of all graduate trainees and holdovers under nineteen years of age in accordance with legislation passed by Congress prohibiting the overseas shipment of eighteen year old trainees with less than six months of training.[52] In July the Replacement and School Command directed that the ARTC be reduced from five regiments to three and a separate specialist battalion. Plans at that time called for the inclusion of two Canadian companies within the specialist battalion, but these companies were never used for that purpose.

The coming of peace brought the cessation of certain rigorous and dangerous training at the Center which involved excessive risks. This affected courses such as infiltration, village fighting, close combat, live grenade practice and rocket launcher firing. On 29 August 1945 R&S Command ordered the reduction of the training week from 48 to 40 hours, scheduling only four hours training for Wednesday and Saturdays. Following the principle involved in the study of combat experiences from the combined theaters and planning for a concentrated course of study for future presentation, the Armored Replacement Training Center faced the peace with a record of high achievement.

Chapter X

TESTING AND EQUIPMENT

General

In the early phase of the war the demands of the lend-lease program and the time necessary for American productive facilities to get into full production were factors which contributed to a general shortage of equipment in every branch of the service. In the later years of the war, the ever changing requirements of combat demanded new and better equipment and modification of existing equipment used by units engaged in a war that raged from African desert to jungle mud.

Communications

Much progress was made in the development of radio and communication equipment for the Armored Force. From the time of General Parsons' study of the armored division in 1930[1] the problem of controlling mobile forces retarded the advance of American armor. Yet, the Armored Force, at its inception, had a clear understanding of its communications requirements and proceeded with characteristic vigor, in cooperation with the Signal Corps, Ordnance Department, and private industry, to develop the required equipment.

The Mechanized Cavalry Board, predecessor to the Armored Force Board,[2] conducted a radio demonstration and conference at Fort Knox, 13 to 18 November 1939, and set up military characteristics for radios that charted the course for years to come. The first important decision was the CW (continuous wave, coded) would be used for long range transmission and voice for the shorter ranges. It was determined that CW provided much greater range for a set of given bulk, weight and power; that voice was more subject to interference, with CW transmission possible at a much greater noise level; that voice required two and a half times the width of a CW channel; and that CW saved time because of the need for repetition of voice messages and the tendency of operators to become conversational when using voice.

On the other hand, it was felt that the use of voice was clearly indicated in the forward area where it was desirable to operate radio without depending upon trained personnel; where the personal contact afforded by voice was useful in the efficient leadership of small units; and where communication ranges were short.[3]

As a basic design for armored needs, characteristics were written for four types of radio sets; Type I - a powerful vehicular set capable of 250 mile CW range; Type II - a vehicular CW radio with lesser range for inter-unit command and administrative nets and comparable to the SCR 193 then serving this purpose; Type III - a vehicular radio similar to commercial police sets for voice communication within tank platoons and companies and other armored units; and Type IV - a small voice, battery powered set that could be installed on the luggage carrier of a motorcycle.[4]

Forerunners of subsequent development in radio equipment for armored needs were the SCR 193 and SCR 245. Arrival of new equipment to fit the requirements of armored development supplanted these sets with the SCR 508, 528 and SCR 506. Also responsible for progress in development was the Link set which introduced the multiple channel receiver. Mr. Fred Link, designer of the first Link sets, saw early models of his sets still in use in armored divisions in combat theaters. The Signal Corps later improved upon the Link set to such a marked degree that their standardized multiple channel receiver was adopted as armored equipment.

Early in 1942, three of the four sets ready for distribution to the troops; Type I (SCR 299) which provided a CW range of 250 miles; Type III (SCR 508, 528, and 538), a frequency modulation voice sets with an average range of seven miles; and Type IV (SCR 509 and 510), a combination portable and vehicular voice set which had a range of five miles. Type II (SCR 506) which had a CW range of 80 to 100 miles and a voice range of 50 miles was first available in the summer of 1943 when the first 100 sets were issued, 50 to The Armored School and 50 to the 10th Armored Division.

Later in solving the problems of air-ground and tank-infantry communication equipment, the SCR 399, a long range air-ground set, replaced the Type II sets used in higher headquarters for this purpose. The SCR 300 voice set used for tank-infantry communication, primarily an infantry set, was modified for vehicular adaptation in the AN/VRC-3 (Army Navy/Very High Frequency Radio Communication), thus supplying the armored need for an adequate means of communication with the infantry. Along with the AN/VRC-3, the GRC (Ground Radio Communication) family was in experimental and testing phases at the Armored Center at the end of the war. The GRC type set was being tested with a view towards replacing the existing Type III equipment.

The problem of providing better communication between supporting tank battalions and infantry was reduced by the expedient of installation of exterior telephones on the rear of tanks. These phones were connected to the interphone system of the tank and carried about fifty feet of wire extension.

Tank Engines

One of the early equipment problems of the Armored Force was that of selecting the best tank engine from a huge assortment of different models. Eager and patriotic manufacturers strove to produce their own version of what they considered to be the best power plant for tanks. The result was a series of Guiberson, Ford, General Motors, Wright, Chrysler, Cadillac, and other engines which complicated the problem of maintenance, instruction and supply. General Devers asserted flatly, six weeks after Pearl Harbor: "The time has come when we should definitely insist on the type of equipment considered necessary to win this war."[5] He decided "to secure a tough gasoline engine and stick to it."[6]

The Armored Force Board, through extensive tests, proved that the Ford 500 horsepower GAA-V-8 engine was the medium tank engine for which General Devers was looking.[7] After completion of the Board tests, immediate steps were taken to provide American troops with the Ford-powered medium tank.

Development of Tanks

The early history of light and medium tank development records a trend toward sacrificing fire power and protection in order to gain mobility and speed. Before the Armored Force was a year old, the trend changed in the direction of greater armored protection. The engine was given a greater load to carry, and the search began for an engine which would provide the same mobility for a heavier tank. A successful effort was made to eat the cake of heavy protection and have mobility too. Consistently, the Armored Force has searched for a tank with 20 horsepower per ton and 9 pounds of ground pressure per square inch. General Gillem always professed a keen interest in the development of armored equipment, and this was one of the first things he gave attention to after taking command of the Armored Force in May 1943. In conference with the Chief of Ordnance and his staff, General Gillem pointed out that ground pressure of the medium tanks was still too high, the electrical system showed great weakness, and there was need for improvement on turret switches, voltage current control regulators, engine instruments, lighting system, and the antiaircraft mounting. (See Study No. 33)[8]

The Light Tank

Early light tank production in 1940-41 consisted principally of the 11-ton M-2A-2 light tank which carried two machine guns in its double turret. Experimentation and development led toward greater fire power and armored protection. Progression along these lines was evidenced in the development of a light tank with a 37mm gun and a light machine gun coaxially mounted in the turret. This heavier and modified version of the M-2A4 was powered by two types of engines, Guiberson Diesel and the Continental radial airplane engine. The M2A4 was the forerunner of the M3 series later modified in M3A1, M3A3 light tanks powered by the Continental seven cylinder airplane engine. The M3A3 tanks were similar to the M3A1 but stressed in development the elimination of vertical angles in its armor design, afforting better protection with no increase in weight.

While the light tank's tactical role was decreasing in importance, significant mechanical changes and improvements were revealed in the M5 series of light tanks. This newer type of light tank had the same armament as the M3 series, but substituted twin Cadillac engines for the radial airplane type. Its general characteristics remained similar to those of the M3A3, but its appearance brought into use for the first time the hydra-matic drive and automatic clutch.

The insistent search for a more efficient tank led the Armored Force to weigh the possibilities of developing a tank which had the speed of a light tank and the firepower and protection of a medium tank. A pilot model of a light weight tank which had great speed was made at Rock Island Arsenal. It was recommended that every effort be made to put this tank, the T7 (later called the M7 tank), into production at the earliest possible date.[9] In January 1942, General Devers conferred with General Somervell. He stated at this conference that he was in favor of only one type of tank, a twenty tonner mounting a 75mm gun, and that the T7 should be altered to fill this bill.[10]

During 1942, General Devers became convinced that this new tank would soon replace all others. He termed it the "tank of the future," and asked that production be rushed. After several revisions had been made on this tank, and the heavier 75mm gun installed, it was discovered that the actual weight was 28 tons and, although it had a high road speed, cross country mobility was poor. Since the medium tank weighed only slightly more, and had better all-round performance, in March 1943 General Devers recommended that production of this tank be discontinued at the "earliest possible date."[11]

Experience in North African operations demonstrated that a light tank combining the features of increased fire power and mobility with additional protective armor was needed. On 29 April 1943 the development of the Light Tank T-24 was undertaken with a view toward providing these features along with increased accessibility and maximum standardization.

The new light tank emerged from the experimental stages with a low silhouette, wide tracks and a high velocity 75mm gun coaxially mounted in the turret with the .30 caliber machine gun, and incorporated an M71 G telescope in addition to the regular gunners periscope. This represented a material advantage in fire power and vision over the M5 series light tank and was further improved by its turret arrangements which provided maximum comfort and a resultant minimum loss of efficiency therein. Power traverse and elevation stabilizers were utilized, and a 2" mortar M3 was installed in the right forward corner of the turret roof. The .50 caliber anti-aircraft machine gun was mounted in a pintle socket to the rear of the loader's hatch improving its utility as a protective feature against aircraft. Stowage of ammunition was conveniently located on the floor in waterjacketed protective containers. Upon satisfactory completion of its experimental tests, the vehicle weighing 35,750 pounds with a speed of 35 miles per hour was standardized as the light tank M24. Production of this series started in April 1944.[12]

Schedules were stepped up for the issuance of 1800 new M24 tanks during 1944. Information regarding these tanks was promptly disseminated to units in the European Theater of Operations, and early in 1945 specialist teams were dispatched to that theater of operations to instruct troops in the operation of the M24. Immediately upon arrival in Europe of the new tanks, four armored divisions were equipped with this new weapon.[13] Experience in active combat with the M24 proved conclusively its superiority over any enemy vehicle in its class. (See Study No. 33)[14]

The Medium Tank

Three weeks after the organization of the Armored Force a pilot model of the new M3 medium tank was started at Rock Island Arsenal.[15] It was a year before the M3 was available in sufficient numbers to be of value to the Armored Force. Dubbed the "General Grant" by the British, the M3 was at that time one of the best tanks in operation.

A number of improvements in tanks were achieved after the early models had been tested in action, and many alterations were made. Several days after he assumed command of the Armored Force, General Devers visited Aberdeen and pointed out to Ordnance representatives that the Medium Tank M3 was overweight, that power would not overcome the need for increased flotation.[16] In producing a new model of medium tank, numerous alterations in the original model were made. The most important of these was the elimination of the 37mm gun. After modifications and redesign the tank was designated as the M-4. The medium tank of the M4 series developed into the principal fighting vehicle of the Armored Force. Firepower was provided by a 75mm turret gun with which a .30 caliber machine gun coaxially mounted, a .30 caliber machine gun in the bow, and a .50 caliber machine gun on the turret for AA use. The power-operated turret could traverse 360°. These were distinct improvements over the old M3 series medium tank, in which the 75mm gun was mounted in a sponson. Much thought was given to the subject of more firepower and heavier armor protection in medium tanks. A new and more powerful medium tank was conceived in 1943 when plans were made for putting the 105mm howitzer in the M4 Medium Tank.

Late in 1943 the 76mm gun made its appearance in the turret of the M4 medium tank partially answering the demand for a more powerful gun. Suggestions were being made for the mounting of an even more powerful gun, the 90mm in the M4 tank. These ideas, while limited in actual material aid to the combat troops, were evidence of the amount of experimental work being devoted to the subject and illustrated the problem of production in quantity of a medium tank with a larger gun, emphasizing the inescapable time lag between experimentation, service test, and final adoption.

The Heavy Tank

The Germans achieved momentary success with the use of heavy tanks in Tunisia. Considerable thought was given by the Armored Force to the use of heavy tanks, and they underwent several tests at the Armored Force Board. American plans went as far as outlining several separate tank battalions to be equipped with heavyweights. General Devers was skeptical from the start. He pointed out that the heavy tank was not sufficiently mobile.[17] Also, if an armored unit had heavy tanks, it would have to carry bridging equipment which would slow it down measurably.

Early in 1944 the Chief of the Technical Division, Army Service Forces, stated that we had the answer to the German Mark VI, the highly vaunted "Tiger" tank of the Nazi panzer armies. The T26E1 heavy tank of forty-three tons was superior to anything yet developed by American engineers. This new thunderbolt had thicker armor than the M-4, with a 90mm gun as compared with the fabulous "88" of the German Tiger. This comparison was more favorable to the T26E1 because of its 45 tons weight as compared with the heavier and more awkward German vehicle of 62 tons.

The T-26 heavy tank was initially developed to provide a tank with a gun and armor equal to that of the German Mark VI Tank. Through subsequent improvement on the original models, the T26E3 was developed. By March 1945 standardization of this tank as the M26 had been effected and allocation made to the various theaters of operations. The largest percentage of these vehicles was sent to the European theater, and the remainder in almost equal ratios were directed to each of the other theaters. The finished product mounted a 90mm gun with a muzzle velocity somewhat higher than that previously obtained, but below that deemed desirable, and less than that of the 88mm gun mounted on the Mark VI Tank, and a frontal armor plate of four inches with 56 degree slope that greatly enhanced its protective features. Weighing only 45 tons it had a mobility almost comparable to that of the medium type tank. The experience resulting from the design and test of various medium tanks made it possible to apply successfully to the heavy tanks torsion bar suspension, torquematic transmission and other new features.[18]

By the use of these improvements a vehicle was developed with characteristics including improved riding quantities and a more stable gun platform. Altogether, the T26E1 heavy tank served to answer the demand for a more powerful gun and more armor protection. At the end of the war even more powerful tanks were in varying stages of development. These dreadnaughts weighed from 60 to 65 tons and carried as primary armament 90mm, 105mm and 155mm guns with a maximum speed of around 22 mph.

The position of The Armored Center relative to opinions expressed by various commanders and observers that American tanks were inferior to German tanks was stated by Maj. Gen. Charles L. Scott as follows:

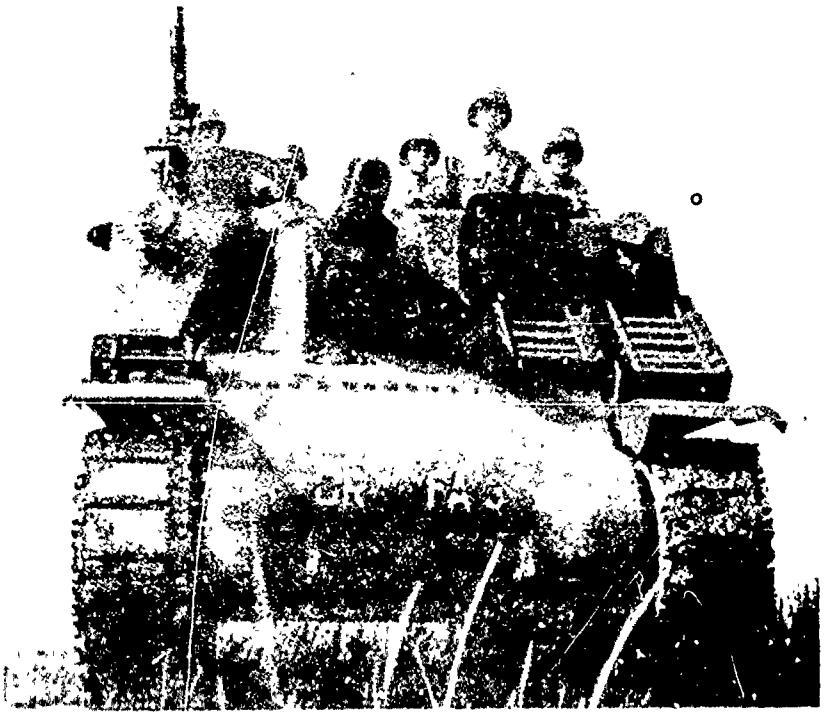
> Since the Third Army started fighting the Germans in August, German tank losses have been virtually double those of the Third Army - 2,287 to 1,136. ...mobility and offensive ability in equipment are requirements which best fit our tactics and strategy and the characteristics of the American soldier. This is not idle chatter, but is being proven daily in combat and by nearing defeat of one of our enemies who is supposed to be the last word in armor and the "blitz."
>
> All in all - to meet the requirements of many theaters and many varying conditions of combat in each theater, we have the finest all-around, all-purpose light and medium tanks in the world. A "fighter tank" to pierce heavy armor and to fight hostile tanks is now ready - only a year and a half after the demand for it came from the battlefront. 23 (See Study No. 33)

The opinion of General Scott, while showing an approximate advantage of two to one in favor of the American tank during the operations of the Third Army, does not reflect a comparison of American and German tanks on the basis of a comparison of the various features of the vehicles. Lt. Gen. Alvan C. Gillem, Jr., Commanding General XIII Corps, and former Commanding General of The Armored Command, stated: "The German tank is superior to ours."[19] Maj. Gen. Hugh Gaffey, commanding the 4th Armored Division, stated: "The German tank has less ground pressure than ours and can go places that we cannot."[20] Lt. Col. Louis A. Hammack, Headquarters Army Ground Forces and a former tank battalion commander stated: "Our tanks are inferior to the German's in that they have a better gun and more flotation. We need wider tracks and a gun that will knock out the Panther and Tiger tanks from the front."[21] Maj. C. J. Madden, commanding the 751st Tank Battalion, in answer to the direct question "Which are better, German or U. S. tanks?" stated: "There is no American tank comparable to the German 'Tiger' (Mark VI) in any way except speed. Flotation, armament, and armor are all superior in the German tank to that of our M-4. The value of additional speed is questionable. Though the 'Panther' (Mark V) is considered the counterpart of our M-4, there again the German vehicle attains the same superiority."[22] (See Study No. 33)

Despite the variety of opinion concerning the comparative merits of American and German tanks, the results obtained with the equipment available were remarkable, and a high tribute to the mechanical ability, training, and courage of the armored soldier.

The Self-Propelled Howitzer

One of the most popular weapons of the Armored Force was the 105mm self-propelled howitzer, which the British named the "Priest" because of its pulpit-like .50 caliber antiaircraft ring mount in the right front of the vehicle.



105-MM, SELF PROPELLED HOWITZER, M-7
"One of the Most Popular Weapons of The Armored Force."

On 5 February 1942, the Armored Force Board commenced one of its most significant tests to determine whether the pilot model represented a self-propelled howitzer mount which would be suitable for the artillery of the armored division. Day and night the Armored Board put the newcomer through its paces over roads and cross country. On the third day of the test the weapon was fired. On the same day, Board and Ordnance officials went into a huddle with the Armored Force Artillery Officer. Maj. Gen. (then Col.) Edward H. Brooks, who had outlined this piece of Armored Artillery, saw his dreams come true as the conferees moved swiftly to approve the basic idea of the pilot model. They suggested some modifications, such as reducing armor plating from 3/4 to 1/2 inch in order to increase speed.[24] Ammunition stowage problems were ironed out, plans for the antiaircraft mount were discussed, the pilot model was marked up with chalk, and before the end of four days, it had been shipped away for modifications and production.

To expedite production and make certain that modifications met their military requirements, the Armored Force Board sent representatives to the American Locomotive Company, and the vehicle was completed with their assistance.[25] Production started before the drawings were completed, and during the summer of 1942, the first howitzers were made available to troops.

A British regiment of the new "Priests" fought all the way from El Alamein to Tunisia, taking a heavy toll of German armored vehicles. Total damages incurred by the regiment was one tract blown by a mine and an armor piercing hit which did only minor damage.

Characterized by its accuracy, having a range of 12,000 yards, and firing a 33 pound projectile, the M7 howitzer was particularly effective because of the speed with which it could change position. It was but one of the many powerful weapons of the Armored Force; and its development was illustrative of the speed with which the Armored Force equipped its units.

The Treadway Bridge

Among the items of engineer equipment tested by the Armored Board and approved for adoption by the Armored Force was the steel treadway bridge with pneumatic floats and related equipment including the hydraulic hoist bridge truck. The treadway bridge was the greatest single improvement in floating bridge equipment since the Civil War. This equipment was devised by Lt. Col. (later Maj. Gen.) Lunsford E. Oliver, Maj. (later Col.) Thomas H. Stanley, and Capt. (later Maj.) W. E. Cowley, all of whom contributed materially to the design and development of the equipment. (See study No. 33)

The Flame Thrower Tank

A flame thrower tank was developed by replacing the major armament in the turret with a flame gun and the modifying of the tank interior to provide the room for its complimentary equipment. This produced a vehicle having a flame gun with a maximum range of approximately 150 yards but with no other armament. It was designed primarily for use with standard tanks for special assault missions. Early in its development, it was recognized that a tank of this type should not be too seriously limited in fire power either in range or effectiveness against a varying array of targets.[26] The 713th Tank Battalion (Flame Thrower) operated successfully in the Pacific Ocean Area employing weapons of this type.

Mine Exploder

One of the greatest hazards to armor was the extensive use of mines by the Germans. As a result of combat in North Africa, the development of a mine exploder was high on the list for development.

Mine exploder, T1E1 (Earth Worm), mounted on a recovery vehicle M32, basically a medium tank chassis, consisted of three staggered and overlapping units of six armored discs, weighing 36,000 pounds, with 119 inches of ground coverage. The Earth Worm was limited to use on favorable terrain because of its poor mobility. A later version, the T1E3 (Aunt Jemima) was tested. It consisted of a unit of discs, 96 inches in diameter, mounted before the tract assembly of a standard M4 tank. The T1E3 weighed 60,000 pounds, its width was insufficient to cover an entire road, and its large turning radius restricted its use to favorable terrain.

A second type exploder, the T3E1 or Scorpion, was a power driven drum, mounted on an M-4 Medium Tank, which rotated a series of whirling 61 inch long wire rope flails, mounted on a boom in front of the tank, which beat a path 115 inches wide. While this

type of mine exploder raised large clouds of dust and the flails only lasted a short time, it was used more extensively than any other type.

The third type, the T5E2, was in reality a mine excavator. A hydraulically operated V-shaped dozer blade equipped with excavating teeth was attached to the front of a medium tank. This blade dug a ditch 111 inches wide, throwing mines off to the side. It was not suitable for use on roads or road shoulders. (See Study No. 33)

The Armored Personnel Carrier

The organization of armored divisions in 1940 comprising a force of the combined arms including Infantry Regiments (Armored) made the development of a vehicle for the transportation of the Infantry element of the armored division necessary. The 7th Cavalry Brigade (Mechanized) had been equipped with an assortment of armored and unarmored vehicles, both wheeled and half-track. Because of the superior crosscountry mobility of the half-track, it was decided to design an armored half-track as a personnel carrier for the infantry, and for such other incidental uses as might be required.

The vehicle was designed to carry a rifle squad of twelve men and a driver. It consisted of a heavy duty chassis, with wheel drive in front, and tracks substituted for the rear driving wheels. An open-topped box-like body of half-inch armor in front, one-fourth inch armor on the sides, and rear, extending high enough to give protection to the head and body of the men, the vehicle weighed approximately 18,000 pounds.

In its various models this vehicle became the utility vehicle of the Armored Force. It served as personnel carrier, reconnaissance vehicle, radio vehicle, ambulance, 81-mm mortar carriage, prime mover for antitank guns, the first tank destroyer gun mount, and as an antiaircraft automatic weapons mount. Despite the multiplicity of its uses, the half-track was never a fully satisfactory vehicle; its crosscountry mobility was limited, its armor was inadequate, and it afforded no overhead protection. But it was rugged and dependable and except for minor modifications continued to the end of the war as the most widely used vehicle in the Armored Force. In Tunisia a charge by a platoon of half-tracks with machine-guns firing enabled one armored infantry company commander to break up a counter-attack and restore his position, which indicates that it was not always employed just as a means of transportation.

As the war in North Africa and Europe progressed the demand for a better personnel carrier became insistent. Armored commanders demanded a vehicle with cross country ability equal to or better than that of the light tank, overhead protection, a wide radius of operation, and mounting supporting weapons. As a result of this demand the full-tracked armored utility vehicle T-16 was developed. This vehicle, capable of carrying 16 men and their equipment, had high road speed, great cross country ability, a wide radius of action, and afforded overhead protection against battlefield missiles.

The Tank Transporter

From the outset of operations in Europe, it was evident that some type of tank transporter would be required to evacuate tanks over long distances. The first type of vehicle designed for this purpose was the tank transporter M19, a twelve wheel trailer. The trailer had 24 operating tires and payload of 90,000 pounds. During extensive use by both British and American forces, certain undesirable characteristics dictated further development of this type of vehicle. A later model, the forty ton M25, consisting of a gasoline powered prime mover with an armored cab and an eight wheel trailer carrying 80,000 pounds was found more desirable in evacuating disabled tanks and the transportation of tanks from depots to units, or from one section to another in combat zones. In spite of the width of this unit which was 150 inches, it was found that most routes on the Continent could be traveled by the M25.

With the advent of the M26 heavy tank, certain modifications of the M25 tank transporter were necessary to accommodate the increased load and width of the heavy tank. A modification kit was designed to meet this requirement and the modified trailer was designated "Semitrailer, transporter, 45 ton, 8 wheel, M15A1."

Chapter XI

TESTING AND EQUIPMENT

THE ARMORED FORCE BOARD

Under the provisions of the National Defense Act of 1920 the Chief of Infantry was charged with the development of tanks, which had been carried on along with the development of other Infantry equipment by the Infantry Board. The principal items of armored equipment developed by the Board in cooperation with the Ordnance Department were the M2A2 light tank and the M2 medium tank. The basic design of these tanks became the basis for the M3 and M5 series of light tanks and the M3 and M4 series of medium tanks.

The Mechanized Cavalry Board at the same time carried on development of equipment for mechanized cavalry units, including the development of armored cars, half-tracks, scout cars, mortar carriages, and at the time the Armored Force was established was developing the M2 "Combat Car," identical with the infantry light tank M2A2 with the exception that it mounted a single turret instead of the twin turrets of the infantry tank.

The directive establishing the Armored Force charged the Chief of the Armored Force with "the development of tactical and training doctrines for all units of the Armored Force, and research and advisory functions pertaining to development and procurement of all special transportation, armament and equipment used primarily by Armored Units."[1] The Armored Forces Board was established to carry on the development and testing of armored tactics, transportation, equipment, and armament used by armored units.

The initial personnel of the Armored Force Board was named on 16 July 1940.[2] The Board was organized as follows: a president (See Appendix E), selected by the Chief of the Armored Force; a recorder, selected by the president of the Board; and two main subordinate sections, the Tactical Section and the Test Section. Six Army officers were originally assigned to carry the load. War Department Circular No. 158 of 30 December 1940, which further defined the functions of the Board, provided for between nine and twelve officers. As the Board expanded, new sections were added. The Test Section was sub-divided into Test and Engineering, Clothing and Equipment, and Communications sub-sections; and the Administration Section was established. The entire organization was a cohesive unit, where the personal opinions of the individual counted little. For example, project reports were so widely circulated and amended that one Board president noted: "These projects, like a mule, have neither pride of ancestry nor hope of progeny."[3]

Originally, the Armored Board was organized to carry out a number of duties. Under the terms of the directive of 10 July 1940 the Board was responsible for the development of training, including the production of training films and field manuals, preparation of tables of organization and equipment, development of tactical doctrines, and the development and testing of equipment. The Board's major responsibility later became the testing of equipment to determine whether or not it met Armored Force requirements.

Primarily, the function of the Armored Force Board was neither engineering research nor the actual designing of equipment. Its function was to test materiel whose specifications had already been completed or was in production, with a view to analyzing its capacities, limitations, and necessity for additional development.

In applying the scientific method, the Armored Force Board officers also had to possess an imaginative type of mentality. This point seemed so important to General Marshall that he wrote a personal letter to General Chaffee warning that "there were evidences of overdoses of imagination" in the Armored Force.[4] General Chaffee replied:

> Ever since the earliest experiences with the old Infantry Tank Board, I used to see them standing around arguing about the size of a bolt hole to the point where they never got any tanks and never thought about tactics, I have dreaded the same thing happening in any force that I had anything to do with. 5

As the work of the Board developed, it became apparent that the Tactical Section was misplaced. Its duties related more closely to the work in training and tactics undertaken by G-3, Headquarters Armored Force and the instructional work carried on in the Armored Force School. Gradually, the Tactical Section was stripped of its functions. In June, 1941, a Tables of Organization Division in G-3 relieved the Board of this work; in October, 1941, the drafting and preparation of manuals came under the jurisdiction of the Armored Force School. Battered and decimated, the Tactical Section was renamed the Training Film Section. In May, 1942, the last vestige of the Tactical Section disappeared when the responsibility for training films and film strips passed to the Armored Force School.

Conversely, the Test Section expanded rapidly, because of increasing production of Armored Force vehicles and materiel. A Materiel and Test Section was created with subsections for supply, shop, communications, clothing and equipment. The Test and Engineering subsection embraced special units designated Engineering and Special Test, Automotive, Stowage, and Weapons and Ammunition.[6]

The speed and efficiency with which the Board operated was aided by the close liaison maintained not only with private industry but also with other branches of the service. A great portion of the work carried on by the Armored Force Liaison Office, maintained in Washington until the establishment of the Army Ground Force, in March 1942, was concerned with Armored Force Board matters. A liaison officer represented the Board at Aberdeen Proving Ground, Maryland, where the Ordnance Department developed and tested most of its equipment.

These permanent liaison arrangements did not preclude additional visits by Ordnance and Armored Force Board representatives. Frequently specific projects would draw specialists to Fort Knox, Aberdeen, or Detroit; or perhaps a joint weapons or ammunition problem would cause several Armored Force and Ordnance officers to visit Rock Island or Frankford Arsenal.

The Board worked in close liaison with representatives of the British Army Staff. Examples of the benefits gained from this association were in the development of fire control equipment. Battle-experienced British officers made valuable contributions to the development of improved sights and such gunnery accessories as the elevation quadrant, the notched elevation hand wheel, the tank commander's vane sight, the azimuth indicator and the periscopic binocular. The Board helped the British adapt the gyro-stabilizer to their vehicles and, in turn, the British 2" bomb thrower was incorporated in the Medium Tank, M4 Series.

In general, projects were initiated by directive of Army Ground Forces or Headquarters Armored Force, perhaps on the initiative of Ordnance or some other branch of the service. On many occasions, the Armored Force Board drew up the military characteristics of a particular vehicle, weapon or piece of equipment, and forwarded these specifications for development and manufacture, usually under the direction of the Ordnance Department. Under Ordnance direction, there was then produced a wooden

"mock-up" (an imitation) or a full sized "pilot model" (a working product, at times virtually hand made). The finished product was then tested by the Armored Force Board to determine whether it met Armored Force requirements.

Each item under consideration was given a series of carefully planned tests, with complete records kept of weaknesses and their causes. Oil and fuel consumption, temperatures, and full records of performance were made on all vehicles tested. Usually, as with tank engines, a deliberate attempt was made to continue the test until some part failed.

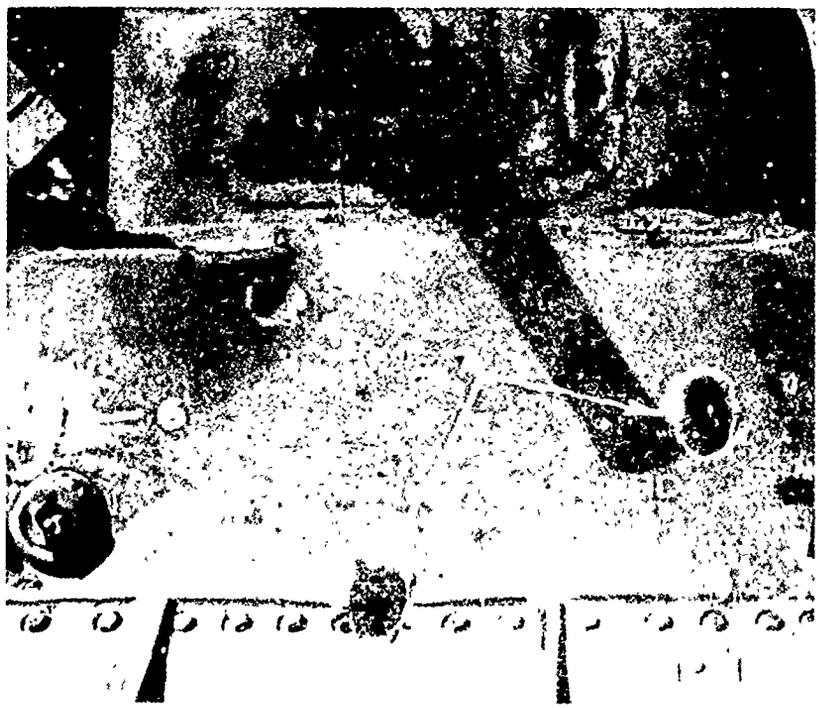
During the early part of 1942, General Devers had been giving considerable thought to the question of standardization and the development of a rugged tank engine. He fully understood how the presence of so many different types of models and engines complicated maintenance, instruction and supply problems. "With our sights set well ahead, we in the Armored Force know what we want," he wrote to Maj. Gen. James H. Burns in April 1942. "At the moment, it is a rugged gasoline engine that has the horsepower, with some to spare, to drive a tank. We believe that this is the new Ford engine. As soon as possible, we should get away from all other types ....."[7] Late in 1942 a test was conducted to try out the durability of the Ford GAA-V-8 engine in a medium tank from the standpoint of performance, necessary maintenance, and the failures of component parts. It concluded that the hull and transmission were on the whole "satisfactory," and the Board recommended that the engine be modified and improved in cooperation with the Ordnance Department and the Ford Motor Company. After the difficulties were ironed out, new engines were sent to the Armored Force Board for further test. The improved engines went through the same 24-hour-a-day runs, and under the critical eye of the board were termed "excellent." Work immediately started on correcting deficiencies discovered in crank-shafts, connecting rods, cylinder head assemblies and the engine suspension system as a whole.

Meanwhile, the need for standardization became more insistent. Although the Board had tested the Chrysler Multi-bank, Continental-built Wright and the General Motors Twin Diesel engines in medium tanks, none had been tested on the same scope as the Ford. It was a natural result of the Ford test that all four of the power plants be subjected to the same tests to secure a definite answer as to which engine was the better. A 40-tank test was inaugurated in March, 1943.[8] Not only did it test the engine and the power train, but also all types of track, synthetic rubber tired bogie wheels, turrets, traversing mechanisms, stabilizers, firing apparatus, communication equipment, ammunition racks, stowage and other features. Records were kept to show the actual time required for maintenance, the fuel and oil consumption for various types of terrain and the detailed reasons for breakdown. For example, the tanks were taken out to negotiate Muldraugh Hill, and their climbing ability and speed were carefully checked.

An appreciation of the scope of this test can be seen from the following figures revealing total engine hours and miles.

Model of Tank	No. of Engines	Engine Hours	Miles
M4A1 (Cont. Radial)	11	2405 hrs 58 min	15,426
M4A2 (GMC Diesel)	11	2475 hrs 00 min	22,566
M4A3 (Ford GAA-V-8)	12	3061 hrs 21 min	26,289
M4A4 (Chry. Multi-bank)	10	2399 hrs 44 min	17,164
	44	10342 hrs 03 min	81,445

The Board concluded as a result of the forty-tank test that "the production of the Ford Tank Engine, Model GAA-V-8, should be expedited to the utmost ....."[9]



"A GRUELING SERIES OF CAREFULLY PLANNED TESTS."

The significant feature of the above tests of medium tank engines is that the Armored Board was able to conduct a series of large-scale tests which produced more representative results than the earlier attempts with single vehicles. Although they had previously recognized the need for fleet tests, it took the production of more equipment, the demand for standardization, and the determination of General Devers to institute the fleet test technique.

The Board had had a great deal of difficulty in impressing other branches of the service with the necessity for adequate stowage, i. e., an adequate means of loading and securing all equipment to be carried in an Armored vehicle in such a manner as to provide combat efficiency. On the surface, it may sound unimportant to worry about such a point rather than the thickness of the armor plate or how many rounds per minute can be fired. Yet at a critical moment in battle, the life of a tank crew and the success of a mission may depend upon the intelligent arrangement of ammunition and equipment within the vehicle. The Stowage Section of the Board made practical tests of the use and availability of items of equipment in all types of armored vehicles. It paid special attention to planning the stowage of a newly-designed vehicle at the earliest possible date, in order that the necessary boxes and brackets might be installed on the pilot model, and deficiencies corrected before the vehicle was put in production.

Early battlefield reports from armored units revealed that casualties ran high in tanks set afire when penetrated by shells. During February and March, 1943, the Armored Force Board found a definite answer. One medium tank was drained of gasoline; another was prepared with normal accumulations of gasoline, oil, grease and fumes. Shells were directed at both tanks. It was concluded that ammunition fires occurred more frequently, and were more dangerous by reason of their occurrence in the crew compartment rather than the engine compartment.[10]

As a result of these tests, it was recommended that ammunition be stowed in the lower part of tanks where it would be less vulnerable to penetration. Lt. Col. Louis T. Heath, Chief of the Test Section, then evolved the additional plan of building water chests around the ammunition to cool red-hot projectiles hurtling through the tank, and to release water in sufficient quantities to aid in quenching ammunition fires.

The Weapons and Ammunition Section, in close collaboration with the Artillery Section of Headquarters Armored Force, and the Gunnery Department of Armored Force School, tested improvements in fire control. Studied, developed, and vastly improved the sights in use by the Armored Force.

Other tests conducted by the Weapons and Ammunition Section were tests of steel cartridge cases, the 76-mm gun and the "bazooka" anti-tank rocket launcher. During the forty-tank tests of engines in medium tanks, it was possible to find and correct many turret deficiencies. The result of study of the turret was standardization of the oil gear traverse for better control and the index finger firing handle.

The Fuel and Lubricants sub-section had conducted many tests of gasoline and other substitute fuels for tank engines. In recognition of a pressing need for more adequate lubricating equipment a manually operated grease bucket was developed and tested by the Board, stimulating private manufacturers to develop and improve lubricating equipment.

Among the other items tested and improved were tires, tents, fire-fighting agents and equipment, radios, and other communication equipment, cipher devices, gas masks, flame throwers, first aid kits, flares, helmets, goggles, dust respirators, boots and clothing, and all types of tanks, half tracks, armored cars, motorcycles, trucks, amphibious "peeps" and other vehicles.

The Bureau of Ships of the Navy Department designed a tank carrier, later called a Landing Ship Tank, for use in landing armored units on enemy beaches. A full-scale 240-foot model of the craft in the form of a building was constructed at Fort Knox and the Armored Board tested individual attachments to the exhausts of the tanks, and a general ventilation system for the entire bay.[11] The collecting and ducting hoses necessary for individual connections to exhausts of the tanks were ruled out as taking up too much space and requiring time to clear away when zero hour approached. The Board recommended the development of general-purpose gas masks which would protect against both carbon monoxide, and war gases which the enemy might be circulating around the landing ship.

In the spring of 1943 exhaustive tests were made of all types of compact range finders that could be readily produced for employment with tanks. A group of approximately thirty selected soldiers were trained to operate a variety of range finders and 72,000 readings were analyzed in order to determine what type of range finder was most desirable for use with Medium Tanks. One instrument designed by Barr and Stroud, Ltd., was outstanding in accuracy and ruggedness. Production was recommended with a view to providing one of these range finders for each Medium Tank Platoon as rapidly as possible.[12]

It is significant that the project on range finders was instituted by the Board some time before experience in the North African theater indicated that such an instrument should be provided. The foresight of the Board, working in close conjunction with the Armored Force Artillery Section made it possible to provide this important instrument to troops several months before it would have been available had the Board awaited reports from combat theaters.

The Board worked consistently toward the goal of developing higher velocity, longer range and higher caliber guns in tanks. The incorporation of the 76-mm gun in

the M4 Tank was tested in the spring and summer of 1943.[13] Another project which the Board conducted in the summer of 1943 was the employment of star shells[14] with a view toward their use by armored units in night fighting. The Ronson Flame Thrower employed on the Bren Gun Carrier by the Canadians was brought to Fort Knox in the summer of 1943 and was tested with a view to the possible incorporation of this weapon in the M5 Light Tank.[15]

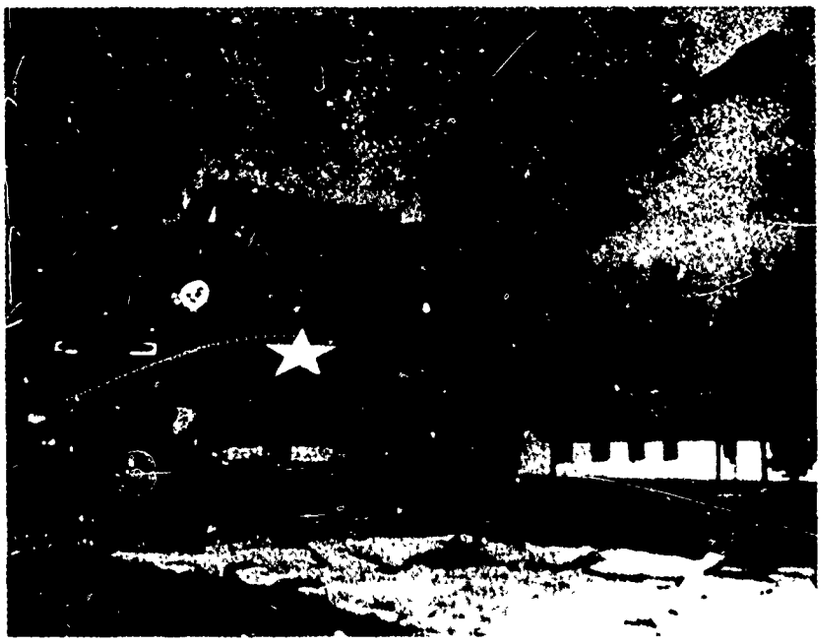
It was the practice of the Board to employ necessary personnel from troops stationed on the Post for testing projects. The 1st and 8th Armored Divisions, the Demonstration Regiment of the Armored Force School, and separate tank, infantry and field artillery battalions stationed at Fort Knox assisted. Although this use of troops provided certain administrative difficulties, it was valuable in furnishing a picture of the efficiency of equipment in the hands of the average soldier, for whom it was designed. The Board had always argued that complicated equipment was useless if the average soldier could not operate it readily in combat.

In July of 1944, a new light tank, the M24, was delivered to the Board and it commenced a continuous service test that was calculated to either make or break it. During the extensive tests to which it was subjected, the M24 survived 309.59 engine hours and 2526 test miles fully loaded and maneuvered under simulated combat conditions of deep mud and heavy dust. In the compilation of data during this test it was discovered that forty-seven percent of all maintenance time was devoted to the suspension system. This was considered to be excessive, and study was given the subject in order to correct the deficiency.

TANK, LIGHT, M-24

On a cross-country course considered to be the toughest of its kind, constructed over a route consisting of steep grades, side slopes, rocky areas, timbered zones for sharp turning tests, sandy ground and stumps and fallen trees, the Armored Board tested the M24, together with eleven other armored vehicles. Of the 12 vehicles, only three actually completed the course. In the tank class the M4 medium tank made the grade in three hours and twenty minutes, and the M24 finished with no difficulty in two hours and sixteen minutes. Further tests were made on slope-climbing courses where the M24 was again matched with the M4 medium. Over a measured climb the M24 successfully coped with a fifty degree slope in 68.9 seconds while the M4 lumbered over the same course in 77.4 seconds. From these and similar tests the Board concluded that the M24 light tank was superior to any known type of light tank in durability, reliability and general field worthiness.[16]

During later combat firing tests it was decided that the full possibilities of the new light tank could not be realized with a crew of four, and subsequent study proved that with a simple rearrangement of stowage a five man crew could be utilized to advantage. This caused the Board to recommend that the table of organization for light tank companies be changed to correspond with that of medium tank companies.[17] Tables of Organization for light tank units were later changed accordingly.



TANK, HEAVY, M-26

Arrival of the M26 heavy tank caused the board to begin a series of exacting service tests to determine its relative performance and ability. Among these, an engine test was initiated and three of the M26 engines were driven to their limit of endurance. When the tests were terminated at seven hundred hours, one of the engines was still operating excellently.[18] At the conclusion of this test the tank had required 82.50 manhours maintenance time and had completed 4056 test miles. The two M26 tanks which started the test finished 3635 and 3052 miles respectively before failing due to mechanical reasons the Armored Board determined from these tests that an engine life

of six hundred hours or better could be expected from the M26, but there were some minor deficiencies to be corrected.[19] Further experimentation was directed toward solving these problems and recommendations were made to speed production of the tank.

Although the trend of tank development toward the end of hostilities was in the direction of heavier tanks, some thought was given to development of the medium tank. The medium tank T23E3, equipped with torsion-bar type suspension system and a 76mm gun, was tested by the Board in early 1945.[20] Although further development was not contemplated on the T23, some of its features merit mention. It was the first electric tank to be equipped with heaters for crew compartments which satisfactorily heated all compartments with the exception of the turret. At ten degrees farenheit, the turret section was not sufficiently heated although the other compartments were satisfactorily heated. The Board learned that the center guide type track on the T23 was superior to the type with the guides on the side, although its life was short. Stowage arrangement in the T23 was considered highly satisfactory and was recommended as an improved arrangement for medium tanks. (See Study No. 33)

While plans were being considered for adoption of new heavy type tanks, the Board dispatched experts to Detroit and other manufacturing centers to observe and make recommendations on pilot models of the T28, T29, T30, and T32 heavy tanks. Although these were in the embryonic stages of development, they were expected to near the experimental stage about July, 1945; none of these tanks reached the Armored Board for testing purposes by the end of the war.[21]

Tests were conducted with polaroid material for improved identification of vehicles and were found to enable easier identification at longer ranges.[22] New camouflage equipment and modifications were designed and tested by the Board.[23] One of the new camouflage kits converted a column of tanks into a column of trucks in a short space of time.[24] New and improved panel identification sets were tested and approved for the direction and control of aircraft.[25]

More spectacular was the testing of flame thrower equipment, and development was expedited considerably by comprehensive tests of a new flame gun, E12R3, which was found superior to any other in production at that time.[26] Arising from a growing need for protection against flash burns, the Armored Board made plans for testing new flame resistent garments and expected to have the necessary clothing developed in 1945.[27]

The Weapons and Ammunition Section conducted tests in August, 1945, to determine the suitability of a rocket launcher T72 for armored use.[28] A project was also initiated to test a new fuze for 90mm and 105mm ammunition that was designed to activate the shell on approach to a land or water mass. The use of this fuze was found to be applicable to field and armored artillery units and was recommended for use after extensive testing.[29] Ammunition of various types was tested in a search for the ideal ammunition for each type of gun used by armored units. Among new types tested was the 105mm HE, AT M67E1. This shell was found to have qualities of penetration and trajectory far superior to earlier types and could completely pierce six and one eighth inches of rolled, homogeneous armor plate.

These tests, and many others too numerous to detail within the short space of a few pages, indicate the contribution of the Armored Board to the development of Armored materiel. Throughout the period of war, the results obtained with equipment on the battlefield reflected the efforts and aggressive enterprise that had been largely responsible for putting tested equipment into the field which assured fighting men the best possible chance for success in combat.

Chapter XII

TESTING AND EQUIPMENT

THE ARMORED FORCE MEDICAL RESEARCH LABORATORY

The Armored Force developed many complex vehicles, weapons and other specialized equipment which placed extreme demands upon the mental and physical capacities of the men who operated them. The first consideration in testing, evaluating and improving armored equipment was of necessity for combat effectiveness. Thus, in forging the machines of war, the original tendency was to concentrate upon fire power, maneuverability, shock action, and protection.

In testing and using this new materiel, it soon became apparent that the peculiar hazards to which Armored Force soldiers were subjected had a direct bearing on their physical and mental efficiency. Within a tank in the thick of battle, members of the crew had to breathe air contaminated by carbon monoxide from the engine exhaust and by gun fumes. Gun-flash and inadequate illumination made vision difficult. Noises resulted in fatigue and stress. Temperature extremes produced physical discomfort, particularly with a tropical sun beating down on the tank hull.

Soldiers were, of course, expected to endure many of these discomforts, but it was apparent that their alleviation would contribute to greater combat efficiency. The British had blazed the trail with their Armored Fighting Vehicles Physiological Laboratory. In America the Aero-Medical Research Laboratory at Wright Field, and the Naval Medical Research Institute at Bethesda, Maryland, had for some time been carrying on studies of clothing and equipment and battle conditions as related to personnel.

In the summer of 1941 the Armored Force requested the Surgeon General's Office and the National Research Council to survey the facilities required for a medical research laboratory. The request was handed over to the Subcommittee on Industrial Medicine of the Committee on Medical Research, which proceeded to make extensive studies at Fort Knox. In October the committee rendered its report and formally resolved that, "Whereas the operation of the Armored Force is attended by concomitant environmental conditions and influences that affect the safety, health and physical and mental efficiency of personnel," a research laboratory should be set up.[1]

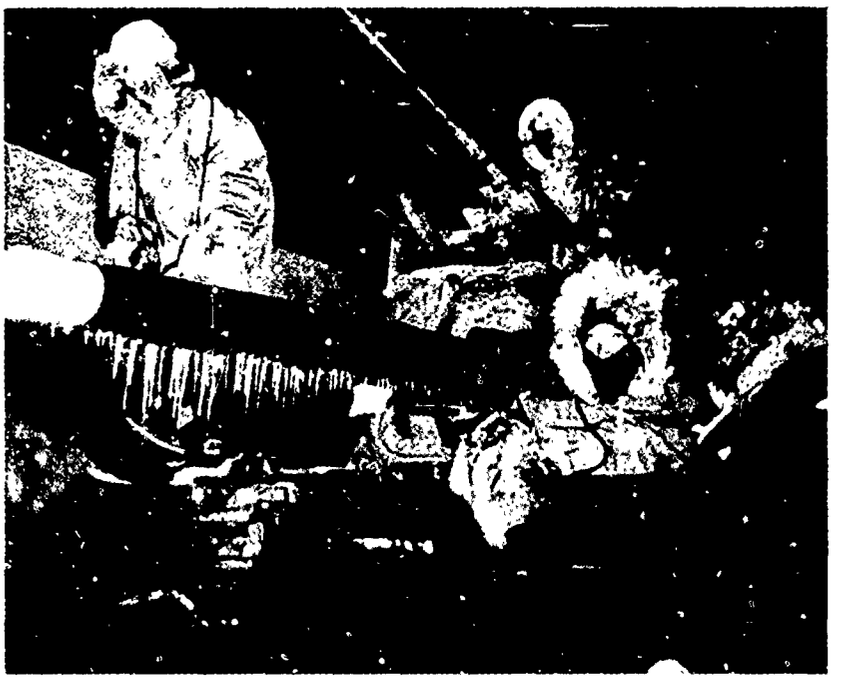
Acting upon the recommendations of the committee, General Devers requested that a medical research laboratory for the Armored Force be established.[2] Authority was granted in February 1942,[3] and work was begun on a building to house the laboratory. The structure, costing approximately $220,000 was completed and occupied 1 September 1942.

Lt. Col. Willard F. Machle (later Col.) was appointed commanding officer of the Laboratory. Colonel Machle had an extensive background in medicine and industrial hygiene which qualified him well for the position. He brought to the work breadth of vision and energetic application to the problems of the Laboratory. The staff was selected so that the combined knowledge of many sciences could be focused on each project. The original and continuing objective has been to obtain basic data on training and equipment from which conclusions might be drawn that would enable the individual soldier to perform his duties with maximum efficiency for the longest possible time.

The Laboratory was at first divided into the following research departments: Medicine, physiology, biochemistry, physics, engineering and ventilation. A later reorganization established three main sections: the physics section; the clinical section, which supervised hot and cold room studies, chemistry and clinical investigation;

and the engineering section, comprising sub-sections concerned with general and ventilation engineering, utility, shop and field tests.

The Laboratory was equipped with cold and hot rooms which approximated the conditions to which men were exposed in the field. The cold room could produce temperatures as low as -63°F., with wind velocities as high as 25 or 30 miles per hour. The hot room was capable of maintaining a temperature of 140°F. This heat could be the intense dry heat of the desert or the steaming, humid heat of the jungle. A special "tight room" was provided to investigate dusts and gases in relation to tank ventilation. Sufficient space was provided so that the largest vehicles used by the Armored Force could be accommodated, as well as a number of men at one time.



"THE COLD ROOM COULD PRODUCE TEMPERATURES AS LOW AS -63° F."

The Laboratory was also equipped to test the noise of battle in varying degrees of intensity. To the tune of tanks roaring over the battlefield, dive-bombers descending on their positions, and heavy artillery shells dropping in the vicinity, soldiers were tested for their mental and physical reactions. For the most part, volunteers were used in the experiments, many of which involved great physical discomfort incident to extreme changes in temperature and nervous tension.

Original instructions from the Chief of the Armored Force directed Colonel Machle and his staff to initiate studies of seven main projects:

1. Cold weather operations.
2. Operations at high temperatures (particularly in tanks).
3. Toxic gases in armored vehicles.
4. Dust exposure in armored vehicles.
5. Crew fatigue research.
6. Vision in tanks.
7. Night vision from tanks.

Almost immediately thereafter, two more projects were added: development of preselection tests for personnel and a study of physical measurements of personnel in relation to headroom and other inner dimensions of tanks.

Liaison

One of the first concerns of Colonel Machle upon taking command of the Laboratory was to avoid duplication of effort with other agencies doing similar work and to coordinate activities where possible. From the beginning, the Laboratory has maintained close liaison with the Armored Force Board which was engaged in testing equipment from the standpoint of combat efficiency. The Director of the Laboratory was made an ex-officio member of the Board, and the President of the Board an ex-officio member of the staff of the Laboratory. Personnel of both units were interchangeably available for advice and consultation, and the facilities of the Board and the Laboratory were made available to each other.

By December 1943, no new designs for tanks proceeded beyond the mock-up stage until they had been made the subject of study and report by the Laboratory. All pilot models of new vehicles were tested by the Laboratory with respect to the gun fume hazard, contamination by carbon monoxide, placement and mounting of sights, lighting, placing of controls and seating.[5]

Close collaboration was maintained also with the Office of the Surgeon General, the National Research Council, the National Defense Research Committee and the Office of Scientific Research Development. The Navy and the Army Air Forces, conducting similar research laboratories, advanced many useful suggestions. Significant information from combat zones was supplied by G-2, Armored Force Headquarters.

At first there was no machinery for exchange of information with the British Armored Fighting Vehicles Physiological Laboratory and some duplication of effort resulted. This was largely eliminated following an agreement reached with the British Laboratory in March 1943.[6]

Tank Interior Design, Seating and Controls

First results from the work of the Laboratory was a report on "Adequate Headroom in Tanks."[7] Submitted to the Commanding Generals of Army Ground Forces and Army Service Forces in November 1942, the report was approved and forwarded to Ordnance for action. Without changing basic tank design, Ordnance installed adjustable seats, providing four different levels to meet the needs of soldiers of different heights. This report also recommended certain limitations on the size of personnel selected to operate tanks, which were approved and taken into consideration in the assignment of personnel.

Subsequently, reports were rendered on alterations in design of seats, positioning of controls, and the size, shape and position of hatchways. The recommendations made in these reports were soon incorporated in tank design. The larger hatches were scheduled for production 1 December 1943. The over-center clutch spring arrangements to reduce pedal pressures to endurable levels went into production 5 October 1943. Field modification of existing vehicles was accomplished in addition to alteration of new tank design. Fabrication of kits for field modification of existing vehicles was accomplished in addition to alteration of new tank design. Fabrication of kits for field modification began in August, 1943, and 2750 modification kits were available for overseas shipment by 1 October 1943.

Basic data relative to the placement and mounting of controls and sights affected all new tank designs. Recommendations of the Laboratory with regard to the design of

turrets were incorporated into tanks of the T20, 23 and 25 series (medium) and the new light tank T24. These same recommendations affected the M4 turrets as redesigned late in 1943.[8] (See Study No. 33)

Fire Control

From the outset it was recognized that the optical devices and fire control apparatus in the tanks then current were woefully inadequate. On the surface it did not appear that this problem was one which would concern a medical research laboratory. Nonetheless, fire control involved the man as one of its most important components, and it was, moreover, apparent that while gunnery test officers were wholly competent to determine the relative value and accuracy of any sight or reticule, they were not able to translate superiority or deficiencies of performance into terms of design. Consideration of the inherent limitations of optical properties of sights, the mechanical limitations of linkage and the physiological limitations of man, led inevitably into design of the integrated systems; the Laboratory's point of view being that of designing the entire fire control apparatus in relation to the attributes of gunners. The first prismatic periscopic sight, for example, designed by the Laboratory and reported on in January 1943[9] was approved and the pilot model later received and tested. The sight was far superior to any available and could be installed in the field. Production of 2,000 T8 sights was scheduled to begin in June 1944, and mass production on a similar sight called the M10 began in September. (See Study No. 33)

Vision

The Laboratory systematically investigated the night vision problem for more than a year. Interest in the problem was spurred by reports from the theatres of operation that almost half of troop operations were at night, and by specific requests for training of troops in night operations before they were sent overseas. Extensive research into the night-seeing ability of ground troops revealed that some men far excelled others in this respect and also that practice in nightseeing technique improved the night vision of most men. As its contribution to meeting this training need, the Laboratory Staff prepared a training manual on the use of the eye at night. This manual was forwarded to Headquarters Army Ground Forces, approved, and published; and, in addition, the following was recommended to the War Department:

1. Assignment of one medical officer and one training officer to establish procurement of necessary equipment and coordinate a program of selection, education, training, and use of visual aids in all ground troops training centers in U. S. and overseas.

2. Assignment of a qualified officer to design and install necessary visual aids in vehicles and to design and procure red filters for flashlights.

3. Selection and commencement of training of teams to be sent to training centers in the U. S. and overseas to inaugurate a training program.

4. Procurement of luminous plaques for selection tests on an initial basis of one per regiment.

5. Preparation and procurement of training aids and literature and lecture material on basis to be recommended by coordination groups.[10]

Study of the lighting inside tanks and its adverse effects on dark adaptation led to the design of a dual red-and-white lighting system which was adopted for use in tanks. Drawings were released for production of fixtures on 1 November 1943.

Excessive casualty rates among tank commanders from air burst high explosive and machine gun fire pointed to the necessity of adequate spotting and all-around vision devices to make it possible for a tank commander to operate with his head under cover. A design of an all-around vision device, developed by the Laboratory, went into production and a periscopic seven-power binocular spotter was in the pilot model stage in December 1943.[11] An alternate model was later studied and finally adopted in August 1945 as Periscope, M15.[12]

Testing of a lateral-offset sight that projected through the right side of a turret instead of through the top led to a recommendation for its adoption for high-trajectory weapons of more than 75mm. Its reported advantages were that it reduced the arc of travel of the sight, decreased interference from smoke and muzzle blast, provided optimum optical properties, and met the need for elevations in excess of those possible in fixed reticule sights.[13]

Toxic Gases

Study of the ventilation in tanks provided basic data for use by all interested agencies and was widely used. An early concern of the Laboratory was the gun fume hazard in tanks. Systematic study of all enclosed armored vehicles was carried out and was continued as new vehicles appeared. As one result of these studies, an exhaust fan was adopted for installation in all M4 tanks to be shipped overseas, and field kits were produced for tanks already overseas. On 1 October 1943, 1370 fans were available for shipment overseas.

Study of the carbon monoxide hazard from auxiliary engine-generator sets in tanks led to recommendations which were immediately adopted and put into production in 1942.

The Laboratory also tackled the problem of protecting personnel in tanks against chemical warfare agents. It was apparent from the outset that two approaches were possible; one, group protection, in which there is a partial sealing of the tank and positive-pressure ventilation by purified air, and the second, individual protection in which purified air is supplied by means of individual hose connections. The Laboratory undertook the development of the group protection method, and a tank modified and equipped by them was sent in 1943 to Edgewood Arsenal to undergo a series of field tests with chemical warfare agents.

"The role of the Laboratory in this development," explained Colonel Machle, "has been that of providing basic data and demonstrating the feasibility of one approach to the problem. Decision as to method to be employed in practice is made by higher headquarters. It is believed that the initiative taken by the Laboratory in the development of a workable protective measure has accelerated and stimulated activity by many other agencies." Since any gas-protective equipment must be tied in with the design of vehicles, the project was turned over to Ordnance Department, Tank-Automotive Center, as soon as the feasibility of the method had been demonstrated.[14]

High Temperature - Desert Heat

A month before the official authorization came through, five members of the Laboratory staff were sent to the Desert Training Center, Camp Young, Indio, California, to make observations during maneuvers with respect to the special problems of the desert. Basic data were collected on fatigue of tank crews, high temperature in tanks and dust exposure of men in armored vehicles. Upon their return to Fort Knox, they were able to simulate desert conditions in the Laboratory for controlled experiments which reflected actual conditions.

Projects were initiated on the influence of high temperatures on the efficiency of personnel, acclimatization to high temperatures, water and salt needs of personnel, length of time that gas-proof clothing could be worn in hot climates, air conditioning of tanks, and related subjects.

Elaborate tests were made to determine the relative efficiency of men who started working immediately in excessive temperatures, and those who had been previously acclimatized. On the basis of these and subsequent tests, a detailed acclimatization schedule was placed in a training memorandum.[15]

Studies of water and salt requirements resulted in the production of a training film for desert troops, on which the Medical Research Laboratory collaborated. Subsequently, two circular letters outlining water and salt requirements for personnel and procedures for acclimatization were prepared for Laboratory reports and published by the Office of the Surgeon General. The studies on K-2 rations made at the Desert Training Center were used by the Office of the Quartermaster General in modifications of rations then in use.

The various studies made by the Laboratory on the effects of desert environment on personnel, together with the work of the Desert Warfare Board and others, resulted in extensive revisions of the Army Field Manual on Desert Operations, to which revisions the staff of the Laboratory contributed.[16] With these revisions in process, most of the work on desert heat had been concluded and a small amount of time was spent on this work. Thereafter the Laboratory's "hot room" was for the most part devoted to experiments with jungle (humid) heat.

High Temperatures - Jungle Heat

Studies of the Laboratory with humid heat soon established that the acclimatization procedure previously worked out for desert heat applied equally well to jungle heat. On 26 April 1943, Armored Force Headquarters published Training Memorandum Number 12, giving the procedures for acclimatization worked out by the Laboratory. This memorandum gave specific, easy-to-follow directions on methods of acclimatization, water requirements, a detailed six-day schedule of graded work during acclimatization, symptoms of heat exhaustion, first aid treatment, salt requirements, and protection afforded by clothing.

Another project in connection with jungle heat, was the study of atabrine as a suppressive agent for Malaria. Early reports from the South Pacific and Central African theaters indicated that Malaria was the largest single cause of ineffectiveness of troops. It was anticipated that the problem would be even greater in the Balkans, China, Indo-China, India and the Dutch East Indies.

By December, 1943, the Laboratory had completed a systematic study involving 250 experimental subjects in which the effects of activity and environment upon suppressive therapy with atabrine had been determined. This work provided basic data necessary for the setting up of field studies in endemic malarial theaters. In addition, much specific information on the behavior of the drug and the likelihood of achieving protection with a regimen of dosage was reported.[17]

Pre-Selection Tests

Another project of the Medical Research Laboratory was the preparation of a series of personnel tests to be administered before men were selected for certain duties. The purpose of the tests was to eliminate from consideration personnel who, because of physiological inadequacies, could not possibly fulfill specific tasks in armored units. By physiological analysis of a number of jobs of principal importance in combat, the

physical attributes desirable in men to fill these jobs were determined. Then tests were prepared to select for these attributes.

A pre-selection test procedure was set up and the fillers for the 12th Armored Division were processed at the request of the division command. Machinery for these tests was so arranged that the test scores and recommendations accompanied the filler through his first day and reached the classification board with him. Later, the same procedures were applied in processing fillers for the 16th Armored Division. A similar series of tests was prepared and used at the Armored Replacement Training Center, the primary purpose being the validation of procedures used in the selection of gunners. By the end of 1943, facilities for handling a thousand men a week were in operation.[18]

Other Tests and Problems

The Laboratory made contributions to the military effort in several other ways. For example, studies of the adequacy of winter and arctic clothing formed the basis for selection of clothing by the Armored Command. All work on clothing was closely coordinated with the Office of the Quartermaster General and, in the case of protective clothing, with the Office of the Surgeon General. Observations and recommendations from the Laboratory influenced the design of the 4-zone TBA clothing and a revised issue of jungle clothing, both adopted late in 1943. A member of the Laboratory Staff spend several weeks in the Florida Everglades in connection with tests on jungle clothing.

In addition, the Laboratory tested for the Armored Command a number of smaller items of clothing or equipment, including electrically heated gloves, individual crew conditioning systems, power controls and an ear protective device. Analysis was made of requirements for fitting of ear phones and the restrictions in design imposed by the necessity for wearing them under helmets.

A further important contribution of the Laboratory, not made the subject of formal report, was the indirect effect upon the work of other agencies with respect to certain problems of vehicle design. The Laboratory called attention to many aspects of design which were unsatisfactory from the standpoint of the man who operated the vehicle. With the lessening of pressure as major design and production problems were solved, it became possible to devote more effort to these refinements.[19]

With the redesignation of the Armored Command as the Armored Center in February of 1944, the Laboratory was placed under direct control of Army Ground Forces,[20] but continued its work toward the improvement of armored equipment. In a memorandum to all officers of the Laboratory, Colonel Machle wrote:

> The primary function of the Medical Research Laboratory continues to deal with the problems of armored vehicles. 21

On 8 March 1944, the Laboratory was transferred to the Army Service Forces and placed under the jurisdiction of the Surgeon General, retroactive to 3 February 1944. While this change broadened the work of the Laboratory to some extent, it still concerned itself primarily with the problems of armor and maintained close liaison with the Armored Center and the Armored Board.

Chapter XIII

REDESIGNATIONS OF THE ARMORED FORCE

On 2 July 1943, the Armored Force was redesignated as the "Armored Command,"[1] and again on 20 February 1944, redesignated as the "Armored Center."[2] The Chief of the Armored Forces was subsequently termed "Commanding General, Armored Command," and "Commanding General, Armored Center," respectively. All Armored installations were renamed to omit the word "Force" from their title. (See Study No. 9)[3]

The reasons for redesignation of the Armored Force can best be understood against the background of the first three years of its existence. In 1940, the War Department seriously considered establishing the Armored Force as a separate branch, on a par with Infantry, Cavalry, Ordnance, and the other arms and services.

Powerful opposition developed toward this idea, particularly on the part of the Chiefs of Infantry and Cavalry. It was subsequently decided by G-3 of the War Department General Staff that "for the present, at least, there will be no separate mechanized arm."[4] Instead of establishing the Armored Force as a separate and independent branch, the next best thing was done: the new Force was established in the field at Fort Knox, Kentucky, and was accorded operative if not legal independence. The designation of the Commanding General of the Armored Force as "Chief" was deliberate, inasmuch as he was made to feel on an actual par with the chiefs of the bona fide independent branches and given to understand that the Armored Force would be set up as a separate branch at the proper time.

The Armored Force was in reality the fair haired boy of the War Department General Staff during the early phases of its existence. Maj. Gen. Richard C. Moore, Deputy Chief of Staff, gave this new organization every consideration in its efforts to reach combat efficiency and become equipped rapidly.[5] With field troops under his direct command and with direct access to the Chief of Staff, the Chief of the Armored Force was in a much stronger position than the legally separate arms and services.

As initial organizational difficulties were smoothed out, and the Armored Force started to emerge from its growing pains, talk of its future status within the War Department and Army was revived. On 19 November 1940, the Assistant Chief of Staff G-3 of the War Department presented a comprehensive study to the Chief of Staff, stating in part:

> The War Department directive establishing the Armored Force organizes it on an experimental basis. G-3 believes that the Force has admirably fulfilled its mission of initial organization and that it has successfully passed through the experimental stages of its existence. In the interest of efficiency, it should be legally established as a separate arm of the service. 6

The Chiefs of Infantry and Cavalry reacted sharply to the G-3 memorandum. The Chief of Infantry pointed out that the Armored Force had only asked for a field force headquarters, not a separate arm; that the infantry and tank battalion under units of the Armored Force were suffering from lack of combined-arms training; and that these units should be returned to Infantry control.[7] The Chief of Cavalry, in a long and embittered review of mechanized developments, charged that there was nothing in the accomplishment of the Armored Force that "could not have been accomplished equally well or better through established agencies of the War Department."[8] He further stated that the Armored Force had been violating the terms of the National Defense Act of 1920 in creating non-Infantry and non-Cavalry armored units.

The result of this proposal was that the Chief of Staff disapproved the immediate establishment of a separate arm, but did not conclusively rule out such a prospect in the future.[9] General McNair said at the time, in a letter to General Scott, "The unfavorable action on a separate arm was to be expected, since the proposal is a bit brusque. However, I should say that this particular set-back need not be the last word in this connection."[10]

Once this flurry of activity died down, there was no concerted move for a separate arm. The Armored Force continued on the high road of expansion. When General Devers assumed command, the Force gained even more in personnel and equipment. More important, it gained in prestige and caught the public eye. A wide-awake Public Relations Section, under the leadership of Col. Tristram Tupper (later Public Relations Officer for the European Theater of Operations) kept the Armored Force constantly before the public, and assisted in building up a pride of accomplishment and unity of spirit which made the Armored Force in many ways akin to the Army Air Forces. When the axe of retrenchment threatened the Public Relations Section, General McNair advised the War Department Bureau of Public Relations Director that he intended to disapprove their request to retain a "large and centralized" section.[11] General Surles intervened on behalf of maintaining the existing strength of the Public Relations Sections "because of the newness of the Armored Force and the unusual public interest in them."[12]

When the Army Ground Forces was established in March, 1942, there is little doubt that the Armored Force was one of the most independent of the commands under the control of the Ground Forces. It continued in this position, and developed its independence by virtue of the close contacts it had already established with all of the arms and services having components in the Armored Force.[13] General Devers, with his ability for accomplishment, made full use of these contacts to bring his units to combat efficiency.

As Armored Force units completed their divisional training, and it became expedient to send them on for combined training with larger units, it was natural that they should be detached from Armored Force control, and placed under the control of field headquarters such as corps or armies. By early 1943 there were many more armored units outside of Armored Force control than under the jurisdiction of the Fort Knox headquarters.

The name "Force" in the title of the Armored Force caused some confusion after the establishment of the Ground, Service and Air Forces, and it was felt that the "Armored Command" would be a more accurate designation of the new position on a plane with the "Airborne Command," "Anti-Aircraft Command," and other commands under Army Ground Forces.

In a memorandum to his Chief of Staff, 11 May 1943, General McNair recommended that the Commanding General of the Armored Command would have inspection functions with respect to all armored units in training within the continental limits of the United States.[14] Under the later redesignation, the Armored Center was placed under the command of the Replacement and School Command but retained as its primary function, directly under Army Ground Forces, the inspection of armored units, and recommendations as to changes of armored organization, doctrine, training, and materiel. Also retained was the function of review and forwarding of training literature to AGF for approval. It was specified that the Armored Board and the Armored Medical Research Laboratory would operate directly under Headquarters, Army Ground Forces.[15] The Armored Force Board was returned to the jurisdiction of the Armored Center effective 25 September 1944,[16] and the Armored Medical Research Laboratory was transferred to the Army Service Forces and placed under the jurisdiction of the Surgeon General as of 3 February 1944.

The staff sections of the Armored Center Headquarters, were reorganized to include only the Adjutant General, Judge Advocate, Inspector General, and two new sections

designated as the Organization, Doctrine and Training, and Equipment and Materiel Sections. This reorganization eliminated all General Staff Sections and added OD&T, and E&M Sections which embraced substantially the scope formerly covered by staff sections G-3 and 4 and the special staff sections whose activities with which they were normally concerned. All units were transferred to R&S Command except those units at the California-Arizona Area which remained assigned to Armored Center.[17]

Under the 1944 redesignation the Armored Center exercised normal command functions as delegated by the R&S Command. Army Ground Forces stated that the reorganization was based upon the principle that routine matters pertaining to supply, training and personnel which concerned the Armored Replacement Training Center and the Armored School would be administered directly between the R&S Command the ARTC and TAS. This chain of communication caused considerable confusion at Headquarters Armored Center, because it complicated the dissemination of information, and coordination between the Center, the ARTC and the Armored School.[18]

Directly concerned with the problem of creating better coordination between the Armored School and the Armored Replacement Training Center and Armored Center Headquarters, General Scott stated that he did not believe the system placed in effect upon reorganization 20 February 1944 to be functioning as well as it should, or as was visualized at the time of its adoption, due to an element of "divided responsibility." He further qualified his opinion by a statement on 4 September 1944:

> As to the work of an Armored Center and the progress that has been made therein, it is necessary to go back to the directives which I received in person from AGF last December. I was specifically told that I was to consider myself as technical advisor in all matters connected with armor, to act as inspectorate of armored units to coordinate and improve training throughout all armored installations. 19

As a result of General Scott's protests this chain of communication was subsequently revised to require all correspondence pertaining to the ARTC and Armored School to pass through the Armored Center Headquarters.

On 9 October 1945, Army Ground Forces ordered that necessary steps be taken to discontinue Headquarters and Headquarters Company, Armored Center at Fort Knox, Kentucky, at the earliest practicable date and not later than 30 October 1945.[20] The Armored Center was inactivated at 2400 hours, 30 October 1945.[21] The Armored School moved its headquarters to the building formerly occupied by the Armored Center Headquarters. Office and enlisted personnel were reassigned to The Armored School, Armored Replacement Training Center, Army Ground Forces Board No. 2 and Post SCU.

From the activation date of the Armored Force, 15 July 1940, to the inactivation of the Armored Center on 30 October 1945, the development of armor had come a long way in experimental work, training, and organization. It had organized and trained four corps headquarters, sixteen armored divisions, all of which had been engaged in combat, approximately sixty-five tank battalions, and a number of amphibious tank battalions and amphibious tractor battalions. All but a few of these units had been engaged in combat.

In addition to the troops which armor contributed to the war effort it had, in the words of Lt. Gen. Willis D. Crittenberger, developed a typical American method of waging war:

> Armor: - in spite of the hard knocks and adversities which had to be overcome, did in the advance across France just exactly what had been expected of it, by those who have known American armor for ten

years. It will do it again if a breakthrough occurs. American armor leaders had expected to occur what occurred in France. Armor has fulfilled their expectations.

We have in our country the facilities to manufacture armor in great quantities. We have also the personnel naturally inclined to fight the armored way. Our manpower, in general, understands motors. Almost every young man has owned or has worked on a motor vehicle or radio. We have become a more or less mechanized nation - more so than any other other nation. We should capitalize on these facilities and these potentialities to the fullest. This war is a gun war. The side which concentrates at a decisive point the greatest power generally wins. This power includes the fire power of guns. To meet these requirements, guns must have mobility, - a tracked vehicle for a mount; armor for protection, and get the gun there with overwhelming firepower.

It is the duty of professional soldiers, because of the potentialities of our country, to push all modern developments of war, including armor, and forget petty branch jealousies.

Armor fits naturally into American ideas and American characteristics in that it is a weapon of opportunity for decisive employment. Give Armor the fullest chance to develop and break away from hidebound conceptions of the past. 22

Inactivation of the Armored Center created three possibilities with regard to the future of Armor. First it might be lost among the branches of the Army as it had been before the creation of the Armored Force; second, it might be given the status of a separate arm by legislative action; third, all arms as such might be dropped and Armor might gain equality in this way. The first possibility was regarded as unlikely, as a majority of leaders in the Army were agreed that Armor should have the status of a separate arm, if arms were retained in the postwar army. Many leaders including General Eisenhower were of the opinion that arms as such should be dropped in the postwar army except for developmental activities and schools, which would result in Armor gaining equality as a result of the abolition of the other arms. One thing was certain, Armor had demonstrated its right to a place in the postwar organization of the Army, whatever form of organization the Army might adopt.

NOTES

Chapter I

PRELUDE TO ARMOR

1. See "A Tank Battalion at St. Mihiel," The Infantry School Mailing List. Vol. XV (1928, pp. 1-54).

2. Gen. John J. Pershing to Brig. Gen. Samuel D. Rockenbach, 20 Feb 19. (Reprinted in Jones, Barey and Icks, The Fighting Tanks Since 1916, p 114).

3. Ltr of Gen Charles P. Summerall to Maj T. E. Sims, 7 Jun 43, sub: Origin of the Armored Force. 314.7.

4. Ibid.

5. Camp Knox was established as a permanent post and redesignated as Fort Knox on 1 January 1932.

6. Major General Daniel Van Voorhis, "Notes on Conference with Chief of Staff, 1931," (Copy in personal files of Maj. Gen. Adna R. Chaffee).

7. Within three months after the formation of the Armored Force, Colonel Palmer recognized defects remedied two years thereafter; the unwieldiness of single armored brigade and the lack of sufficient infantry support troops. (Colonel Bruce Palmer to Maj. Gen. Lesley J. McNair, 14 Oct 40. WD, Adj Gen File 320.2).

8. Memo, Brig Gen T. J. Camp, 5 Aug 43; Col Edwin K. Wright, Memo, 9 Aug 43; Memo, Col Victor B. Wales, July 43. (Copies in Hist Off files.)

9. Brig Gen Adna R. Chaffee to Capt Floyd Parks, 4 Apr 39. (Copy in personal files of Maj Gen Adna R. Chaffee).

10. Chief of Cavalry, Memo for the Chief of Staff, 17 Oct 38. (Copy in personal files of Maj Gen Adna R. Chaffee).

11. Brig Gen T. J. Camp, Memo, 5 Aug 43. (Copy in Hist Off files).

12. Statement of Maj Gen Adna R. Chaffee before Army and Navy Sub-Committee, Committee on Appropriations, House of Representatives, 14 May 41. G-2 files.

13. Interview with Maj Gen Charles L. Scott, May 43. (Copy in Hist Off files.)

14. Maj Gen Daniel Van Voorhis to Maj T. E. Sims, 26 May 43. (Copy in Hist Off files 314.7.)

15. Col James K. Parsons to TAG, 17 Apr 30. (Copy in WD G-3/41665.)

16. Col Emerick Kutschko to Maj T. E. Sims, 24 Jul 43. 314.7.

17. Maj Gen James K. Parsons to Maj T. E. Sims, 28 Aug 43. Ibid.

18. Brig Gen Adna R. Chaffee to TAG of the United States, 15 Sep 39. 320.5.

19. Col Alvan C. Gillem, Jr, "Conference of Second Armored Division," 7 Oct 40. G-3 conference file.

20. Report of the Tank Brigade (Provisional) AG 353 (4-25-40) M-C.

21. Brig Gen Adna R. Chaffee to Col Charles L. Scott, 9 Apr 40. (Personal files of Maj Gen Adna R. Chaffee).

22. Col Alvan C. Gillem, Jr, "Lessons Drawn from a Concentration of the Provisional Tank Brigade," Conference for Officers, 2nd Armd Div, 7 Oct 40. (Copy in G-3 files, 337).

23. Maj Gen Alvan C. Gillem, Jr, Memo, June 43; Interview August 1943, Brig Gen T. J. Camp, Memo, 5 Aug 43; Interview, August 1943. (Copies in Hist Off files.)

24. Brig Gen T. J. Camp, Memo, 5 Aug 43. Hist Off files.

25. Brig Gen Frank M. Andrews, Memo for the CofS, 29 May 40. WD G-3 files 41665 (C).

26. Agenda for Conference on Mechanization, 10 June 1940. WD G-3 files 41665, Sec 1.

27. Conference held on the establishment of Armored Divisions, Operations and Training Division, G-3, 10 June 1940, p 15. G-3 file 337.

28. Statement of Maj Gen Adna R. Chaffee before Army and Navy Sub-Committee, Committee on Appropriations, House of Representatives, 14 May 41. G-2 files.

29. Maj Gen E. S. Adams, Adj Gen, Memo for ACofS, G-4, 15 Jun 40. 334.7.

Chapter II

INITIAL STRUCTURE

1. AG 320.2 (7-540) H (Ret) M-C.

2. Col Emerick Kutschko to Maj T. E. Sims, 24 Jul 43. (314.7).

3. Memo, Maj Gen Alvan C. Gillem, Jr, June 1943; Interview, August, 1943. 314.7.

4. AG 320.2 (7-5-40) H (Ret) M-C, according to General Chaffee, the initial actual strength of the Armored Force was 242 officers, 7,015 enlisted men. The initial equipment strength was 1,848 vehicles, including a total of 393 tanks of all types. (Statement of Maj Gen Adna R. Chaffee before Army and Navy Sub-committee, Committee on Appropriations, House of Representatives, 14 May 41.) G-2 files.

5. Brig Gen Adna R. Chaffee to Maj Gen Delos C. Emmons, 1 Aug 40. Personal files of Maj Gen Adna R. Chaffee.

6. Data obtained from Post Engineer, Fort Knox, Kentucky.

7. Tng Memo 4, Tng Dir, Armd F, 1940-1941, 6 Aug 40, p 1. G-3 files.

8. Maj Gen Adna R. Chaffee to Representative David D. Terry, 4 Jun 41. 201 file Maj Gen Adna R. Chaffee.

9. Ibid.

10. Interview with Col William L. Barriger, ACofS G-4, May, 1943. Hist Off files.

Chapter III

ORGANIZATION AND TACTICS

General

1. See Chap I, pp 10-13.

2. Maj Gen Charles L. Scott, address to press, Ft Knox, 17 Nov 40.

3. Col Emerick Kutschko to Maj T. E. Sims, 24 Jul 43. 314.7.

4. Statement of Maj Gen Adna R. Chaffee before Army and Navy Subcommittee, Committee on Appropriations, House of Representatives, 14 May 41. Hist Off files.

5. Captain Carl T. Schmidt, "The German Armored Force," Infantry Journal, December, 1941.

6. WD ltr AG 322 (28 Sep 43), 1 Oct 43, sub: Redesignation and Reorgn of II, III, and IV Armd Corps and Organic Corps Type Units. 320.2/104.

7. "The German Armored Army," - Military Intelligence Service, War Department, 10 August 1942.

8. WD Tng Cir No 4, 27 Sep 40.

9. Lt Gen Jacob L. Devers, "The Armored Force," Military Review, Vol 22, No 87, Jan 43.

10. Brig Gen Adna R. Chaffee to Gen George C. Marshall, 26 Jul 40. Personal files of Maj Gen Adna R. Chaffee.

11. Brig Gen T. J. Camp, Memo, 5 Aug 43.

12. Brig Gen Adna R. Chaffee, Memo to the DCofS, 26 Jun 40. Conference on "The Establishment of Armored Divisions in the Operations and Training Division, G-3," 10 June 1940. G-3 files 337.

13. Maj Gen Charles L. Scott to Maj Gen John K. Herr, 7 Aug 40. Personal files of Maj Gen Charles L. Scott.

Chapter IV

THE ARMORED FORCE: COMMANDERS AND PRINCIPLES

1. Interview with Brig Gen W. F. Dean, Jul 43. Hist Off files.

2. Interview with Brig Gen David G. Barry, Jul 43. Ibid.

3. Interview with Maj Gen Charles L. Scott, Aug 43. Ibid.

4. For example, Headquarters Armored Force announced to the separate tank battalions and tank groups that "GHQ training directives will receive special attention." (Headquarters, Armored Force, letter to tank battalions and tank groups, 320.2 T).

5. See appendix for list of activation dates for Armored Divisions, Tank Groups and Tank Battalions.

6. See appendix for a complete list of Armored Division and Armored Corps and the periods when they were under and passed from control of the Armored Force.

7. Ltr, Maj Gen Stephen G. Henry to CG Armd F, 2 Sep 41. Copy in General Henry's 201 file.

8. The activities of foreign armor naturally have been a day-to-day concern of the commanding generals. Just a few examples are listed here: "Organization for Command of Large Armored Units in European Armies" by Major General Charles L. Scott; 18 January 1941; Statement of Major General Adna R. Chaffee before Sub-Committee, Committee on Appropriations, House of Representatives, 14 May 1941; Lieutenant General Jacob L. Devers to Lieutenant General Lesley J. McNair, 18 December 1941 and 3 September 1942. Hist Off files.

9. Gen Devers to Maj Gen Richard C. Moore, 19 Jan 43. Hist Off files.

10. Ltr, Maj Gen Stephen G. Henry to CG Armd F, 2 Sep 41. Copy in Gen Henry's 201 file.

11. Interview with Brig Gen Williston B. Palmer, 18 May 43. Hist Off files.

12. Ltr, Maj Gen Stephen G. Henry to CG Armd F, 2 Sep 41. Copy in Gen Henry's 201 file.

13. "Notes on Recent Fighting in Tunisia." 350.05 (R) GNGCT, 27 Jan 43.

14. Hq AGF, 29 Mar 43. 319.1/48.

15. "Extract of Observers Report, Hq Armd Comd, 20 Jul 43." 210. 684-GNOAG.

16. Interview with Brig Gen Williston B. Palmer, 18 May 43. Hist Off files. Lt Gen Jacob L. Devers to Maj Gen D. H. Pratt, 26 Mar 43. Ibid.

17. Lt Gen Jacob L. Devers to Maj Gen William H. H. Morris, 14 Apr 43. Copy in Gen Devers personal files. Maj Gen E. N. Harmon to Lt Gen Jacob L. Devers, 2 Mar 43. Hist Off files.

18. Lt Interview with Col J. B. Murphy, 20 Apr 43. Ibid.

19. "Notes on Medium Tank M-3"; M.A. 2626; 24 Jun 42. G-2 files.

20. M.A. 3010, Cairo, 28 Jan 43. G-2 files.

21. G-2 USAFIME, 28 Nov 42; USA-114. Ibid.

22. Rpt to Chief, Mil Int Serg by Maj Gen Charles I. Scott, 28 Jul 42. Personal file Gen Scott.

23. Conference with Col Haines, Armd F.Bd. 210.864.

24. Maj Gen E. N. Harmon to Lt Gen Jacob L. Devers, 2 Mar 43. Hist Off files (S).

25. Project No 6, Armd F Med Research Laboratory, sub-project "Study of Characteristics and Limitations of Present Visual Devices in Tanks." Project 249-3, Armd F Bd, 21 Apr 43.

26. Project 249-1, Armd F Bd, 21 Apr 43.

27. Project 389, Armd F Bd, 7 Apr 43.

28. War Dept, Mil Int Serv, Tactical and Technical Trends No 11, 5 Nov 42; No 18, 11 Feb 43; No 32, 26 Aug 43; Intelligence Summary, ACofAir Staff, Int, No 43-21, 10 Mar 43; Chemical Warfare Int Bull No 24, 15 Nov 43. G-2 files.

29. AFV Middle East Liaison Ltr No 9 & 10. G-2 files (S).

30. "Extract of Observers Report" 210.684-GNOAG, Hq Armd Comd, 20 Jul 43.

31. "Report of Observations at European Theater of Operations and North African Theater of Operations" by Maj Gen Alvan C. Gillem, Jr. 210.684 (C).

32. Tng Memo No 16, Hq Armd F, 29 Jun 43; "Vehicle Operation in Smoke -- Tentative."

33. Maj Gen E. N. Harmon to Maj Gen Adna R. Chaffee and Maj Gen Charles L. Scott, 9 May 41. Personal files Gen Scott.

34. Lt Gen Jacob L. Devers to Col Cheves, 10 Oct 41. Personal files Gen Devers.

35. Armd Ctr ltr, 4 Sep 44, sub: Notes on Important Armd Matters. 320.2/102, Vol VII.

36. Ltr of Col L. A. Hammack, Hq AGF, to Col R. E. Tibbetts, Hq Armd Ctr, 29 Nov 44. 320.2/102, Vol VII.

Chapter V

ORGANIZATION AND TACTICS

1. Armd F Tng Memo 4, 6 Aug 40. G-3 files.

2. Col E. K. Wright, Memo, 19 May 43. Personal files of Gen Devers.

3. AG 320.2 (7-5-40) M (Ret) M-C.

4. T/O 15, 16 Nov 40.

5. Brig Gen Adna R. Chaffee to Brig Gen Charles L. Scott, 24 Aug 40. Personal files Gen Scott. Armd F Ltr, 22 Aug 40, sub: Revision of Tables of Organization of the Armd F. Armd F Bd 320.2.

6. T/O 17, 1 Mar 42 superseding T/O 15, 16 Nov 40.

7. Chief of the Armd F to TAG, 20 Dec 41, sub: Orgn of an Armd Corps. 320.2 (I Armd Corps).

8. Gen Devers to Gen McNair, 13 May 42. Personal files Gen Devers.

9. WD memo, G-2 MID to CofS, 1-11-43, sub: Trends in Orgn of Armd F. 320 (S&C), Vol II.

10. "The Light Armored Regiment," by Col A. D. Surles, Conference No. 9. Officers School, 1st Armored Division, 15 Apr 41. G-3 files.

11. Brig Gen Bruce Magruder to CG 1st Armd Corps, 19 Aug 40. Armd F Bd 320.3.

12. Lt Col Robert W. Grow, Memo to the Armd F Bd on Armd Div Orgn, 3 Sep 40. Armd F Bd 320.3.

13. Maj Gen Jacob L. Devers to Brig Gen Orlando Ward, 30 Sep 40. Armd F Bd 320.3.

14. 1st ind Hq 12th Army Group, 12 Mar 45. Hq Armd Cen 351.

15. Col E. K. Wright to Col Ralph E. Tibbetts, 15 Mar 45. Personal files Col Tibbetts.

16. AGF ltr to CG 12th Army Gp, 14 Feb 45, sub: Postwar Army. 3.0.01/165 (S). AGF files.

17. Lt Col Julian H. Bauman, "Armored Field Artillery in Combat," Military Review, Vol 23, No 3, June, 1943.

18. Brig Gen Adna R. Chaffee to Maj Gen R. M. Danforth, Chief of FA, 3 Aug 40, Ltr, Hq Armd F, 22 Aug 40, sub: Revision of T/O for the Armd F. 320.3.

19. "The Armored Artillery Regiment," by Lt Col John B. Wogan, Conference No 13, Officers School, 1st Armored Division, 13 May 41.

20. Col W. O. Potter, Exec, FA, to TAG WD (through CofArmd F), 13 Nov 40. 320.2/55.

21. Memo, T/O Div, G-3 Sec, sub: Decisions Announced by Chief of Armd F, 2 Sep 42. Armd F G-3 files, T/O Sec.

22. See p 11, this chapter, for discussion of use of artillery liaison planes.

23. FM 11-17, "Signal Orgn and Opns in the Armd Divs and Armd Corps," p 16.

24. FM 17-80, "Medical Units, Armd F," for discussion of various methods developed for removing wounded from tanks.

25. Maj Gen Jacob L. Devers to CG AGF, 16 Jun 42; Brig Gen David G. Barr to Brig Gen Ralph C. Tobin, 23 Dec 42 and 11 Jan 43. Lt Gen Jacob L. Devers to Maj Gen R. C. Moore, 26 Feb 43. Personal files Gen Devers.

26. Brig Gen Adna R. Chaffee, "Notes for the Staff," 21 Aug 40. Personal file Gen Chaffee.

27. Lt Col J. H. Gilbreth, Memo, Office of ACofS, G-3, Armd F, 25 Jul 42. G-3 file 452.1.

28. AGF Memo 353/77 (Air Ground) GNTRG (6-17-42), 17 Jun 42, sub: Pilots and Mechanics for Organic FA Air Obsn. G-3 file 452.1.

29. Battle Experiences No 36, 12th Army Group, 31 Aug 44.

30. Battle Experiences No 38, 12th Army Group, 3 Sep 44.

31. Immediate Rpt No 34, Hq ETOUSA, 26 Jan 45.

32. Memo, 27 Nov 42, sub: Maintenance and Supply in the Armd Div. 401.

33. Third Army ltr (S), 23 Apr 45, sub: Reorgn of Armd Div. 1426 (Armd S)

34. Ibid.

35. Incl to above.

36. Ltr of Maj Gen White to CG 9th Army, 5 Jun 45. 320 (G-3) 116.

37. Ibid.

38. Ltr, Gen Devers, 13 Jun 45. 320 (G-3) 116. Incl to above.

39. Col E. K. Wright to Col Ralph E. Tibbetts, 15 Mar 45. Personal files Col Tibbetts.

Chapter V

ORGANIZATION AND TACTICS

Tank Battalions and Tank Groups: Armored Groups

1. Rpt of 70th Tank Bn, 24 Apr 41. 320.2 T.

2. Brig Gen Adna R. Chaffee to Lt Col William M. Grimes, 14 Aug 40. Maj Gen Adna R. Chaffee to Maj Gen William Bryden, DCofS, 6 Oct 40. Personal files General Chaffee.

3. Col Charles H. Unger to Brig Gen Robert Grow, 29 Jul 40. Armd F Bd 320.3.

4. Maj Gen Jacob L. Devers to TAG WD, 8 Dec 41. AG 325.

5. AG 320.2 (1-21-41)M(Ret) M-C, dated 3 Apr 41. 320.2.

6. Memo of Col Orlando Ward, GS Secretary, for ACofS G-3, 25 Mar 41. 320.2. Interview with Brig Gen W. F. Dean, July, 1943. Hist Off files.

7. Maj Gen Anda R. Chaffee, Memo for CofS, 27 Mar 41. Personal files Gen Chaffee.

8. AG 320.2 (1-21-41)M(Ret) M-C, 3 Apr 41.

9. Memo of Brig Gen Adna R. Chaffee to TAG WD, 31 Aug 40. 320.2.

10. Armd F GO 13, 26 May 41. 320.2 (T). They were designated as "provisional" pending approval of tables of organization by the War Department.

11. Armd F ltr to comdrs of tk bn, armd div, and tk gp, 24 May 41. 320.2 (T).

12. Maj Gen Jacob L. Devers to Col Gilbert X. Cheves, 8 Oct 41. Personal files Gen Devers.

13. Col H. B. Lewis, Adj Gen Western Defense Comd and Fourth Army, to TAG, 3 Feb 42. 320.2 (AT) (478).

14. Memo of Col E. K. Wright, ACofS G-3, 19 May 43. Personal files General Devers.

15. Maj Gen Jacob L. Devers to ACofS G-3, 22 Jan 42; TAG to the Chief of the Armd F, 27 Feb 42. AG 320.2 (1-22-42) PC.

16. WD Tng Cir (Proposed) Chap VII, p 22.

17. Memo of Gen McNair for ACofS WD, 28 Jan 43. 320.20 (Armd F) (S).

18. Interview with Maj Gen Alvan C. Gillem, Jr, August, 1943.

19. Maj Gen Alvan C. Gillem, Jr to tank group and Bn Comdrs, 5 Aug 43.

20. Memo of Gen Scott, 21 Mar 45, sub: Orgn of the Army, Armd Cen. 314.7 file 320, Vol 3 (C).

21. Memo. Gen Scott, 21 Mar 45. Ibid.

22. R&S Comd ltr, 350.06, 23 Mar 45, sub: Board of Officers. 353 Vol VI.

23. R&S Comd ltr, 350.06, 29 May 45, sub: Reconvening of Board of Officers. 353 Vol VII.

24. Memo of Col R. E. Tibbetts, ExO Hq Armd F G-3, 3 Jul 43. Hist Off files.

25. AGF to Chief of the Armd F, 2 Jan 43. 320.2/9 (Airborne) (C)-GNRQT-3/29010.

26. Hq A/B Comd to Hq Armd F, 6 Feb 43. 320.2 (C).

27. AGF to Chief of the Armd F (353/16) (C)-GNGCT (2-2-43), 2 Mar 43. 320.2 (C).

28. Chief of the Armd F to CG AGF, 28 Mar 43. 320.2 (C).

29. AGF to CG Armd Comd, 6 Aug 43. 320.2.

30. Hq Armd F to CG 20th Armd Div, 1 Jul 43. 320.2 (S).

31. Armd F Bd ltr, 3 Aug 44, sub: Limitations on the Use of Light Tank, T9#1, as Other than an Airborne Vehicle, p 367.

32. AGF ltr (370.5/125), 5 Jul 44, sub: Transfer of 151st A/B Tank Co. 370.5 Vol XII.

33. AGF to CofArmd F, 2 Mar 43 and 25 Mar 43. 320.2/278.

34. (1) AGF to CofArmd F, 1 Sep 42. 320.2/24. (2) Hq Armd F to TAG, 5 Sep 42. 320.2/243.

35. Brig Gen John M. Lentz to Brig Gen David G. Barr, 2 Jan 43. 320.2 (C).

36. AGF Bd Rpt. No 165, 5 Jul 44, sub: Rpt on Armd Comd Matters. USA 625 TAS.

26. See Chapter VIII, Training: Armored Force Replacement Training Center.

27. General Devers to General Gillem, 14 Apr 43. Personal files General Devers.

28. Armd F Tng Memo No 11, 16 Apr 43.

29. Memo of Col Edwin K. Wright for CofS, 17 May 43. G-3 file.

30. Armd F ltr to CG AGF, 19 May 43. 353/4 (G-3 file).

31. Major Gen Gillem to Armd and Tank Gp Comdrs, 6 Aug 43. Ibid.

32. CDL -- Code used to describe equipment. No particular meaning.

33. Ltr, Hq AGF 353, 9 Mar 43, sub: CDL Equip. 320 (S) Vol I.

34. Tentative Tactical Pamphlet, 1 Jan 44. Ibid, Vol II.

35. Ltr, Hq Armd Comd, 20 Nov 43, sub: Cassock Project. Ibid.

36. Ibid.

37. Ltr, Hq AGF, 353, 9 Mar 43, sub: Cassock Project. 320 (S), Vol I.

38. Ltr, Hq Armd Comd, 20 Nov 43, sub as above. Ibid, Vol II.

39. Ltr, SHAEF 12754/Ops (A), 10 Aug 44, sub: Use of CDL Units. 12th Army Gp, Armd Sec file at Hq Armd Cen.

40. 3rd ind, Hq ETO, 322, 27 Sep 44. Ibid.

41. AGF 461 GNRQT-2/26167 (12-30-42) ltr to CofArmd F, 30 Dec 42, sub: Commendation 201.22.

42. Brig Gen R. P. Shugg to Maj Gen C. L. Scott, 30 Aug 44. 320 (S), Vol III.

43. Ltr of General Gillem to General McNair, 7 Sep 43.

44. Ltr of Gen Scott to CG AGF, 16 Feb 44. 353, No 43, Vol V.

45. Ltr of Gen Scott to CofS AGF, 4 Sep 44. 320.2/102, Vol VII.

46. 1st W/ind, 350.05 (S), 5 Jan 45. 319.1, Vol II.

47. Ltr of Gen Gillem to Gen McNair, 7 Sep 43. 350.06.

48. Memo (S) of Col E. K. Wright, CofAS 12th Army Gp, to Gen Bradley, 31 May 45. 470.8, 312.12.

49. Rpt (S) of Conference, 25 May 45, Hq The Armd Bd. Filed at Hq Armd Sch.

Chapter VI

TRAINING

General

1. Armd F Tng Memo No 1, 17 Jul 40.
2. Armd F Tng Memo No 4, 6 Aug 40.
3. See Chapter VII, Training: Armored Force School.
4. Armd F Tng Memo No 20, 19 May 4.
5. Armd F Tng Memo No 10, 23 Oct 40.
6. Memo, Col R. E. Tibbetts, 3 Jul 43. Hist Off files.
7. Armd F Tng Memo No 14, 8 Nov 40.
8. See Chapter VIII, Training: Armored Force Replacement Training Center.
9. Armd F. Tng Memo No 18, 5 Dec 40.
10. Maj Gen Charles L. Scott, "Notes for Div Comdrs," 15 Jan 41. 353.
11. Armd F Tng Memo No 14, 24 May 41.
12. Armd F Tng Memo No 25, 30 Jun 41.
13. Armd F Tng Memo No 31, 15 Oct 41.
14. Copy in Armd F 353.
15. Armd F Tng Memo No 34, 24 Nov 41.
16. Armd F Tng Memo No 35, 20 Dec 41.
17. Armd F Tng Memo No 2, 22 Jan 42.
18. Ltr, Hq AGF, 20 May 42. 353/02.
19.
20.
21. Lt Gen Lesley J. McNair, "Post-Maneuver Comments, 1942," 1 Jan 43. 354.2.
22. Hq AGF, Tng Dir effective 1 Nov 42. 353/52 (Tng Dir).
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24. AGF "Tng in Opns Against Permanent Land Fortifications," 5 Jan 42. 353.01.
25. Ltr, AGF, 20 Jan 43. 353.01.

22. Memo of ExO OD&T Sec Armd Cen to Hist Off, 19 Sep 45. Hist Off files.

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25. Remarks of Col R. C. Prather, Asst Comdt TAS, 5 Mar 44. Personal files General Robinett.

26. AGF ltr, 24 Aug 44, sub: Reduction in Length of Courses at Serv Schs. 352.11, Vol III.

27. Ltr of Gen Robinett to CG R&SC, 26 Aug 44. Personal files Gen Scott.

28. Ltr of CG 84th Inf Div to Gen Scott, 30 Mar 45. 353, Vol VI.

29. R&SC ltr, 350.06, 23 Mar 45, sub: Board of Officers. Ibid.

30. R&SC ltr, 29 May 45, sub: Reconvening of Board of Officers. Ibid.

31. Proceedings of Board of Officers. 320.3/1 (S).

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33. AGF ltr, 7 Feb 45, 353/118 GNGCT-15, sub: Air Ground Tng of Offs in AGF Schs. 353/13, Vol III.

34. Memo from Tactics Dept, TAS to Hist Off, 24 Sep 45. Hist Off files.

35. Unnumbered Memo, Hq TAS, from Comdt to Dir Tactics Dept and Dir OCS thru Asst Comd, 12 May 45. TAS files.

36. 2nd ind AGF, 3 Mar 45. 320.2.

Chapter VII

TRAINING

Armored Force School

1. Gen Chaffee to DCofS WD, 26 Jun 40. Personal files General Chaffee.

2. Armd F Memo to Lt Col Stephen G. Henry, 27 Jul 40. 201 file, General Henry.

3. Par 30, WD Dir, 10 Jul 40. AG 320.2 (7-5-40)M(Ret).

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6. General Marshall to General Chaffee, 24 Jul 40. Personal files General Chaffee.

7. Colonel Henry, "The Armored Force School," Cavalry Journal, March - April, 1941.

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9. Interview with Maj F. W. Townsley, G-3 Armd F. June, 1943.

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11.

12. General Marshall to Hq Armd Sch to CG Armd Comd, 3rd ind, 23 Jul 43. 320.3/1, Vol III.

13. R&SC ltr 352, 6 Oct 44, sub: Consolidation of Armd, Cav, and TD OCSs at Ft Knox. 320.2, Vol III.

14. Ltr, Hq TAS, 9 Sep 44, sub: Revision of Armd OC Course. 352.11/02.

15. AGF 1st ind to R&SC ltr, 30 Oct 44, sub: Consolidated Program of Instruction for OCs of Armor, TD and Cav (Mecz). 352.11, Vol III.

16. Armd F to Comdt Armd F Sch, 17 Jun 42. G-3 files 353/21.

17. Memo No 28, Hq Armd F, 12 Feb 42.

18. General Devers to Div and Tank Bn Comdrs, 16 Feb 42. Personal files General Devers.

19. Canadian Legation to Foreign Liaison Off, WD, 31 Oct 42. Personal files General Devers.

20. Ford Mtr Co to General Henry, 4 Sep 42; Comdt Armd F Sch to CofArmd F, 12 Sep 42. Personal files General Devers.

21. General Henry, Address before Louisiana Superintendents of Schools, New Orleans, Louisiana, 23 Mar 43.

Chapter VIII

TRAINING

Armored Force Replacement Training Center

1. Office TAG WD, 1st ind, 1 Oct 40. AG 320.2 (8-15-40)P(C).

2. Colonel Heard was promoted to Brigadier General on 25 October 1940.

3. Armd F Spec O No 93, 15 Nov 40.

4. WD Tng Cir No 24, 1 Apr 41.

5. For a discussion of some of the initial problems, see ltr of Brig Gen Adna R. Chaffee to TAG WD, 15 Aug 40. G-3 file 320.2.

6. General Devers to Lt Gen R. M. Weeks, 11 Feb 43. Personal files Gen Devers.

7. Office of TAG WD to Chief of Armd F, 15 Jan 45. AG 320.2 (1-9-41) M-C-M.

8.

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10.

11. Office of TAG WD to Chief of Armd F, 26 Aug 41. 320.2.

12. Brig Gen Thompson Lawrence to CSigO, 26 Jan 42; Brig Gen Edward H. Brooks to Chief of FA, 29 Jan 42. 353/9.

13. Maj Gen Charles L. Scott to CofS and G-3 Armd F, 2 Feb 43. G-3 file 353/9.

14. Chief of Armd F to CG Armd F RTC, 9 Oct 42. G-3 file 320.2.

15. AG 320.2 (12-31-41), 5 Jan 42.

16. Hq AGF to CG Armd Comd, 9 Sep 43. 354.1/4 (RTC)(C)-GNGCT.

17. Office of TAG WD to Gen Scott, 5 Aug 42. 210.31 (C).

18. By June 1943, the venereal rate in the Center was one-half of that existing in civilian life. Gen Scott to Brig Gen David G. Barr, 22 Jun 43. 353/4.

19. Gen Scott to C of Armd F, 10 Mar 43. Ibid, Vol II.

20. Hq Armd F to CG Armd F RTC, 5 Sep 42. G-3 file 353/9.

21. Gen Scott to C of Armd F, 10 Mar 43. Ibid.

22. Gen Scott to Regtl Comdrs and Heads of Depts, 8 Oct 43, sub: Principles for the Opn of the ARTC under new Orgn; Tng Memo No 56, Hq ARTC, 18 Oct 43; Revised Tng Memo No 6, Hq ARTC, 10 Nov 43.

23. WD Tng Cirs 2 and 35, 1941.

24. Brig Gen Jack W. Heard to C of Armd F, 14 Aug 41. 320.2, Vol I.

25. Brig Gen. Henry C. Newton to Maj T. E. Sims, 21 Jun 43. 314.7.

26. Gen Scott to C of Armd F, 10 Mar 43. G-3 file 353/9.

27. AGF to C of Armd F, 20 May 43, 1st ind 354.1/57 (Armd F)-GNGCT, (5-5-43); Col Harvie R. Matthews to CofS Armd F, 21 May 43. G-3 file 353/9.

28. Hq Armd F to Comdt Armd F Sch and CG AFRTC, 15 May 43. 353/4, Vol II.

29. Mobilization Training Program 17-1 (Revised), 24 July 1943.

30. Gen Scott to C of Armd F, 9 Jun 43. G-3 file 353/9.

31.

32. Hq Armd Comd to CG ARTC, 25 Jul 43, 1st ind. G-3 353/9.

33. AGF to CG Armd Comd, 9 Sep 43. 354.1/4.

34. Mobilization Training Program 17-1 (Revised), 24 Jul 43; Hq Armd Comd to CG AGF, 3 Aug 43. 320.2/2, Vol III.

35. Mobilization Training Program 17-1 (Revised), 1 Oct 43.

36. For a complete analysis of the various methods by which the Center carried out the training directives of the Army Ground Forces, see AFRC to CG Armd F, 13 Jul 43. G-3 file 353/9.

37. Lt Col Louis H. Bell to C of Armd F, 15 Jan 43. Col Bell to Lt Holman Hamilton, 11 May 43. Hist Off files.

38. IG 451 ADR (AFRTC)(M) 29 Dec 42. G-3 files 353/9.

39. Memo of ExO OD&T to Hist Off, 19 Sep 45. Hist Off files.

40. Ltr Gen Scott to CG R&SC, 28 Mar 44. 201 File Gen Scott.

41. Ibid.

42. Memo of ExO OD&T Sec to Hist Off, 19 Sep 45. Hist Off files.

43. Ltr Gen Camp to AGF, 12 Jul 44. 220.3.

44. Memo of Gen Scott to Hist Off, 12 Sep 45. Hist Off files.

45. Memo of Gen Scott, 12 Sep 45, to Hist Off. Hist Off files.

46. Ibid.

47. Ltr of Gen Hazlett to ARTC, 5 May 44, GNRST 353 (ARTC files).

48. Gen Hazlett, R&SC, 22 Aug 44. (ARTC files).

49. GO No 46, Hq ARTC, 30 Oct 44.

50. Ltr Hq Armd Cen, 320.2/102, 4 Sep 44, sub: Notes on Important Armd Matters. 320.2/102, Vol VII.

51. Gen Camp, Ltr to COs and Heads of Staff Secs, ARTC, 19 Dec 44. 353 ARTC files.

52. Ltr of Gen Wood to CO Advance Tng Gp, 6 Jun 45. ARTC files.

Chapter IX

TESTING AND EQUIPMENT

General

1. See Chap I, pp 11-12.

2. See Chapter X for a full discussion of the activities pf the Armored Force Board.

3. Proj No 161, Mech Cav Bd. Armd Bd files.

4. Ibid.

5. Maj Gen Jacob L. Devers to Maj Gen R. C. Moore, 19 Jan 42. Personal files Gen Devers.

6. Gen Devers to Col R. P. Shugg, 29 Mar 42. Ibid.

7. See Chap X, Testing & Equipment, The Armd Bd.

8. Studies in the History of AGF No 33, The Role of the Army Ground Forces in the Development of Equipment.

9. Armd F Bd to CofArmd F, 19 Nov 41. 470.8.

10. Memo on Decisions of Conference of 13 Jan 43. 479.8 (C).

11. Gen Devers to CG AGF, 16 Mar 43. Personal files Gen Devers.

12. Development Manual, Office of the Chief of Ordnance.

13. Ltr, Hq ETO, 25 Jan 45, sub: Instructional Tms, Light & Heavy Tnks. Memo filed therewith. AG 200.3/2 (Armd Gen)

14. Studies in the History of AGF No 33, The Role of the Army Ground Forces in the Development of Equipment.

15. Lt Col J. L. Phillips to Gen Chaffee, 31 Jul 40. Personal files Gen Devers.

16. Gen Devers to Maj Gen R. C. Moore, 19 Jan 42. Ibid.

17.

18. Ord Com Meeting 27123, 22 Mar 45.

19. Memo (S) of Col Hammack for ACofS G-3 AGF, 12 Jan 45, sub: Rpt on Trip to ETO.

20. Ibid.

21. Ibid.

22. Ltr (C), Hq 751st Tk Bn (Maj C. J. Madden), sub: Comments to AGF Bd, FAAC, APO #777, U. S. Army.

23. Maj Gen C. L. Scott to Armored News, 2 Apr 45.

24. Armd F Bd Proj No 218, Test of 105mm Howitzer Motor Carriage.

25. Col J. A. Holly, Memo to Gen Devers, 23 Feb 42. Personal files Gen Devers.

26. Ord Com Meeting 27569, 25 Apr 45.

Chapter X

TESTING AND EQUIPMENT

1. Armd F "Office Directive No. 1," 16 Jul 40. 201 file Col. C. C. Benson.

2.

3. Interview with Col. G. B. Devore, Apr 43. Hist Off files.

4.

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6. Hq Armd F to Armd F Bd, 22 Aug 42. 320.2.

7.

8. Proj No 378, "Special Test of 40 Medium Tanks." Proj No 267-1, "Special Test of 17 M-4A3 Medium Tanks."

9. Proj No 378, "Special Test of 40 Medium Tanks."

10. Armd F Bd Proj No 364, "Incendiary Effect of Firing Against Medium Tanks, M4." AG files.

11. Proj No 251, "Navy Tests in Tank Lighter." (C)

12. Proj No 386, "Service Test of Range Finders."

13. Proj No 338, "Test of Medium Tank M4A1 with 76-mm Gun."

14. Proj No 413, "Test of Illuminated Projectiles (Star Shells)."

15. Proj No 460, "Test of Bren Gun Carriers Equipped with Ronson Throwers."

16. Proj 482, "Test of Light Tank, M24."

17. Ibid. Ltr Hq AGF, 26 Jul 44, sub: Increase of crew of Light Tank M24 from Four to Five. 320.3.

18. Proj 546-2, "Test of Heavy Tank, T26E3,"Engine Breakdown."

19. Proj 724, "Test of Heavy Tank T26E2.

20. Proj 607, "Test of Medium Tank T23E3."

21. Ltr, The Armd Bd, 210.453, sub: Detached Serv of Offs of Armd Bd.

22. Proj 733, "Test of Polaroid Material for Identification of Armd Vehicles."

23. Proj 673, "Test of Camouflage of Tanks." (S)

24. Proj 668, "Test of Camouflage Kit for Medium Tanks," (S)

25. Proj 713, "Test of Panel Set VX-8/G. (S)

26. Proj 679, "Test of Serv Unit, Mech Flame Thrower, E8." (C) Proj 651, "Test of Guns, Mech Flame Thrower E6R2 and E12R2." (C); Proj 745, "Test of Gun, Mech Flame Thrower, E12R3. (C).

27. Proj 760, "Test of Flame Resistant Garments. (C)

28. Proj 744, "Test of Launcher, Rocket, Multiple, 4.5" T72." (S)

29. Proj 689, "Test of Fuze VT, T80E6."

30. Proj 743, "Test of Shell, 105mm HE AT M67E1."

Chapter XI

TESTING AND EQUIPMENT

1. Resolution adopted by the Sub-Committee on Industrial Medicine, 10 Oct 41. 700.2.

2. CofArmd F to TAG WD, 8 Dec 41. AG 444.5.

3. WD Adj Gen Off, 3 Feb 42. AG 322.39, Ft Knox, Ky. (12-8-41)

4. CofArmd F to CG Armd F Med Research Lab, 24 Sep 42. 400.112/6.

5. Director of Med Research Lab to Hist Off Armd Comd, 27 Nov 43. Hist Off files.

6. Maj Gen D. H. Pratt to G-2 Armd F, 13 Mar 43; Hq AGF to CofArmd F, 23 Mar 43. 700.2. Lt Col Willard F. Machle to Dr. Omond Solandt, 9 Mar 43. Ibid.

7. Proj 5-1, 27 Nov 42, "Adequate Headroom in Tanks."

8. Director of Med Research Lab to Hist Off Armd Comd, 27 Nov 43. Hist Off files.

9. "Study of the Characteristics and Limitations of Present Visual Devices in Tanks," Jan 43, Armd F Med Research Lab.

10. Proj 7-5, 7-6, "Program for Improvement of Night-Seeing Ability of Ground Trs," reported 5 May 44. Armd Med Research Lab.

11. Proj 6-1, 6-6, Vis Reqmts for Spotting, repted 20 Feb 43. Ibid.

12. Ord Com Meeting 28266, 23 Aug 45.

13. Proj 6-4, Lateral Offset Sight, reported 27 Sep 43. Armd Med Research Lab.

14. Director Armd Med Research Lab to Hist Off Armd Comd, 27 Nov 43. Hist Off files.

15. Armd F Med Research Lab, Sub-proj 2-11, "Influence of High Temperatures on the Efficiency of Pers;" Sub-proj 2-12, "Study of Methods of Attaining and Maintaining Acclimatization to High Temperatures."

16. Director Armd Med Research Lab to Hist Off Armd Comd, 27 Nov 43. Hist Off files.

17. Ibid.

18. Ibid.

19. Ibid.

20. WD GO 21, 13 Mar 44. Ltr CG AGF to CG Armd Comd, 13 Feb 44, sub: Reorgn of the Armd Comd. 320.2, Vol II.

21. Memo of Col Machle to All Offs of this Lab, 1 May 44. AMRL.

Chapter XII

REDESIGNATIONS OF THE ARMORED FORCE

1. WD GO 36, 2 Jul 43.

2. WD GO 21, 13 Mar 44.

3. Studies in the History of AGF No 9, Organization and Training of New Mechanized Forces.

4. Agenda for Meeting of 10 Jun 40, Tab A, "Present Plans for Mechanization." (WD G-3 Confidential File 41665, Sec I.)

5. Interview with Maj Gen R. C. Moore, Jul 43. Hist Off files.

6. ACofS G-3 WD, Memo to CofS, 19 Nov 40, sub: Orgn of the Armd F. 320.2 AF.

7. Chief of Inf to ACofS G-3, 7 Dec 40. WD G-3 41665 (C).

8. Chief of Cav to ACofS G-3, 7 Dec 40. Ibid.

9. Office of the CofS, Memo for ACofS G-3, 21 Jan 41, sub: Orgn of the Armd F. Ibid.

10. Gen McNair to Maj Gen Charles L. Scott, 24 Jan 41. Personal files General Scott.

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13. Interview with Brig Gen W. F. Dean, Jul 43. Hist Off files.

14. Gen McNair to CofS, 11 May 43. 320.2 AGF.

15. AGF ltr 320.2/87, 13 Feb 44, sub: Reorgn of Armd Comd. 320.2 Vol II.

16. AGF ltr 320/76, 21 Sep 44, sub: Assignment of the Armd Bd to the Armd Cen. 320.2, Vol II.

17.

18. Memo of Lt Col Fonda to Hist Off, 29 Sep 45.

19. Armd Cen ltr, 4 Sep 44, sub: Notes on Important Armd Matters. 320.2/102, Vol VII.

20. AGF ltr, 9 Oct 45, sub: Discontinuance of Hq & Hq Co, Armd Cen, Ft Knox, Ky. 320.2/191 (R&SC) (R).

21. Armd Cen ltr, 30 Oct 45, sub: as above. 320.2 (GNREA)

22. Ltr (S) of Maj Gen Willis D. Crittenberger to CG AF, 27 Dec 44, sub: Status of Post War Armor. 370.01/165 (S).

APPENDICES

Appendix A

Courses Offered by the Armored School

Certain courses offered were so general in nature as to preclude their classification under any of the departments. An outline of these courses follows:

General Courses

Special Division Cadre Course - Opened 7 September 1942; closed 5 June 1943. Duration of each class - 4 weeks. Graduated 343 officers. Provided refresher training in tactics, communication, maintenance, and gunnery to division cadre officers through instruction in the tactical employment of armored units to include the combat command for line officers; duties of communication and maintenance officers for officers cadred in this classification.

United States Military Academy Graduates Course - Opened July 1943; current. Duration of each class - 8 weeks. Graduated 53 officers. A general armored course in communications, covering procedure; infantry-tank-artillery-communication; motors, covering engine theory; maintenance; inspections and spot checks; tank maintenance, covering complete instructions on heavy, medium, and light tanks; tactics to include field engineering; familiarization driving M24 light and M26 heavy tanks; command staff and logistics; basic medical subjects; combined arms; mechanized cavalry; tank destroyer; tank employment; and gunnery, to include the 75-mm gun, direct and indirect firing, and tanks as artillery.

Officers Special Basic Course (also Field Artillery and Antiaircraft Artillery officers conversion course) - Opened 13 March 1944; closed 10 May 1944. Duration of each class - 8 weeks. Provided broad conversion training for officers of field artillery units by instructions in communications; tank and wheeled vehicle maintenance; tank gunnery; tactical employment of tank and infantry units; mines, minefields, and mine laying and removal; enemy tanks, tank tactics, and antitank methods and means. Graduated 469 officers.

Officers Armored Refresher Course - Opened 15 January 1945; current. Duration of each class - 8 weeks. Graduated 35 officers. Provided refresher training for officers of armored units during the restaging period by instruction in signal communications; internal combustion engines; chassis units; power train; maintenance systems; driver selection and training; function, functioning, construction, and maintenance of the various circuits, systems, units, and assemblies in tanks; practical work in first echelon maintenance; crew drill; tank gunnery, to include direct and unobserved fires; reconnaissance and security; tactical employment of tank and infantry units; employment of tank and supporting arms; and functions of staff officers.

Cavalry Officers Refresher Course - Opened 12 March 1945; closed 7 April 1945. Duration of each class - 4 weeks. Graduated 18 officers, Provided broad conversion training for officers of cavalry units by instructions in armored organization; communications; tank and wheeled vehicle maintenance; tank gunnery; tactical employment of tank and infantry units, armored engineers, and tank battalions in landing operations; enemy antitank means, methods, and tank tactics; flame thrower and snake demonstrations.

Tactics Courses

Officers Basic Tactics Course - Opened 9 February 1942; closed 22 April 1943. Duration of each class - 8 weeks. Graduated 595 officers. Basic tactical principles

for lieutenants and captains, as applicable to elements of the armored unit, with particular emphasis on the platoon and company; field engineering to include demolition, AT defense, and field expedients; a review of map reading and aerial photograph interpretation; gunnery to include small arms, tank weapons, AT weapons, and the combat principle of the tank section, platoon, and company; tank drill to include that of the company; communications to include familiarization with voice procedure on FM sets and proper use of interphone equipment.

Officers Advanced Tactics Course - Opened 1 April 1943; closed 30 November 1943. Duration of each class - 6 weeks. Graduated 145 officers. Provided an orientation, indoctrination, or refresher course for officers of field grade serving with armored units for the first time or not graduates of The Armored School. Instruction included organization of armored units; training doctrines; employment; characteristics of light and medium tanks; field engineering; reconnaissance; crew drill, tank drill; cooperation of all arms; combat principles and tactics (platoon to division); GHQ Reserve tank units; defense against chemical attack; supply; staff duties; gunnery; principles of maintenance; driver selection and training; and convoys.

Company Officers Course - Opened 26 April 1943; closed 12 February 1944. Duration of each class - 8 weeks. Graduated 968 officers. Basic tactical principles for lieutenants and captains, as applicable to elements of the armored units, with emphasis on platoon and company; field engineering to include demolition, AT defense, and field expedients; a review of map reading and aerial photograph interpretation; gunnery to include small arms, tank weapons, AT weapons, and the combat principles of the tank section, platoon, and company; tank drill to include that of the company; communications to include familiarization with voice procedure on FM sets and proper use of interphone equipment.

Battalion Commanders Course - Opened 21 June 1943; closed 5 February 1944. Duration of each class - 6 weeks. Graduated 194 officers. Designed for selected captains and field officers partially trained in armored units to fit them for duty as battalion commanders or staff officers. Instruction in organization of the armored units; training doctrines and methods; employment of armored units to include the armored battalion reinforced; characteristics of light and medium tanks; field engineering; reconnaissance; employment of armored organizations; cooperation of all arms; service units; combat principles and tactics; supply and staff duties; GHQ Tank Units; defense against chemical attack.

Officers Advanced Tank Course - Opened 17 January 1944; closed 3 March 1945. Duration of each class - 13 weeks. Graduated 375 officers. Training for selected officers to better qualify them for duty as company and battalion commanders or staff officers of tank units. Instruction included signal communications; use of maps and aerial photographs; mines, laying and removal; reconnaissance and security; tactical employment of tank and armored infantry units; tank-infantry cooperation; employment of supporting arms; staff functions; and tank gunnery.

Officers Advanced Armored Infantry Course - Opened 7 February 1944; closed 2 December 1944. Duration of each class - 12 weeks. Graduated 130 officers. Training for selected officers to better qualify them for duty as company and battalion commanders or staff officers of tank units. Instruction included signal communications; use of maps and aerial photographs; mines, laying and removal; reconnaissance and security; tactical employment of tank and armored infantry units; tank infantry cooperation; employment of supporting arms; staff functions; and tank gunnery.

Officers Advanced Armored Infantry Course - Opened 7 February 1944; closed 2 December 1944. Duration of each class - 12 weeks. Graduated 130 officers. Trained selected officers to better qualify them for duty as company and battalion commanders or staff

officers of armored infantry units. Instruction included signal communications; maps and aerial photograph reading; mine laying and removal; reconnaissance and security; tactical employment of armored infantry and tank units; infantry-tank cooperation; employment of supporting arms; staff functions; gunnery with emphasis on infantry weapons, antitank guns, assault howitzers, and indirect fire by forward observation methods.

Tank Maintenance Courses

Officers Tank Maintenance Course - Opened 4 November 1940; current. Duration of each class - 12 weeks. Graduated 2,259 officers. Trained officers of company grade to perform the duties of maintenance or motor officers in armored units. Instruction included essential nomenclature; functions and functioning of circuits, systems, units, and assemblies; performing scheduled maintenance inspections and servicings; emergency repairs and replacements; trouble diagnosis; practical work in maintenance system, organization, administration, vehicle evacuation, and vehicle recovery.

Enlisted Tank Mechanics Course - Opened 4 November 1940; current. Duration of each class - 12 weeks. Graduated 2,165 officers and 17,110 enlisted men. Trained selected personnel to perform organizational maintenance on current model tanks used in armored units. Included instruction in essential nomenclature; functions and functioning of all circuits, assemblies, units, and systems in tanks; performance of scheduled preventative maintenance inspections and servicings; trouble diagnosis; emergency repairs; unit replacements; and field expedients.

Airborne Tank Course - Opened 8 November 1943; closed 18 December 1943. Duration of each class - 3 weeks. Graduated 33 Enlisted men. A maintenance course to acquaint personnel of airborne tank battalions with the features and maintenance peculiar to the airborne tank through instruction in hull, turret, track, suspension system, and vision devices; detailed instruction on the Lycoming engine; trace lubrication and cooling systems; trouble diagnosis; removal and service of units and assemblies; maintenance inspections and servicings.

Special Medium Tank Maintenance for Field Artillery Personnel - Opened 31 January 1944; closed 4 April 1944. Duration of each class - 4 weeks. Graduated 15 officers and 120 enlisted men. Trained field artillery personnel in maintenance on the M7 self-propelled howitzer through instruction in lubrication, tank suspension, and tracks; power train; engine maintenance and overhaul; electrical system; trouble diagnosis; maintenance systems and inspections, preparation of tanks for shipment and deep fording; driving; and field expedients in maintenance and recovery.

Enlisted Amphibious Vehicle Mechanics Course - Opened 15 May 1944; current. Duration of each class - 3 weeks. Graduated 152 enlisted men. Trained selected tank mechanics in the characteristics and installations peculiar to amphibious vehicles. Included instruction in the track and suspension system; power train; engine; electrical system; trouble shooting and construction; operation and maintenance of the bilge pump, turret, and auxiliary operator.

Enlisted Armorer and Artillery Mechanic Specialists Course - Opened 12 June 1944; current. Duration of each class - 9 weeks. Graduated 691 enlisted men. Trains specialists in disassembling and assembling all weapons of tank units for normal care and cleaning; replacement of parts; nomenclature and function of parts; determining types of malfunctions and applying immediate action; administering the proper technique in care and maintenance of all weapons, mounts, sights, power traverse, and gyrostabilizer; inspecting each type of weapon and weapon equipment to ascertain its fitness for service; removing, replacing, or repairing damaged parts; and writing out job orders and requisitions.

Overseas Instructor Course - M24 and M26 - Opened 8 January 1945; closed 2 June 1945. Duration of each class - 3 weeks. Graduated 11 officers and 574 enlisted men. Trained instructional teams to be sent to the theaters of operations to instruct personnel in all phases of the M24 and M26 tanks. In addition to familiarizing the teams on the flamethrower, rocket launcher, bulldozer, and snake, instruction was given in Instructor Training; tank gunnery; detailed maintenance and operation of the particular tank; characteristics and performance.

Wheeled-Vehicle Maintenance Courses

Enlisted Motor Course - Opened 4 November 1940; current. Duration of each class - 12 weeks. Graduated 14,717 enlisted men. Trained enlisted men to perform first and second echelon maintenance on the vehicles of their respective branches. Covered the essential subjects of mechanical training sufficient to give the student a firm foundation on which to base his later work. Course included the use of tools; engine theory; fuel and electrical systems, and trouble shooting; preventative maintenance inspections and services; and maintenance under field conditions.

Radiator and Sheet Metal Course - Opened 5 November 1941; closed 9 February 1943. Duration of each class - 8 weeks. Graduated 154 enlisted men. Trained enlisted men to use sheet metal working tools and radiator repair and painting equipment issued to armored units by instruction in body and fender repair; welding, brazing; soldering; heat treatment of metals, testing and painting of military vehicles.

Radiator, Body, and Fender Repair Course - Opened 15 February 1943; closed 8 April 1944. Duration of each class - 7 weeks. Graduated 283 men. Trained selected enlisted men to make necessary repairs on army vehicles using regularly issued equipment. Instruction in oxy-acetylene welding; body and fender repair; radiator repair; alignment and painting.

Enlisted Replacement Motor Course - Opened 12 June 1944; current. Duration of each class - 9 weeks. Trained selected enlisted men to perform organizational maintenance on wheeled and half-track vehicles used in armored units by means of instruction in essential nomenclature; functions and functioning of circuits, systems, units, and assemblies found in wheeled and half-track vehicles; practical work in performing scheduled preventative maintenance inspections and servicing emergency repairs and replacements; trouble shooting; practical and theoretical work in maintenance systems; vehicle evacuation and recovery.

Blacksmith and Welders Course - Opened 5 November 1941; closed 27 May 1944. Duration of each class - 7 weeks. Graduated 492 enlisted men. Trained selected enlisted men in effective use of blacksmith and welding equipment issued to armored units through instruction in smithing, oxy-acetylene welding and cutting; electric arc welding; and practical experience in actual welding jobs.

Motorcycle Courses

Motorcycle Mechanics Course - Opened 4 November 1940; closed 26 July 1943. Duration of each class - 8 weeks. Graduated 1,289 enlisted men. Gave selected personnel effective training and instruction in the construction, adjustment, servicing, repair, diagnosing of troubles, inspection, operation, and maintenance of military motorcycles. Instruction including theory of operation of motorcycle engines, carburetors; electrical system; power transmission units; chassis units; records; reports; overhaul inspection; servicing; and all other fourth echelon maintenance operations. All students were taught to ride both the chain drive and the shaft drive cycles.

Motorcycle Operators Course - Opened 4 November 1940; closed 31 May 1941. Duration of each class - 2 weeks. Graduated 232 enlisted men. Provided qualified motorcycle operators for armored units and organizations through instruction in proper care and servicing; first echelon maintenance and adjustments; practical instruction in riding; safety precautions; and development of boldness in scouting and riding.

Communications Courses

Officers Communication Course - Opened 4 November 1940; closed December 1944. Duration of each class - 12 weeks. Graduated 748 officers. Trained officers of company grade to serve as communications officers of companies, battalions, and regiments of armored units by instructions in organization of the army and armored units; command and staff principles; duties of communications officers; principles of signal communication; signal supply; radio nets and procedure; radio fundamentals; practical radio code practice; field operation; and command post exercises.

Cryptographers Course - Opened 4 November 1940; closed 24 July 1941; Duration of each class - 14 weeks. Graduated 142 enlisted men. Trained selected enlisted men to serve effectively as code and message center clerks in all armored units by instructions in types of codes and ciphers; encoding and decoding; enciphering and deciphering; and message center procedure.

Enlisted Radio Repairman Course - Opened 4 November 1940; current. Duration of each class - 14 weeks. Graduated 3,427 enlisted men. Trained enlisted men in the installation, adjustment, maintenance, and repair of all radio equipment used by armored units by means of instructions in electricity and magnetism; shop practice; radio theory; battery changing; testing procedure; radio maintenance and repairs; vehicular installations; emphasizing the practical application of each subject.

Enlisted Communications Course - Opened 4 November 1941; current. Duration of each class - 12 weeks. Trained enlisted men to operate effectively all radio equipment used by armored units by instructions and practice in code practice; voice and CW procedure; army organization; tactical messages; field codes and ciphers; operation and first echelon maintenance of radio sets used by armored units; and field operation. Graduated 12,732 enlisted men.

Enlisted Replacement Communications Course - Opened 12 June 1944; current. Duration of each class - 9 weeks. Graduated 655 enlisted men. Trained enlisted men to operate proficiently all radio and telephone equipment used by armored units by instructions in code practice; visual signaling; voice and CW radio procedure; organization of armored communications systems; tactical messages; cryptography; operation and first echelon maintenance of radio sets; field telephones and switchboards; wire ties and splicing.

Enlisted Amphibious Communications Course - Opened 4 June 1945; closed 23 June 1945. Duration of each class - 1 week. Graduated 15 enlisted men. Trained radio operators in the additional details of radio procedure afloat and salt water maintenance of radios in amphibious vehicles by instruction in amphibian radio nets; organization; maintenance; visual communication by arm and hand signals, blinkers, flag, pyrotechnics, and semaphore signalling; operation of navy radio sets TCS5 and TCS7; tropicalizing, waterproofing, and maintenance of equipment.

Enlisted Amphibious Radio Repairman Course - Opened 2 July 1945; current. Duration of each class - 1 week. Graduated 10 enlisted men. Trained radio repairman in the additional equipment issued to amphibious tank units. Instructions included radio procedure afloat; salt water maintenance; organization of amphibious units; care; operation, and repair of navy radio sets TCS5 and TCS7.

Gunnery Courses

Officers Basic Gunnery Course - Opened 14 February 1944; closed 20 January 1945. Duration of each class - 6 weeks. Graduated 281 officers. Specialized instruction in the technique of tank gunnery so as to qualify selected officers to conduct and supervise the gunnery training in tank units. Instruction given in range and speed estimation; ammunition; cleaning and maintenance of weapons; capabilities of tank and antitank guns; medium tank weapons; light tank weapons; mortars; antiaircraft machine guns; forward observation and night firing.

Officers Advanced Gunnery Course - Opened 14 February 1944; closed 30 December 1944. Duration of each class - 3 weeks. Graduated 361 officers. Specialized instruction to train selected officers of tank units in the technique of employing tanks as reinforcing artillery. Instruction covered signal communications; surveys; platoon firing (including laying of base angles, compass; measuring adjusted base angle, compass; use of elevation quadrants; aiming circle, azimuth indicator); conduct of fire; observed fires; fire direction, and service practice.

Teacher Training Course

Instructor Training Course - Opened 2 March 1942; closed 1 July 1944. Duration of each class - 2 weeks. To improve the teaching technique in the academic departments of The Armored School and to instruct officer candidates in the proper technique of teaching. Instruction in human relations; teaching techniques; evaluation techniques. Number of graduates not available.

Clerical Courses

Clerical Course - Opened 4 November 1940; closed 22 July 1944. Duration of each class - 8 weeks. Graduated 12,832 enlisted men. Trained selected enlisted men in army administration procedure to make them capable of performing the duties of personnel and supply clerks in company and higher headquarters. Instructions included a detailed and comprehensive study in military records and reports, typing (or shorthand), and military correspondence. Student participation was stressed.

Special Typing Course - Opened 3 August 1942; closed 5 November 1943. Duration of each class - 12 weeks. Provided additional typing practice and instructions in the preparation of military correspondence by clerical personnel in headquarters of department, troop, and agencies of the Armored School. Instructions included seven weeks of touch system typing and typing practice, one week of preparation of military correspondence, and four weeks of additional instruction and practice in typing. Number of graduates not available.

Enlisted Replacement Clerical Course - Opened 12 June 1944; current. Duration of each class - 9 weeks. Graduated 535 enlisted men. Trained selected enlisted replacements in army administration procedures to make them capable of performing the duties of personnel and supply clerks in company and higher headquarters. Instructions included military records and reports, typing, and military correspondence. Part of the student's time was devoted to a completion of his basic military training.

Miscellaneous Courses

Machinists Course - Opened 15 January 1943; closed 1 April 1944. Duration of each class - 7 weeks. Graduated 207 enlisted men. Trained selected enlisted men in the effective use of and operation of machine shop equipment issued to armored units; to familiarize them with the repairs and maintenance of armored equipment in the field. Instruction was in bench work, machine tools; brake reconditioning; lathe operation; practical work preceded by a conference demonstration.

Radio Controlled Airplane Target Course - Opened 28 February 1943; closed 25 September 1943. Duration of each class - 3 weeks. Graduated 33 officers and 162 enlisted men. Trained airplane target crews to maintain and operate the OQ2A, RCAT through instruction in characteristics of the target plane; nomenclature of the parts; ordering replacement parts; operation of the catapult; radio control equipment; care, maintenance, and functioning; engine check and maintenance; parachute packing; practical work in flying; maintenance and repair in actual field flying.

Odograph Course - Opened 22 November 1943; closed 27 July 1944. Duration of each class - 2 weeks. Graduated 59 officers and 108 enlisted men. Trained selected personnel in the maintenance and operation of the recording odograph through instruction in first and second echelon maintenance; compass theory and compensation; night navigation and deak reckoning; map making with odograph; special application to Field Artillery surveys.

Night Vision Instructors Course - Opened 10 May 1945; current. Duration of each class - 2 weeks. Graduated 72 officers and 48 enlisted men. Trained selected personnel for teams to be used in theaters of operations and in service schools for testing and selecting key personnel for night operations based on their ability to see at night; to instruct such personnel in night vision. Instruction given in construction, use, assembling, and maintenance of Army Night Vision Tester - 1; theory and principles of night vision; and practical field work.

Appendix B

Armored Divisions

1st Armored Division: (Old Ironsides)

Activated 15 July 1940, participated in maneuvers in Louisiana and the Carolinas in 1941. Returned to its home station at Fort Knox, Kentucky, and resumed training for overseas movement. Moved to European Theatre of Operations in April 1942. Was the first armored division to engage in combat in North Africa, participated in the Tunisian Campaign, and the operations in Italy. Inactivated at Camp Kilmer, N.J., 26 April 1946.

2nd Armored Division (Hell on Wheels)

Activated 15 July 1940 at Fort Benning, Georgia, from Infantry (Tank) units. Participated in Louisiana and Carolina maneuvers in 1941. Moved overseas 7 September 1942. Participated in North African, Tunisian, Sicilian Campaigns, and in operations in France, Holland, Belgium and Germany.

3rd Armored Division: (Spearhead)

Activated 15 April 1941 at Camp Polk, Louisiana. Participated in operations in the Desert Training Center. Transferred to European Theatre of Operations in September 1943. Participated in operations in France, Belgium, Luxembourg, and Germany. Inactivated in ETO 10 November 1945.

4th Armored Division: (Breakthrough)

Activated at Pine Camp, New York, 15 April 1941. Engaged in Desert Maneuvers in 1942. Moved to European Theatre of Operations in December 1943. Participated in operations in France, Belgium, Luxembourg, Germany and Czechoslovakia. Inactivated at Camp Kilmer, N.J., 26 April 1946.

5th Armored Division: (Victory)

Activated 1 October 1941 at Fort Knox, Kentucky. Participated in Desert Maneuvers in 1942. Moved to European Theatre of Operations in January 1944. Participated in operations in France, Belgium, Luxembourg, and Germany. Inactivated at Camp Miles Standish, Massachusetts, 11 October 1945.

6th Armored Division: (Super Sixth)

Activated at Fort Knox, Kentucky, 15 February 1942. Trained in the Desert Training Center in 1942. Moved to European Theater of Operations in January 1944. Engaged in operations in France, Belgium, Luxembourg and Germany. Inactivated in ETO, 18 September 1945.

7th Armored Division: (Lucky Seventh)

Activated at Camp Polk, Louisiana, 1 March 1942. Trained in Desert Training Center in 1943. Moved to European Theater of Operations in April 1944. Engaged in operations in France, Belgium, Holland, and Germany. Inactivated at Camp Patrick Henry, Virginia, 11 October 1945.

8th Armored Division: (Thundering Herd)

Activated at Fort Knox, Kentucky, 1 April 1943 as a cadre division. Relieved of this function by the 20th Armored Division on 15 March 1943. Moved to Camp Polk, Louisiana, and trained for combat. Moved to European Theater of Operations in October 1944. Engaged in operations in Germany and Czechoslovakia. Inactivated at Camp Kilmer, N.J., 11 November 1945.

9th Armored Division:

Activated 15 July 1942, at Fort Riley, Kansas. Trained in Desert Training Center in 1943. Moved to European Theater of Operations in August 1944. Participated in operations in Luxembourg, Belgium and Germany. Inactivated at Camp Miles Standish, Massachusetts, 13 October 1945.

10th Armored Division: (Tiger)

Activated 15 July 1942 at Fort Benning, Georgia. Engaged in maneuvers in Tennessee in 1943. Moved to European Theater of Operations in September 1944. Engaged in operations in Belgium, France, Luxembourg, and Germany. Inactivated at Camp Patrick Henry, Virginia, 18 October 1945.

11th Armored Division: (Thunderbolt)

Activated 15 August 1942 at Camp Polk, Louisiana. Moved to European Theater of Operations in September 1944. Participated in operations in Luxembourg, Belgium, Germany, and Austria. Inactivated in ETO, 31 August 1945.

12th Armored Division: (Hellcat)

Activated at Camp Campbell, Kentucky, 15 September 1942. Moved to European Theater of Operations in September 1944. Participated in operations in France, Belgium and Germany. Inactivated at Camp Kilmer, N.J., 3 December 1945.

13th Armored Division: (Black Cat)

Activated 15 November 1942 at Camp Beale, California. Moved to European Theater of Operations in January 1945. Engaged in operations in Germany and Austria. Inactivated at Camp Cooke, California, 15 November 1945.

14th Armored Division:

Activated 15 November 1942 at Camp Chaffee, Arkansas. Moved to European Theater of Operations in October 1944. Engaged in operations in France and Germany. Inactivated at Camp Patrick Henry, Virginia, 23 September 1945.

16th Armored Division:

Activated at Camp Chaffee, Arkansas, 15 July 1943. The last armored division to be activated. Moved to European Theater of Operations in February 1945. Engaged in operations in Germany and Czechoslovakia. Inactivated at Camp Miles Standish, Mass., 16 October 1945.

20th Armored Division:

Activated 15 March 1943 at Camp Campbell, Kentucky as a cadre division. Relieved of its cadre duties 1 September 1943 and trained for combat. Moved to European Theater of Operations 6 February 1945. Engaged in operations in Germany and Austria. Inactivated at Camp Hood, Texas, 2 April 1946.

Appendix C

Armored Corps

I Armored Corps:

Activated 15 July 1940, at Fort Knox, Kentucky. Inactivated 7 September 1942, personnel used to organize headquarters for Task Force "A." Reactivated 9 January 1943 in North Africa, and inactivated again a short time later. Its personnel was used in the activation of the Headquarters of the Seventh Army which was organized for the Sicilian Campaign.

II Armored Corps:

Activated 17 January 1942 at Camp Polk, Louisiana. Participated in Maneuvers in the Desert Training Center area, in 1942. Was inactivated and redesignated as the XVIII Corps in October of 1943.

III Armored Corps:

Activated at Camp Polk, Louisiana, 20 August 1942. Inactivated and redesignated as the XIX Corps in October of 1943.

IV Armored Corps:

Activated 5 September 1942, at Camp Young, Indio, California. Relieved from Desert Training Center 29 March 1943. Inactivated and redesignated as XX Corps in October of 1943.