CHAPTER 4

DOCTRINE AND DEVELOPMENT, 1943--1944

The results of combat actions in North Africa were quickly felt in the United States. Written doctrine had to be revised to incorporate combat experiences. One product of those experiences, towed guns, forced the Tank Destroyer Command to change its organizations to accept the new weapon. Adoption of towed guns also affected development since AGF wanted to increase the effectiveness of this type of weapon.

Developing better weapons continued to demand a great deal of attention from the Tank Destroyer Center. The Center persevered in supporting the T-70 and finally put that vehicle into production. Spurred by the appearance of heavy German tanks such as the Tiger and Ferdinand, the Army worked to get a heavier antitank weapon, the 90-mm gun, to the battlefield. Technical problems slowed and complicated development efforts. Not surprisingly, rewriting doctrine proved simpler than developing equipment.

The lessons of combat quickly created pressure to revise the doctrine of tank destroyers. Significantly, the lessons from the front were those perceived by men outside the Tank Destroyer Center. The officers at Fort Hood believed that tank destroyers had suffered from misuse and expedient equipment, not bad doctrine. However, the Center began revisions to modify their doctrine during the summer of 1943. As the Center's history indicates, "The

revision of FM 18-5 was undertaken to bring tank destroyer doctrine into conformity with the lessons of combat in Africa as interpreted by higher headquarters."[1]

Apparently, the aggressive tactics of early doctrine for tank destroyers had irritated some important people. Emphasis on aggressiveness and offensive action in FM 18-5 was missing from its revision. The bold, colorful language of the field manual's 1942 edition was subdued and conservative by 1944. For example, the sentence, "Action of tank destroyer units is characterized by rapid movements, sudden changes in the situation, and a succession of brief but extremely violent combats separated by sporadic lulls," dissappeared in the later edition.[2] In contrast, the 1944 version blandly comments that, "Action of tank destroyers is characterized by an aggressive spirit."[3] Further, the tactics of fire and movement emphasized by the 1942 manual nearly disappears in the later text.[4] While the 1944 edition was generally more subdued than its predecessor, some changes were more specific.

The constant attachment of tank destroyer battalions in North Africa to divisions or smaller units was reflected in the new manual. While the 1942 version only allotted 5 pages to the topic of supporting divisions, the 1944 edition devoted 21 pages to the subject, with diagrams. More significantly, the tank destroyers assumed the role of protecting friendly infantry by repelling the enemy's initial attack rather than his breakthrough, something which had been avoided in 1942.[5] While the Tank Destroyer Center was willing to help units cope with the realities of tank destroyer

employment, the officers at Fort Hood were forced to make other changes to their doctrine.

Tank destroyers in North Africa were often accused of chasing or hunting tanks. This was a false criticism as far as General Bruce of the Tank Destroyer Center was concerned. He complained:

> I believe that many reports from higher headquarters about tank destroyers chasing tanks are based on the fact that one platoon of three guns did attempt to chase tanks, the lieutenant commanding admitting his error.[6]

Despite General Bruce's beliefs, the new field manual emphasized that, "Tank destroyers ambush hostile tanks, but do not charge nor chase them."[7] The most drastic changes in doctrine resulted from the modification to include towed weapons, which were never in favor at Fort Hood. Reflecting the new weapons, FM 18-5 discussed appropriate doctrine for towed battalions.

In general, the employment of towed units was the same as that for self-propelled. The basic concept of mobile guns employed in mass remained the same. When towed battalions were addressed specifically, it was usually to mention their limitations. For example, while self-propelled companies could withdraw under fire, FM 18-5 cautioned that "Daylight withdrawals of towed units are likely to result in heavy casualties . . . ."[8] Towed guns were deemed superior for advanced positions.[9] This was probably due to the fact that a towed gun, dug-in, was less likely to be observed than a self-propelled weapon. Doctrine for towed units was based on experience with such units at Fort Hood.

The failure of the Cletrac had breathed new life into the

towed 3-inch gun. On 22 August 1942, AGF directed the Tank Destroyer Center to restudy the matter of towed mounts. Towed guns, noted AGF, could be unloaded at places where docking facilities were too limited to handle the 30-ton M-10. AGF pointed out that it contemplated organizing a number of towed battalions and therefore directed the Center to develop a tentative plan for a towed battalion.[10]

After studying the matter, General Bruce remained opposed to towed battalions. He believed that a towed battalion would require 300 more men than a self-propelled unit. He pointed out that a prime mover and gun required more shipping space than a self-propelled weapon. Instead of the towed gun, Bruce recommended adapting the M-3 so that its 75-mm gun could be shipped separately from the half-track. The half-track and gun could then be reassembled and employed until facilities were available to land heavier tank destroyers.[11] However, events from the field overruled Bruce.

In the light of comments from North Africa, on 1 January 1943 AGF directed the Center to test a towed tank destroyer battalion. Personnel of the 801st TD Battalion conducted extensive field tests during January and February, which resulted in a tentative organization on 12 March.[12]

Maintaining momentum, AGF ordered 15 self-propelled battalions converted to towed units on 31 March as a tentative measure for training. On 7 May, the War Department issued a table of organization for the towed battalion and officially authorized the new unit.[13]

The organization of the towed battalion was essentially the same as for the self-propelled unit. Elimination of one reconnaissance platoon and the inclusion of the remainder of those platoons in the headquarters company were the main adjustments. In addition, both the gun crews and the security sections were enlarged.[15]

While the creation of a towed battalion was probably the most significant organizational change for tank destroyers, the measure had been preceded by other changes. As a result of the AGF decision during July 1942 to convert all TD units to 3-inch guns, the Center submitted a table of organization on 9 November 1942 that substituted another heavy gun platoon for the light gun platoon in each company. The only battalions that employed the light platoons in combat were the first two units in North Africa.

On 12 November 1942, AGF directed the Center, along with all other commands subordinate to AGF, to reduce all organizations by 15 percent in personnel and 20 percent in motor transportation. The biggest cuts were made against administration and supply elements. Some tactical vehicles were eliminated, including the antiaircraft section of each platoon. The War Department published the new tables on 27 January 1943.[16]

While the adjustments to tables of organization forces by General McNair's "cutting board" proved to be digestible, the towed units remained a matter of controversy. A year after the War Department authorized the units, some officers still condemned the towed guns as "worthless," but the Tank Destroyer Board noted

that preferences for self-propelled over towed guns stood at about eight to five, about the ratio of units furnished to the theaters by the summer of 1944, justifying both types of organization.[17]

General McNair had resisted pressure to have all tank destroyer units converted to towed guns. He believed that the combat experiences of North Africa had not been conclusive concerning the matter. Unless further experience justified a change, General McNair remained convinced that both towed and self-propelled weapons should be supplied.[18] After General McNair personally coordinated the matter with the War Department, the latter directed in November 1943 that half the battalions should be self-propelled and half towed.[19] By that time, the process of converting self-propelled battalions in the United States to towed guns was well under way. An important part of that effort was devoted to the gun itself.

Faced with the reality of towed battalions, the Tank Destroyer Center began serious efforts to develop the 3-inch gun. The 3-inch gun had been standardized as the M-1 in December 1941, prior to the completion of service tests.[20] Despite standardization, service tests discovered many defects in the 3-inch gun. Although opposition to towed weapons from the Tank Destroyer Command had been the principal reason that the 3-inch gun was cancelled in the summer of 1942, SOS noted several deficiencies in the weapon and concluded that, "In general, [the] carriage is not properly designed to accommodate the gun."[21] However, the failure of the Cletrac convinced AGF to ask for production of 500 3-inch guns on

23 August 1942.[22] Lack of participation of the Tank Destroyer Center in the development of the 3-inch gun up to that time is evident from the fact that no example of the gun was shipped to Fort Hood until 25 August 1942.[23]

The deficiencies of the M-1, 3-inch gun proved to be amenable to modifications. A new traversing mechanism cured one of the main problems of the prototype gun.[24] Other problems of the M-1, primarily a poor sight and excessive hop, were eliminated with field modifications that could be applied to completed guns, and the resulting weapon was standardized as the M-1A1.[25]

Development work continued at Fort Hood through 1943. The Tank Destroyer Board went beyond correcting technical deficiencies and began adapting the gun to make it more suitable for tank destroyer tactics. Resulting from the work at Fort Hood, the M-6 was standardized in November 1943.[26] The most visible change was a large, sloping gunshield on the M-6. In addition, 10 other significant modifications were developed by the Tank Destroyer Board including firing segments and a trail castor.[27] By February 1944, AGF was impressed enough to comment that, " . . . the redesign of the 3" Gun Carriage M-1 into the 3" Gun Carriage M-6 has resulted in an excellent towed tank destroyer weapon."[28]

One thousand M-1 guns had been manufactured before the M-6 was completed. AGF asked that all M-1's be converted to M-6's. In addition, AGF requested 500 more M-6's. The M-1's had to be modified at the factory, but ultimately all units going overseas were equipped with the M-6.[29] While the development and production of

the M-6 continued during 1943, ordnance engineers labored to put a heavier antitank gun into the field, the 90-mm.

Like the 3-inch gun, the 90-mm antiaircraft gun's ballistic characteristics made it a natural candidate as an antitank weapon. The higher velocity and heavier projectile that made the 90-mm gun a better antiaircraft weapon than the 3-inch gun also made it better for penetrating armor. However, the 90-mm gun was only beginning to reach antiaircraft units when America entered the war. Had the 90-mm gun been readily available, the 3-inch gun might never have been adapted for antitank use. In any case, there was early interest in the 90-mm gun as an antitank weapon.

Ordnance officers initiated the development of the 90-mm antiaircraft gun mounted on the M-4 tank chassis on 2 February 1942. Formally recognizing the project on 1 July 1942, the Ordnance Technical Committee recommended development of the vehicle designated the T-53, noting that "Reports from various sources have indicated the effectiveness of the German 88-mm aircraft (sic) gun when used as an anti-tank weapon." Intended to use a maximum of components already in production, the T-53 appeared to offer a way to get a self-propelled, 90-mm gun into production very quickly.[30]

For its part, AGF directed the Antiaircraft Command on 25 July 1942 to study the problem of firing the 90-mm gun against ground targets. Finding that an average crew needed 5 to 10 minutes to emplace the gun with its single axle mount, the Antiaircraft Board concluded that the 90-mm gun was "undesirable" for use against

mechanized targets, but the T-2 gun mount then under development showed promise of delivering shorter emplacement times.[31]

Therefore, the T-53 appeared to be the only means available to use the 90-mm gun in an antitank role. Similar to the T-24 carriage for the 3-inch gun, the T-53 was an M-4 tank chassis with a shielded, 90-mm gun perched on top. Its high silhouette certainly limited its tactical usefulness. At a conference on 24 August 1942, representatives of AGF, SOS, and the Ordnance Department agreed to produce 500 of the vehicles despite the problems.[32]

General McNair had already pointed out the superiority of the 90-mm over the 3-inch gun. He wrote to General Bruce in July that, " . . . there is a material advantage in the 90-mm so far as penetration is concerned. The trajectory seems a little flatter than that of the 3"."[33] General Bruce quickly complained about production of the T-53 before tests at Fort Hood, commenting that, " . . . the vehicle is an expedient and entirely lacks many of the major military characteristics considered essential by the TDC, in fact is a step backward rather than forward." AGF retorted that, "It is the opinion of this Headquarters that the Tank Destroyer Board will find this gun mount an adequate anti-tank weapon."[34]

Despite assurances from AGF, the Tank Destroyer Board was quick to condemn the T-53 after they received an example for tests. Following those tests in the fall of 1942, AGF agreed to cancel production of the T-53 although they believed that development of a self-propelled mount for the 90-mm gun should continue. However, the T-53 lingered until tests by the Antiaircraft Board convinced

that organization that they had no use for the weapon, either. The project was not terminated until 12 April 1944, and by that time a much more promising development was well advanced.[35]

While the T-53 used the standard antiaircraft gun, it was obvious that adapting the gun to fit the turrets of tanks or tank destroyers would be more advantageous. Therefore, on 21 September 1942, Barnes directed his engineers to begin drawings of such an adaptation.[36] The Ordnance Committee approved the project on 1 October.[37]

Ordnance engineers accomplished the task of making the 90-mm gun suitable for vehicles by adapting the gun to fit the recoil system of the vehicle-mounted, 3-inch gun. The process required several modifications including a new breech ring and machining down the outer surface of the tube.[38] Quickly accomplishing the necessary work, ordnance engineers mounted the gun in an M-10 tank destroyer and fired it by the end of December 1942.[39] Taking the next, obvious step, General Barnes recommended that the modified M-10 continue development as the T-71.[40]

Objections to the T-71 appeared quickly. Apparently, General Bruce viewed the vehicle as just another expedient; an expedient made worse by the fact that he already disliked the M-10. However, AGF had already shown an interest in the development of the 90-mm gun for antitank purposes. Compromising, AGF agreed to the T-71 with the understanding that it was a development project intended only to secure information about the practicability of mounting the 90-mm gun on the M-10. Objections from Fort Hood

were obvious from the statement that:

> The gun is not desired by the Tank Destroyers as a tank destroyer weapon since it is believed that the 3-inch gun has sufficient power. It is further felt that the Gun Motor Carriage, M-10, is too heavy and too slow.[41]

Despite the early success of the T-71, the project quickly met delays. Tests of the original mount which were ended in January 1943 proved that the vehicle was unsatisfactory, principally because of the basic faults of the M-10. The unbalanced turret of the M-10 became excessively so with the 90-mm gun, and the heavier gun made the lack of power traverse unacceptable. Therefore, ordnance engineers had to institute a complete development program for a new turret.[42]

By May 1943, a wooden mockup of the new turret was completed in Detroit.[43] Enthusiastically, Colonel Joseph M. Colby, head of research and development at the Tank-Automotive Command, recommended in August that the T-71 be standardized even though metal prototypes were still incomplete.[44] The prototype of the T-71 finally arrived at Aberdeen, Maryland, in mid-September.[45]

Armed with a prototype, Major General T. J. Hayes, acting Chief of Ordnance, requested production of 500 T-71's. However, Hayes lumped the request for T-71's with requests for production of a large number of experimental tanks which were the subject of heated controversy. Army Service Forces (ASF) reacted by refusing the whole request.[46]

Apparently unhappy about the refusal to produce T-71's, General Barnes tried to cultivate acceptance of the vehicle. General Barnes contacted members of the Armored Command trying to

sell the T-71 and exhibited the vehicle to General Moore of AGF.[47] Favorable response from those parties encouraged Barnes to request production of from 500 to 1,000 T-71's on 4 October 1943.[48]

Brigadier General W. F. Dean of the Requirements Section at AGF thought that "General Barnes' recommendation is considered to have considerable merit . . . ." Besides a superior fighting compartment and power traverse, General Dean mentioned that the T-71 weighed 3,900 pounds less than the M-10 since the new vehicle's turret eliminated the need for counterweights. In addition, he pointed out the superior ability of the 90-mm to destroy German tanks or pillboxes.[49]

The superiority of the 90-mm gun was not the main reason that Dean recommended producing 1,000 T-71's. The measure would also use excess M-10 chassis and allow cutbacks in the production of M-10's. The G3, Brigadier General John M. Lentz, agreed heartily, commenting that "We have more M-10's than we know what to do with . . . ."[50]

In the fall of 1943, AGF found itself with far more tank destroyer weapons than it could possibly use. This was primarily due to a sharp reduction in the number of projected tank destroyer battalions. While General McNair had wanted over 200 tank destroyer battalions in 1942, the War Department had only authorized 144. Since there was no great demand for tank destroyers from the theaters, McNair recommended in April 1943 that the program be reduced to 106 battalions. By October 1943 the War Department planned to cut the number to 64. After McNair objected, the War

Department settled on 78 battalions.[51] Meanwhile, production of M-10's had continued during 1943 because there was no alternative weapon. In any event, AGF found itself in October 1943 with existing or projected production of 11,547 self-propelled tank destroyers, sufficient to equip over 200 battalions, versus a requirement for only 2,862.[52]

Based on the fact that "We are over-producing on TD's," General Lentz would not recommend producing 1,000 T-71's. General Lentz believed that:

> The mobility of the T-70 precludes going to the T-71 unless the added power of the 90-mm gun is essential. It is not at this time. Conditions might change. A few heavily armed units might find employment against fixed defenses.

Despite his misgivings, General Lentz concluded that, " . . . possible future developments of German armor, and the possible need for power against fortification, . . . warrant construction of a moderate number (300) of T-71's."[53] General McNair agreed but felt that they would not be amiss to raise the number to 500, enough for 10 battalions and a reserve, while ceasing production of M-10's.[54] Therefore, on 25 October AGF requested ASF to produce 500 T-71's and terminate the production of M-10's.[55]

Despite the rapid approval of production for the T-71, the vehicle would not see action for nearly a year. Tests at Fort Knox revealed serious problems with the T-71 that necessitated time-consuming modifications.[56] However, the Tank Destroyer Board recommended that the T-71 "be considered suitable for use as a tank destroyer" after modifications.[57] Production of T-71's did not begin until April.[58] In June, the T-71 was standardized as the

M-36.[59] The M-36 was not the only project intended to provide a 90-mm gun for tank destroyers.

In the fall of 1942, General Barnes requested his engineers to initiate a design study of a towed antitank carriage for the 90-mm gun.[61] Development of the weapon proceeded very slowly. The idea was not presented to the Ordnance Committee until 22 March 1943, when only a sketch of the proposed gun was available.[61] Formal approval of the project came on 29 April 1943.[62] The infancy of the project was emphasized by the AGF's comment to the Tank Destroyer Command that " . . . the studies are only in the first stages of development . . . ."[63]

The lack of progress is somewhat surprising, since the Ordnance Department was not proposing a major development program. Ordnance sketches envisaged modifying the carriage and recoil system of the M-2, 105-mm howitzer, to mount the 90-mm gun. Protection for the carriage would be provided by adapting the gunshield of the M-6, 3-inch gun.[64] This apparently straightforward adaptation proved to be very difficult for ordnance engineers.

Immediately following the Ordnance Committee's approval of the project, the Ordnance Department contracted with the Link-Belt Company to design the gun.[65] By November, the manufacturer was complaining that completion of the design was delayed because a subcontracter had failed to deliver gunshield designs.[66] The Ordnance Department caused more delay by ordering numerous design changes, including completely new trails.[67] Despite delays, Link-Belt managed to deliver a complete gun to Aberdeen, Maryland, in

January 1944.[68]

Apparently pleased with their progress, the Link-Belt Company reported in January that they could begin production during June. Tests at the proving ground quickly dampened their optimism.

Tests by the Ordnance Department revealed some serious defects. The resulting changes, including new trails and a change in the position of the axle, caused a redesign and a change in designation to T-5E1.[69] By May, Link-Belt had delivered another gun to Aberdeen.[70] Discovery of 38 defects, primarily unsatisfactory recoil characteristics, caused further redesign.[71]

Meanwhile, pressure was building to get the gun into production. General McNair witnessed a demonstration of the T-5E1 on 2 May and was apparently impressed.[72] General McNair's visit was followed shortly by a request for completion of the design and production of 600 guns " . . . at the earliest possible date."[73]

AGF had been interested in the 90-mm antitank gun for some time. During October 1943, General Moore called General Barnes about a 90-mm towed mount and was assured that " . . . we are pushing it."[74] On 2 November 1943, AGF had submitted their own military characteristics for a towed 90-mm gun.[75] Responding, the Ordnance Department extended the T-5 program to include the desires of AGF.[76] AGF's request included the addition of a "blast deflector (muzzle brake)."[77] This item had not been a component of the T-5 and was to cause some controversy.

The Ordnance Department did not ignore the desires of AGF.

During June, they instituted a design program to adapt the T-5 for a muzzle brake.[78] The dispute arose after General McNair witnessed a firing test that compared the gun with and without a muzzle brake. Ordnance officers apparently believed (erroneously) that General McNair dropped the requirement for a muzzle brake after this test. In their clarification of the requirement on 14 July 1944, the AGF comment that "The Ord/Dept alleges . . . the requirement . . . was withdrawn . . ." indicated the acrimonious nature of the dispute.[79] In defense of the Ordnance Department, the addition of a muzzle brake to the end of the 90-mm gun tube, in effect a long, moment arm, drastically changed the balance of the weapon and thus the characteristics of the carriage. Amid the controversy over muzzle brakes, the checkered career of the T-5 continued.

Hopes of AGF for early production of the T-5 were soon dashed. During July, tests of the latest version of the gun, without a muzzle brake, revealed serious problems with the carriage. Of some 30 problems, the most serious were a broken axle and cracks in the trails. As a result, representatives of AGF, ASF, and the Ordnance Department held a meeting to discuss the future of the T-5. AGF elected to reduce their immediate requirement to 200 guns while holding production of the remaining 400 guns in abeyance until a decision could be reached on exactly what type of gun should be produced.[80] Ordnance officers elected to design a completely new carriage to meet AGF requirements.[81]

The problems experienced with the T-5 during July 1944 are a good example of the hidden, technological pitfalls that plague the

development of virtually any weapon. An error in design computation caused the broken axle, but the cracks in the trails were due to poor steel. Hurrying to complete the prototypes, the Link-Belt Company used metal from the Inland Steel Company instead of their preferred supplier, Carnegie Steel. It seemed that Inland steel had a lower impact value (more brittle) than Carnegie steel. The result was cracked trails.[82] Appearance of such problems some 6 months after completion of the first prototype accentuates the technological difficulties of developing weapons.

The ultimate result of the T-5's technical problems was a long delay in production. Instead of the Link-Belt Company's optimistic prediction of production in July 1944, production of the final version of the gun, the T-5E2, did not begin until December 1944.[83] While the Ordnance Department struggled with the problem of mounting the 90-mm gun on two wheels, the weapon designed by the Tank Destroyer Center, the T-70, progressed rapidly.

Shortly following the Palmer Board, the Ordnance Committee approved the development of the T-70 on 4 January 1943 and approved the production of six pilot models.[84] Orders for production quickly increased. Uncharacteristically, AGF requested production of 1,000 T-70's only 2 days later.[85] AGF rarely requested production of any major item of equipment before a prototype existed and preferred to wait until service tests were completed. Justifying its action, AGF commented that:

> It is recognized that all of the modifications have not as yet been tested, however, the lack of a satisfactory tank destroyer gun motor carriage makes imperative the expediting of the production of the Gun Motor Carriage, T-70.[86]

Apparently, AGF was trying to support General Bruce who continually complained about expedients and the lack of a suitable tank destroyer. However, some disharmony over the T-70 marred the relationship between AGF and the Tank Destroyer Center.

Trying to build the best vehicle possible, the Tank Destroyer Center wanted to continue improving the design as studies progressed. On the other hand, AGF believed that the design should be frozen as quickly as possible in order to start production. As General Moore commented in reaction to some changes proposed by the Tank Destroyer Center, "I think Bruce should be given emphatic instructions to finalize the design of this vehicle at once." General McNair settled the problem during a telephone conversation with General Bruce. General Bruce assured General McNair that the proposed changes were only inquiries and any recommendations for modification would be coordinated with the latter's headquarters.[87] It was not surprising that a vehicle placed into production so hastily would require many changes.

When the first pilot models reached Fort Hood, there were serious problems. Most important, the T-70 could not negotiate a 60-percent slope because the engine was underpowered and the torquomatic transmission slipped excessively. Installing a more powerful engine and modifying the transmission allowed the T-70 to meet minimum requirements.[88]

Despite problems, the T-70, enthusiastically named Hellcat by the Tank Destroyer Center, went into production during the fall of 1943. Service tests of the production vehicles revealed a host

of new problems. Among the most serious faults, the starter was undependable, and there were various weak points in the suspension. As the defects were revealed, the manufacturer applied modifications to vehicles still on the production lines.[89] As production continued while more and more modifications became necessary the earliest vehicles grew increasingly obsolete. By early 1944, the situation was chaotic. There were over 1,000 T-70's in existence in varying states of modification.

To settle the matter, the Ordnance Department hosted a meeting on 5 February 1944 with representatives of the Ordnance Department, AGF, and the General Staff present. The men agreed that vehicles below serial number 658 would be returned to the factory for modification, and the remainder would be modified in the field.[90] On 17 February 1944, the T-70 was standardized as the M-18. When the M-18 was standardized, 1,200 had been produced; and a total of 1,097 of them required modification to meet the characteristics of the standard vehicle.[91]

The M-18's that were available did not go immediately into action. The War Department offered 40 M-18's to the European Theater of Operations (ETO). They were refused, because the theater did not want to reequip units at that time. The North African Theater of Operations (NATO) accepted 40 for shipment in March. However, most of the M-18's went to 14 tank destroyer battalions training in the United States.[92] Thus, they would reach the front as the new battalions were deployed.

Despite the problems involved in arriving at a satisfactory

design for the M-18, the development program of the Hellcat was phenomenally good. In just over 2 years, the M-18 sped from conception to standardization. That record is better than any other armored fighting vehicle produced by the United States and is probably better than any produced by any other country. Rated at 50 miles per hour, the M-18 was the fastest tracked combat vehicle in any army, and it pioneered such important features as torsion bars and the torquomatic transmission. However, Bruce's worries about tank destroyer doctrine being discredited before the proper weapon became available proved to have some foundation.

The results of tank destroyers in the early days of the war, inhibited by expedient equipment and misemployment, resulted in changes to tank destroyer doctrine, organizations, and equipment. The changes were unwanted by the Tank Destroyer Center. Doctrine became less aggressive and had to cope with the desires of field commanders to disperse tank destroyers among small units and protect infantry. Towed guns, an anathema to Bruce, became standard equipment, but the Tank Destroyer Center improved the weapon for their use after the decision was final, resulting in the M-6, 3-inch gun. Pressure for heavier weapons, believed unnecessary at Fort Hood, resulted in the retention of the hated M-10 in a 90-mm gun version, the M-36. Attempts to obtain a heavier towed gun involved the Ordnance Department, AGF, and the Tank Destroyer Center in the development of a weapon, the T-5 90-mm gun, which exhibited all the tribulations of technological development.

After all the difficulties of doctrinal change and tech-

nological development during 1943 and early 1944, tank destroyers were finally receiving the weapon they desired to implement their doctrine. Along with the rest of the US Army in Europe, tank destroyers were about to meet their major test, the German Army in France.

ENDNOTES

[1]Study No. 29, p. 35.

[2]FM 18-5, 42, p. 8, and War Department, FM 18-5, Tactical Employment: Tank Destroyer Unit, 18 July 1944, hereafter referred to as FM 18-5, 44.

[3]FM 18-5, 44, p. 5.

[4]In FM 18-5, 42, p. 20, paragraph and several later references are devoted to fire and movement while FM 18-5, 44, p. 59 uses the term only once.

[5]FM 18-5, 42, pp. 107-112 and FM 18-5, 44, pp. 72-93.

[6]Letter from Bruce to McNair, dtd. 5 June 1943, Bruce.

[7]FM 18-5, 44, pp. 5, 76-79.

[8]Ibid., p. 57.

[9]Ibid., p. 6.

[10]Letter from HQ, AGF to CG, Tank Destroyer Center, dtd. 22 August 1942; quoted in "Heavy Antitank Carriages," April 1944, OHF.

[11]Letter from Bruce to CG, AGF, dtd. 9 October 1942, AGF (472.1).

[12]Study No. 29, p. 30.

[13]Ibid.

[14]TDC Hist. I, Chap. I, p. 30.

[15]Ibid.

[16]Ibid.

[17]TDC Hist. III, Chap. II, p. 4.

[18]Letter from McNair to Bruce, dtd. 11 June 1943, Bruce.

[19]Greenfield, Organization, p. 427.

[20]OCM, item 17545 dtd. 7 November 1941 with indorsement from the War Dept. dtd. 10 December 1941, in "History of the 3-inch Gun Carriage M1, M1A1 and M6," OHF. This history can best be described as an office journal titled a chronology and a collection of pertinent documents such as the OCM item mentioned above. Hereafter, the document collection will be referred to as 3-inch Hist. The chronology will be referred to as 3-inch Chron. followed by the date of the entry in the chronology, e.g. 3-inch Chron., 1 January 1943.

[21]Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 3-inch Hist.

[22]Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-inch Hist.

[23]3-inch Chron., 25 August 1942.

[24]3-inch Chron., 27 August 1942.

[25]OCM item 22132, dtd. 18 November 1943, appended to "Heavy Antitank Carriages," April 1944, OHF.

[26]Ibid.

[27]Study No. 29, pp. 65-67.

[28]3-inch Chron., 1 February 1944.

[29]"Heavy Antitank Carriages," op. cit., pp. 3-4.

[30]OCM, item 18495, dtd. 1 July 1942.

[31]Letter from AGF to CG, Antiaircraft Cmd., dtd. 25 July 1942 and 2d indorsement from Antiaircraft Bd. to CG, Antiaircraft Cmd., dtd. 19 August 1942, AGF (472).

[32]OCM, item 18726, dtd. 26 August 1942.

[33]Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

[34]Letter from HQ, AGF to CG, TDC, dtd. 11 September 1942, AGF (472). The "Memo for record" portion of this letter quoting a letter from Bruce dtd. 1 September 1942 is the source of Bruce's comment.

[35]OCM, item 23745, dtd. 12 April 1944.

[36]"Chronology," History of the 90-mm Gun Motor Carriage, T-71 (M-36) entry for 21 September 1942, hereafter cited as M-36 Hist. This document is similar to the 3-inch Hist. and will be cited the same way.

[37]OCM, item 21210, dtd. 10 July 1943.

[38]Ibid.

[39]M-36 Chron., 10 December 1942 and 28 December 1942.

[40]OCM, item 19845, dtd. 13 January 1943.

[41]Ibid. Memo from HQ, AGF to the Ordnance Committee, dtd. 9 February 1943, is an appendix to this OCM item.

[42]OCM, item 22129, dtd. 8 November 1943.

[43]M-36 Chron., 10 May 1943.

[44]M-36 Chron., 10 August 1943 and 23 August 1943.

[45]M-36 Chron., 13 September 1943.

[46]Letter from CG, Armd. Cmd. to AGF, dtd. 1 September 1943, AGF (470.8); 3d Ind., letter from Hayes to HQ, ASF, dtd. 13 September 1943, M-36 Hist.; and memo from HQ, ASF to Chief of Ordnance, dtd. 16 September 1943, M-36 Hist.

[47]M-36 Chron. 21 September 1943, 22 September 1943, and 24 September 1943.

[48]Letter from Barnes to CG, ASF, dtd. 4 October 1943, M-36 Hist.

[49]Memo from Reqts. 1 to G-3, CG, dtd. 9 October 1943, AGF (470.8).

[50]Ibid. and Memo from G-3 to CG, dtd. 15 October 1943, AGF (470.8).

[51]Greenfield, Organization, pp. 427-428.

[52]Memo from Armd. Branch, G-3 Section to G-3, dtd. 12 October 1943, AGF (470.8).

[53]Memo from G-3 to CG, dtd. 15 October 1943, op. cit.

[54]Memo from CG to C of S, dtd. 22 October 1943, AGF (470.8).

[55]Letter from HQ, AGF to CG, ASF (2d Ind. to Barnes' letter of 4 October), dtd. 25 October 1943, AGF (470.8).

[56]M-36 Chron., 6 January 1944 and 17 January 1944.

[57]M-36 Chron., 19 February 1944.

[58] M-36 Chron., 10 April 1944.

[59] OCM, item 24985, dtd. 29 August 1944.

[60] "History of the 90-mm Gun (AT), T5E2," OHF, entry for 15 September 1942, hereafter cited as T-5 Hist. This document is similar to the 3-inch Hist. and will be cited the same way.

[61] OCM, item 20126, dtd. 22 March 1943.

[62] T-5 Chron., 29 April 1943.

[63] Letter from HQ, AGF to CG, TDC, dtd. 18 April 1943, AGF (472).

[64] Ibid.

[65] Ibid.

[66] Letter from Link-Belt Co. to Mr. G. W. Sullivan, Ord. Dept., dtd 4 November 1943, T-5 Hist.

[67] Letter from Maj. S. F. Musselman to Chicago Ord. Off., dtd. 5 January 1944, T-5 Hist.

[68] T-5 Chron., 18 January 1944.

[69] T-5 Chron., 19 February 1944.

[70] T-5 Chron., 4 April 1944.

[71] T-5 Chron., 17 May 1944 and letter from Ord. Research Center to ASF, Ord. Off., dtd. 10 May 1944, T-5 Hist.

[72] Letter from Ord. Research Center to ASF, Ord. Off., dtd. 8 May 1944, T-5 Hist.

[73] Letter from HQ, AGF to CG, ASF, dtd. 15 May 1944, T-5 Hist.

[74] "Activities of Maj. Gen. G. M. Barnes," OHF, 1 October 1943. This is a daily record signed by Barnes. Although the official histories refer to this as the Barnes Diary it is really not a diary since it contains no personal information.

[75] Letter from HQ, AGF to CG, ASF, dtd. 2 November 1943, AGF (473.1).

[76] Letter from Off. of Chief of Ord. to CG, ASF, 2d Ind. to letter above, dtd. 8 February 1944, AGF (473.1).

[77] Letter from HQ, AGF to CG, ASF, op. cit.

[78] T-5 Chron., 2 June 1944.

[79] "Memo for record," appended to letter from HQ, AGF to CG, ASF, dtd. 14 July 1944, AGF (473).

[80] Letter from HQ, AGF to CG, ASF, dtd. 2 August 1944, AGF (473) with inclosure "Deficiencies, 90-mm Gun Carriage T-5E1 as developed during tests at Aberdeen Proving Ground, 20 July 1944."

[81] Letter from Ord. Off. to CG, ASF, dtd. 2 August 1944, AGF (473), 2d Ind. to letter above.

[82] Record of telephone call from Mr. Martin, Link-Belt Co. to Gen. Wells, Ord. Dept., dtd. 25 July 1944, T-5 Hist.

[83] T-5 Chron., 31 October 1944.

[84] OCM, Item 19438, dtd. 4 January 1944.

[85] Letter from HQ, AGF to CG, SOS, dtd. 6 January 1943, AGF (473).

[86] Ibid.

[87] Letter from Brig. Gen. J. Christmas, Tank-Auto. Center to CG, SOS, dtd. 15 February 1943 accompanied by AGF memo slip with entries RWT to CG, dtd. 22 February 1943 and CG to RWT, dtd. 23 February 1943, AGF (473). Parenthetically, an interesting point in Christmas' letter points out the willingness of manufacturers to engage in a little war-profiteering. The transmission manufacturer (unnamed by Christmas) demanded 176 machine tools, extremely critical items, but settled for 9 after being informed that an alternate manufacturer existed.

[88] Maj. D. L. McCaskey, "The Role of Army Ground Forces in the Development of Equipment," Study No. 34. Historical Section, AGF, 1946, p. 65, and TDC Hist. II, Chap. II, p. 3.

[89] Ibid. and letter from Tank-Auto. Center to Chief of Ord., dtd. 7 December 1943, AGF (473).

[90] Letter from Chief of Ord. to CG, ASF, dtd. 15 February 1944, AGF (473).

[91] Letter from Maj. Gen. S. C. Henry, New Developments Division, to Deputy Chief of Staff, U.S. Army, dtd. 23 February 1944, Records of the Chief of Staff, RG 165, file no. 470.8, National Archives, hereafter referred to as C/S.

[92] Ibid.

CHAPTER 5

COMBAT IN NORTHWEST EUROPE

The experiences of the American Army in Europe would ultimately cause the abandonment of the tank destroyers. After an attempt to use tank destroyer doctrine, the Army ignored that doctrine because of tactical circumstances and refused to reinstitute the doctrine when circumstances changed. The complacency of the Army before D-day about German tanks would be replaced by intense concern after American units encountered them in combat. The Army was to be unpleasantly surprised about the limitations of its antitank weapons, including tank destroyers, when facing German armor.

Tank destroyer battalions were part of the forces being massed in England during the first months of 1944 for the invasion of France. By 23 March, there were 19 TD battalions in England, 16 self-propelled and 3 towed. Ultimate plans intended to redress the balance of towed and self-propelled weapons, calling for 50 percent of each type. By the time the invasion was launched, there were 19 self-propelled battalions equipped and ready for combat and 11 towed units.[1]

The number of tank destroyer battalions planned for the overall campaign following the invasion indicated a declining concern for the German tank forces that had seemed so awesome in 1941. Originally, the plan called for 72 tank destroyer battalions. By

November 1943, General Bradley approved reducing the number to 52.[2]

Less concern about German armor was also evident in requests from the European Theater for the armament of future tanks. In May, Brigadier General Joseph A. Holly advised the G3 of ETO that armored vehicles were low on the priority list of probably targets for Allied tanks, fifth behind personnel, machineguns, artillery, and soft vehicles. For production in 1945, Holly wanted tanks with 90-mm guns and 105-mm howitzers in the ratio of one to three. The 105-mm howitzer, then available in the M-4 tank, was deemed an effective weapon against most of the probable targets, while a limited number of 90-mm guns would compensate for the howitzer's lack of "hole punching" ability.[3] Lack of concern for German tanks was also evident in ETO's decision not to issue M-4 tanks with 76-mm guns prior to the invasion. Combat commanders deemed that the lack of time to train crews with the new tank and obscuration caused by the 76-mm gun's muzzle blast were " . . . an excessive price for the additional inch of armor penetration obtained."[4]

Even though General Holly asked for 90-mm guns, the need for those guns to deal with heavy German tanks was apparently not a matter of immediate concern. In response to a War Department query in May 1944, General Eisenhower mentioned training requirements and concluded that "No T-71's are desired at this time for converting Bns now under our control."[5] While the state of training of invasion forces was of course very important by May 1944, Eisenhower's refusal of tank destroyers with the 90-mm gun indicates that he felt no pressing need for the gun. All theater

commanders agreed that they would rather receive trained units equipped with new weapons than attempt to reequip units in the field.[6]

Prior to the invasion, towed tank destroyer battalions began to fall short of expectations. Planners had hoped to attach a towed battalion to each division while retaining self-propelled battalions as corps or army reserves. This solution partially agreed with doctrine in FM 18-5 since it compensated for the lesser mobility of towed guns. Amphibious exercises prior to the invasion revised planning by revealing the vulnerability of towed weapons while unloading and going into action. Therefore, only one towed battalion was present in the initial invasion while several self-propelled units were used.[7]

After the invasion, the limitations of towed guns became more evident. Shortly following D-day, divisions that had not been in the initial landings began requesting self-propelled tank destroyers to replace towed units because of:

> (1) the organic need for an armored self-propelled assault gun in the infantry division; (2) the inability of the towed gun to shoot direct fire over the hedgerows; (3) the thin armor of the towed gun which made it impossible to push it far enough forward to take advantage of the small field of fire defined by the hedgerows; and (4) the immobility of the towed gun once emplaced.[8]

Originally, the invasion plans called for a tank destroyer group to be attached to each corps and to control varying numbers of TD battalions as the armor threat might dictate.[9] This idea was exactly the doctrine recommended by FM 18-5. However, the Normandy countryside, compartmented by hedgerows--each one a tank

obstacle--was poorly suited for the employment of large numbers of tanks. Most of the Panzer divisions became committed against the British further to the east, and as a result, German tank attacks involved only small numbers of tanks and aimed at limited objectives. This created pressure to disperse tank destroyers among frontline units rather than leave them concentrated in reserve positions to counter penetrations. Consequently, tank destroyer battalions were rarely attached to groups " . . . because of . . . the piecemeal employment of German armor." The various group headquarters quickly became advisory groups " . . . interested in seeing that the tank destroyer battalions were adequately supplied and gainfully employed."[10] The concept of massing tank destroyers succumbed to the tactical situation and would not be revived even when needed.

Shortly after the breakout at St. Lo, a tactical situation occurred that begged for the employment of massed tank destroyers. Such massing never occurred.

During the first days of August 1944, American units were pouring through the gap that had been opened at St. Lo. Hoping to stem the tide and cut off a large American force, Hitler ordered an attack against the chokepoint of Avranches (See Maps 3 and 4). For the attack, the Germans assembled two corps which included four Panzer divisions.[11] Fortunately, the Allies were warned of the attack by Britain's Ultra organization which decoded German messages throughout the War.[12] Despite the warning, tank destroyers were not massed to defeat this threat of a large force of German armor. Instead, the 30th Infantry Division and its attached tank destroyer

unit, the 823d TD Battalion with 36 towed guns, would meet the brunt of the German attack.

On 5 August 1944, the 30th Infantry was attached to VII Corps and ordered to relieve the 1st Infantry Division in the vicinity of Mortain.[13] Typically, the division ordered the 823d to attach each of its companies to a regiment of the division.[14] Receiving no intelligence that the sector was anything but quiet, the 823d generally occupied the same positions as the previous tank destroyer unit. Unfortunately, some of the positions were exposed and lacked protection from infantry units.[16] Thus, when the German attack came on 7 August, it found the 823d dispersed, unprepared, and in some cases unsupported.

Receiving only 20 minutes warning from the 30th Infantry Division, the 823d came under attack during the first hour of 7 August. By daylight, the German attack was well underway.[17] The third platoons of both A and B Companies were in exposed positions. A Company's Third Platoon, unprotected by American infantry, quickly succumbed when German troops swept around their positions and made the guns untenable because of fire from small arms.[18] The platoon from B Company fared little better. Although that platoon was able to kill two German tanks, "The heavy towed tank destroyer guns were sitting ducks when they revealed their locations by firing."[19] Although other units of the 823d were more fortunate, the situation in the 30th Division's sector was very serious. As the unit's historian noted, " . . . with a heavy onion breath that day the Germans could have achieved their objec-

tives."[19] Still, by the end of the day, American lines had generally held.

Although the 823d was generally successful, it took heavy losses. By the end of 7 August, the battalion had lost 11 guns with their prime movers (halftracks), three soldiers were dead, and 101 were missing. For their part, the tank destroyers had killed about 15 German tanks.[20] Most of the losses came from the two platoons that had been overrun in their exposed positions.

One incident on 7 August clearly illustrates the difficulties created by commanders who would not allow the tank destroyers to operate as a battalion. At about 0630 hours, the division ordered the 823d to move TD's to cover the southern flank "at once." After the battalion commander reminded the division that he had not a single tank destroyer under his control, the division gave him a platoon from C Company, which was not in contact with the enemy. However, the 119th Infantry regiment refused to release the platoon until noon.[21] Fortunately, the delay did not prove to be critical since the Germans did not materialize in the south.

The attack continued for several days, but after 7 August German thrusts became progressively weaker. By 11 August, the German pressure was nearly gone; and on 14 August, American units began to advance.[22] Although the 30th Infantry and the 823d TD Battalion were vital elements in the defeat of the attack, Allied air power was probably just as important in stopping the Germans.

One surprising aspect of the 823d's experience at Mortain was the fact that the TD's apparently had little trouble killing

the Germans' Panther (Mark V) tanks. Apparently, skilled employment of individual platoons and guns enabled the TD's to get shots at the vulnerable flanks of the Panther whose frontal armor had already proved impervious to the 3-inch gun.

Apparently aggravated by the tough hide of the Panther tanks during the first weeks of the Normandy campaign, the First Army set about finding exactly what weapons could kill that tank. A board of officers moved a Panther to a suitable location and fired at it with virtually every weapon in the First Army, including rifle grenades, 40-mm antiaircraft guns, and 105-mm howitzers. The results were disheartening. Only the 90-mm gun and the 105-mm howitzer proved capable of penetrating the Panther's frontal armor. However, the low velocity of the 105's HEAT ammunition made it nearly impossible to get hits with that weapon beyond 500 yards. The 90-mm was credited with penetrating the Panther's front from 800 yards.[23]

When advised of those results, General Eisenhower was shocked:

> Why is it that I am always the last to hear about this stuff: Ordnance told me this 76 would take care of anything the German had. Now I find you can't knock out a damn thing with it.[24]

General Eisenhower quickly took action to rectify the situation. He dispatched General Holly with a letter for General Marshall demanding tanks and tank destroyers with 90-mm guns. General Marshall expidited shipment of M-36's and pointed out that a new tank with the heavy gun would be available soon.[25]

The main reaction in the United States was an increase in

the production of M-36's. Initial production of the M-36 had already been increased from 500 to 900, primarily for the Army's strategic reserve. As a result of General Eisenhower's letter, the War Department's G4 authorized total production of 1,400 M-36's.[26] However, this was of no immediate help to General Eisenhower, who had exhibited such surprise concerning the results of the First Army's firing tests.

The reason behind General Eisenhower's surprise was that the US Army's technical intelligence, a responsibility of the Ordnance Department, had failed to adequately compare the effectiveness of America's antitank weapons against the armor of German tanks, particularly the Panther. There were two major elements in this failure. First, the effectiveness of the 3-inch gun, and thus the 76-mm gun, was greatly overestimated. Second, no one properly assessed the protection offered by the Panther's angled (55-degree), frontal armor.

Overestimation of the 3-inch gun was firmly established by 1944. While justifying a heavier weapon in March 1943, the Ordnance Committee had claimed that the 3-inch gun could penetrate the face of a Mark VI (Tiger) at 1,000 yards.[27] Later that year, the Commanding General of the Armored Command optimistically observed that the 76-mm gun could penetrate the Mark VI at 1,400 yards.[28] In stark contrast, soldiers in combat saw both 76-mm and 3-inch shells bounding off Tigers. A report from Italy mentioned the 3-inch gun versus the Mark VI, saying "While penetration of frontal armor has been effected at a range of 50 yards, it is believed in general the

3" gun is ineffective against the front armor of the Mark VI."[29]

American intelligence never assessed the protection of the Panther (Mark V) despite the fact that the Army had all pertinent details of the tank by the fall of 1943. In the Armored Command's letter mentioned above, the Panther is conspicuously absent. But in a memo discussing a new American tank on 18 October 1943, General Dean accurately laid out the details of the Panther including the thickness of its hull front (3 and 5/16 inches at a 57-degree angle). General Dean believed, however, that future German production would emphasize the Tiger.[30] Apparently by May 1944, Allied intelligence corrected Dean's assessment of production, since General Holly emphasized the Mark IV and Mark V as the most important German tanks.[31] Despite this, firing tests in England that same month compared England's 17-pounder against various American guns using slabs of armor angled at 30 degrees.[32] Apparently the English were also unaware of the increased protection that the Panther accrued by having its armor angled at 55 degrees.

Even after the First Army tests revealed the inability of the 3-inch gun to penetrate the Panther, the Ordnance Department remained unconvinced. On 5 July, General Campbell cabled General Eisenhower that the "Panther Tank is generally less heavily armored than Tiger Tank . . . ." Despite the tests in France, Campbell claimed that the 76-mm gun would penetrate the Panther's turret at 1,000 yards while the 90-mm could penetrate the hull at 1,600 yards and the turret at 2,500 yards.[33] Eisenhower's reaction to this cable is unknown.

It is difficult to explain why the Ordnance Department had not assessed the effectiveness of the Panther's armor. Ordnance officers and, indeed, many officers outside the Ordnance Department were aware of the benefits of angled armor. The angular shape of the M-10 gives sufficient proof of that awareness. Still, Campbell seemed convinced in July 1944 that the Panther was less heavily armored than the Tiger. In fact, the thinner, angled armor of the Panther had a greater effective thickness than the Tiger's nearly vertical armor against flat-trajectory weapons. The conclusion is inescapable that the Ordnance Department was, at best, guilty of a major oversight. In their defense, it is obvious that ordnance officers were not the only ones to ignore the matter, but they were obliged to take the blame. At least the Ordnance Department had managed to have a self-propelled version of the 90-mm gun in quantity production by D-day.

If there is a lesson in all of this, it is that antitank weapons should be tested against captured enemy material, or at least the closest possible equivilent. Theoretical penetration data from a proving ground can be very misleading. In addition, the morale of the soldiers who must fight enemy armor is raised far more by the sight of holes in an enemy tank than by sterile data. Such testing must be accomplished early, because technological development requires time to cope with problems. The Americans fighting in Europe in 1944 had to wait months for a solution to heavy German tanks.

Although General Marshall had ordered that M-36's be shipped

during July, the new vehicle would wait some time before entering combat. The new tank destroyers did not reach the hands of troops until September-October 1944.[34] The delay was probably due to two factors, the time required for the sea voyage and the tactical situation at the end of the voyage. Shortly after the First Army tests, the American Army broke out of the confines of Normandy and began an exploitation that soon made tactical problems subordinate to logistical difficulties. Any combat commander in France during August and September 1944 would have probably preferred to see 30 tons of gasoline arrive in his area rather than 30 tons of tank destroyer.

In addition to the gradual shift toward heavier guns, the fall of 1944 also saw a move away from towed weapons. By September, ETO began requesting more self-propelled units. After coordinating with the War Department, ETO decided to begin converting towed units in the theater to self-propelled equipment. During November, the War Department confirmed that ETO's desires were 40 self-propelled battalions and 12 towed. Additionally, all towed units were to receive 90-mm guns.[35]

In general, the combat troops were finding the self-propelled units to be more useful and effective than towed battalions. For example, in contrast to the mixed success of the 823d at Mortain, the 704th--fighting near Arracourt, France in September 1944--was able to deal heavy losses to the Germans with comparatively few casualties.

The 704th was attached to the 4th Armored Division almost

immediately after its arrival in France during July 1944 and accompanied that division through August and September. Like the 823d, the 704th soon found itself dispersed among the combat commands (roughly equivilent to regiments) of the divisions.[36] Unlike the 823d, the 704th was equipped with M-18's.[37] By 19 September 1944, C Company found itself with Combat Command A (CCA) west of Nancy, France. Two platoons manned an outpost line while the Third Platoon remained at the combat command headquarters.[38]

Achieving surprise in thick fog, the Germans managed to hit CCA with a Panzer brigade that included 42 Panthers. Initially, one company of tanks took the brunt of the attack. The commander of CCA ordered the Third Platoon of C/704th to outpost a hill between CCA headquarters and the tank company. Unaware of the actual situation, the platoon leader, Lieutenant Edwin Leiper raced off into the fog with his M-18's. Approaching the hill, Lieper suddenly spotted the muzzle of a German tank gun some 30 feet away. He gave the dispersal signal and his well-trained platoon quickly deployed and opened fire. Minutes later, five German tanks had been destroyed while only one M-18 had been damaged. Remaining on the hill until afternoon, the platoon destroyed 10 more tanks while losing 2 more M-18's.[39] The third platoon's losses, while destroying 15 German tanks, are in sharp contrast to those of the 823d TD Battalion on 7 August. In addition, the maneuverability of the M-18 played a major role in this action and in the remainder of the battle:

> It was also generally agreed that the tank destroyer missions at ARRACOURT could not have been as well performed by

> heavy tanks . . . in as much as the tank destroyers were able to utilize speed and maneuverability over rough and muddy terrain over which [heavy] tanks would have been unable to move.[40]

In addition to superior performance while performing their primary mission, self-propelled tank destroyers proved to be generally more useful than towed weapons. One tank destroyer officer commented that:

> . . . the appearance and knowledge that self-propelled tank destroyers were at hand was a major reason that the infantry attained success and victory. . . . The towed guns can be just as brave and thoroughly trained but they never give much "oomph" to the fighting doughboy when the "chips are really down."[41]

Despite the fact that the other arms generally held the tank destroyers with high regard, there were exceptions. Training and morale varied among tank destroyer battalions. Probably more important, the status of tank destroyers as an attached unit often meant that the companies and platoons suddenly found themselves joining an infantry or armored unit just prior to combat. Unfamiliarity bred mutual mistrust, sometimes with unfortunate consequences. One man who commanded an infantry regiment commented about the attached tank destroyers:

> Company C, [number omitted] TD Battalion, was probably the most dependable attached unit which I commanded. It uniformly failed in all its assigned tasks! It possessed no fighting spirit whatsoever, and was happiest when well to the rear, or tagging along behind the tanks. It was useful on road-blocks and defensive situations, where they served to deter the enemy if he should see them.[42]

Fortunately, that observer's comments were not typical.

The effort to convert towed battalions to self-propelled guns was still underway in December 1944. In general, units with

M-18's were new units equipped in the United States. The M-36's replaced either towed guns or M-10's. Excess M-10's were given to towed units as they became available. Some units were in the midst of conversion when the greatest challenge to tank destroyers began, the German attack of nearly 1,500 armored vehicles in the Ardennes in December 1944.

The American Army never had the opportunity to mass tank destroyers as advocated by FM 18-5 to meet the German attack. Unwarned by "Ultra," the American Army was completely surprised by the Germans.[43] The attack found American units spread thinly among the forests and ridges of the Ardennes, with tank destroyers dispersed among them.

Since the German formations involved in the attack included many armored vehicles, tank destroyers played a crucial role throughout the battle. But even after the Allies realized the scale of the attack, there was no attempt to concentrate tank destroyers into groups. The Battle of the Bulge was a confused, fluid action that found American command and control fragmented. Combat commanders, from army commanders to squad leaders, fought their own local battles with the means they found at hand. Dispersal of tank destroyers reflected the general confusion. However, as the Army's history of the battle points out, "The mobile, tactically agile, self-propelled, armored field artillery and tank destroyers are clearly traceable in the Ardennes fighting as over and over again influencing the course of battle."[44]

While tank destroyers played an important and generally

successful role in stopping the German attack, the presence of large numbers of Panthers and Tigers accentuated the weakness of American firepower that had been revealed during the summer. The Commander of the 2d Infantry Division, in his first fight against a large force of tanks, asked for more 90-mm guns. As H. M. Cole points out in The Ardennes, the wish for:

> . . . adequate armament to cope with the German Panthers and Tigers was being echoed and would be echoed--prayerfully and profanely--wherever the enemy panzer division appeared out of the Ardennes hills and forests.[45]

The available M-36's proved to be a blessing. Often, the M-36 proved to be the only weapon capable of dealing effectively with the heavy, German tanks. For example, one narrative of the fighting near the Elsenborn Ridge relates the following incident:

> Powers [Lieutenant Powers of the 740th Tank Battalion] slowly pushed on, having no idea what lay ahead. A second big tank loomed up. Before the German could fire, Powers sent a round into the Tiger's front slope plate. The shell bounced off harmlessly.
>
> Powers' gun jammed. Since the radios were useless he hand-signaled the tank destroyer to move in. The Tiger, jarred by Powers' first shot, fired two wild rounds. Then the American tank destroyer's big 90-mm roared. The Tiger flamed.[46]

The main problem with the M-36 at the Ardennes was its scarcity. By 20 December, there were only 236 of the vehicles in the hands of troops.[47]

In addition to creating more pressure for heavier antitank weapons, the fighting in the Ardennes completely discredited the towed guns of tank destroyer units. The towed guns' lack of mobility made them less effective than self-propelled guns and resulted in greater losses. Towed guns could not maneuver to obtain

the flank shots necessary to kill heavy, German tanks. In addition, they could not advance to support a counterattack and were almost inevitably lost when a retreat was necessary. For example, of 119 tank destroyers lost by the First Army in December, 86 were towed.[48] The veteran of Mortain, the 823d TD Battalion, contributed to those losses.

Still attached to the 30th Infantry Division of the First Army, the 823d was one of those units that was in the middle of conversion to self-propelled equipment when the Germans attacked. The battalion had begun to receive M-10's in early December and, by mid-month, had four per company. Hastily committed to battle on 17 December, the battalion's companies generally tried to use towed guns in forward positions and retain the M-10's as a mobile reserve. Typically, the 823d TD Battalion recorded that "Upon the withdrawal of friendly Infantry, TD guns were one by one flanked by enemy tanks and personnel driven from the guns by small arms and machine gun fire . . . ." Nine guns were lost in the foregoing incident.[49]

By 29 December, General Holly wrote to the War Department that, "100% self-propelled T.D.'s now desired. Towed people are quiet these days."[50] As a result of losses in the Ardennes, ETO requested to convert all towed battalions to self-propelled equipment.[51] The War Department approved the theater's request on 11 January 1945.[52] Thus, towed guns, demanded as a result of combat experience, were abandoned as a result of combat experience.

Combat commanders still viewed the self-propelled tank

destroyers with esteem. The Third Army was so enthusiastic about the M-18's mobility that they referred to the vehicle as " . . . the finest piece of tracked equipment in the U.S. Army."[53] However, views concerning tank destroyers were not unanimous. While the Third Army preferred mobility, the First Army desired heavier armor instead of speed.[54]

The desires for armor tended to prevail over desires for speed. As a result of requests from Europe, the Ordnance Department developed armored tops for tank destroyer turrets.[55] With the advent of armored tops, tank destroyers became more and more like tanks.

Probably more important for the fate of tank destroyers, the Army introduced a new tank, the M-26, with the 90-mm gun. Previously, one of the main advantages of tank destroyers had been that they had generally had a better gun than tanks. While the Sherman tank had been limited to the 75-mm gun, tank destroyers carried the 3-inch gun. As 76-mm guns began to appear in Sherman tanks, the M-36 with the 90-mm gun became available. The appearance of the M-26 meant that America's best antitank gun was now available in a tank. Increasingly, the tank destroyer was viewed as a hybrid tank.

After hostilities ended, the European Theater appointed a General Board to conduct studies to determine the lessons learned during the campaign in Europe and how those lessons should change doctrine and equipment in the Army. Among the recommendations was a proposal to increase organic, antitank firepower in the infantry

division and thus climinate the need for attached tank destroyers. Antitank firepower in the infantry division could be increased by making tanks organic to the regiments. Noting the increased firepower of tanks, the board concluded that armored division had no requirement for tank destroyers. Therefore, the board recommended that the tank destroyer function should be assumed by tanks and "That the tank destroyers as a separate arm be discontinued."[56] Ultimately, the War Department agreed; and after World War II, the tank destroyers were abandoned.

Thus, despite their contribution to victory, the career of tank destroyers came to an end. The tactical situation had never allowed tank destroyer doctrine to be properly used. Throughout the campaign against Germany, tank destroyers tended to be used to substitute for or to supplement tanks. As the demand for heavier guns grew, those guns were mounted on tanks as well as on tank destroyers. Towed guns, unable to compete with tanks or self-propelled guns, were totally abandoned. Sadly, when the ideal tank destroyer, the M-18, on which General Bruce and others pinned such great hopes, actually appeared, it proved to be undergunned. Finally, after never receiving a fair test, tank destroyer doctrine was quickly forgotten.

ENDNOTES

[1]The General Board, United States Forces, European Theater, "Report on Study of Organization, Equipment, and Tactical Employment of Tank Destroyer Units," Study Number 60, dtd. 22 April 1946, CGSC Library No. R-12885.60-2, p. 1, hereafter referred to as GB 60.

[2]Ibid.

[3]Memo from Brig. Gen. J. A. Holly, AFV & W Section, to G-3, ETOUSA, Records of the Armored Fighting Vehicles and Weapons Section, European Theater of Operations, RG 338, National Archives, hereafter referred to as ETO.

[4]Maj. Irl D. Brent, II, "Final Historical Report," ETO, p. 19, hereafter cited as Report, ETO.

[5]Cable from Eisenhower to War Deaprtment, dtd. 20 May 1944, AGF.

[6]Memo from Maj. Gen. S. G. Henry, Director, New Developments Division to Chief of Staff, U.S. Army, dtd. 17 April 1944, C/S.

[7]GB 60, p. 10.

[8]Ibid., p. 2.

[9]Ibid., p. 5.

[10]Ibid., p. 10.

[11]Committee 24, Officers Advanced Course, The Armored School, Employment of Four Tank Destroyer Battalions in the ETO, Fort Knox, Kentucky, May 1950, pp. 83-84, hereafter cited as Employment.

[12]F. W. Winterbotham, The Ultra Secret (New York: Harper & Row, 1974), pp. 148-154.

[13]Employment, p. 85.

[14]After Action Report, 823d TD Battalion, RG 407, National Archives, 5 and 6 August 1944, hereafter cited as AAR, 823.

[15]Employment, pp. 86-88.

[16]Ibid., p. 86 and AAR, 823, 7 August 1944.

[17]Employment, pp. 94-95.

[18]Ibid., pp. 95-96.

[19]Robert L. Hewitt, Workhorse of the Western Front--The Story of the 30th Infantry Division, p. 54 quoted in Employment, p. 99.

[20]AAR, 823, 7 August 1944.

[21]Ibid.

[22]Employment, pp. 99-106.

[23]First United States Army, "Report of Proceedings of Board of Officers," Report of Operations, 1 August 1944-22 February 1945, Annex 5, Appendix 2, pp. 65-66.

[24]Eisenhower quoted by Omar N. Bradley, A Soldier's Story (New York: Popular Library, 1964 [originally 1951]), p. 322.

[25]Alfred D. Chandler, Jr., gen. ed., The Papers of Dwight D. Eisenhower, 4 vols. (Baltimore: Johns Hopkins Press, 1970), Vol. 3: The War Years, pp. 1973-1974.

[26]Disposition form from Maj. Gen. R. L. Maxwell, G-4, War Dept., to CG, ASF, dtd. 10 July 1944, G-4 Decimal file, file no. 473, RG 165, National Archives.

[27]OCM, Item 20126, 22 March 1943.

[28]Letter from Maj. Gen. A. C. Gillem, CG, Armd. Cmd., to CG, AGF, dtd. 4 September 1943, AGF (470.81).

[29]Letter from Brig. Gen. John W. Coffey, Ord. Off., HQ, SOS, NATO to Col. James L. Guion, Off. of the Chief of Ord., dtd. 21 August 1944, OHF.

[30]Memo from RQTS 1 to CG, dtd. 18 October 1943, AGF (470.8). Most contemporary sources specify that the Panther's hull front was 80-mm thick angled at 55°.

[31]Letter from Brig. Gen. J. Q. Holly to G-3, ETOUSA, op. cit. Although Holly emphasizes the Mark V he appends a chart showing penetration of U.S. guns against the Mark VI which, however, accurately shows that the 3-inch gun would not penetrate the front of the Tiger.

[32]Memo from Capt. Irl D. Brent, II to Exec. Off., AFV&W Section, dtd. 24 May 1944, ETO.

[33]Cable from Campbell to Eisenhower, dtd. 5 July 1944, OHF.

[34]Final Report, ETO, App. G.

[35]Letter from Maj. Gen. J. E. Hull, Asst. C/S to HQ, ETO, dtd. 16 November 1944, and Memo from Hull to G-4, dtd. 27 November 1944 with Memo for record, Records of the Operations and Plans Division (OPD), RG 165, file no. 472.1, National Archives.

[36]Employment, p. 65.

[37]Report No. 1095, "M-18 Hellcat Tank Destroyer," dtd. 9 February 1945, Bruce.

[38]Employment, pp. 66-70.

[39]Ibid., pp. 71-76.

[40]Ibid., p. 79.

[41]GB 60, p. 18.

[42]Letter from HQ, AGF to CG's Replacement and School Cmd., Armored Center, and TD Center, undated (but sometime after August 1944), Folder 189, AGF Obs. The letter contains extracts of a report by Col. Clyde E. Steele who commanded a regiment of the 36th Inf. Div. in France.

[43]Winterbotham, The Ultra Secret, p. 177.

[44]Hugh M. Cole, The Ardennes: Battle of the Bulge (Washington, D.C.: OCMH, 1965), p. 653.

[45]Ibid., p. 125.

[46]John Toland, Battle: The Story of the Bulge (New York: Random House, 1959), p. 135.

[47]Final Report, ETO, App. G.

[48]First Army Report, Annex 4, p. 22.

[49]823 AAR, 4 December, 10 December, 11 December, 17 December, and 19 December 1944.

[50]Letter from Holly to Brig. Gen. W. A. Borden, New Developments Division, War Dept., dtd. 29 December 1944, G-4 decimal files, fiel no. 473, RG 165, National Archives.

[51]GB 60, p. 2.

[52]Routing Slip, dtd. 3 March 1945, G-4 decimal files, op. cit., contains a reference to the message.

[53]Third Army After Action Report, Part 24, "Tank Destroyer," Chapter 13, undated, CGSC Library No. N-11480-B.

[54]Letter from HQ, 12 Army Group to CG, ETO, dtd. 9 November 1944, AGF (473).

[55]M-36 Chron., 18 January 1945 and 5 April 1945.

[56]GB 60, p. 29.

CONCLUSION

Spurred by the German conquest of France in 1940, the United States Army had developed a unique weapon, the tank destroyer, to defeat the instrument of Germany's success—massed armor. During the interval between the fall of France and America's entry into war, the Army created a concept of mobile antitank organizations specifically designed to meet the German threat. Primarily the brainchild of Major General Lesley J. McNair, the concept of tank destroyers encompassed tactical doctrine, organizations, and equipment. Each of those features had to be developed in a short time.

The doctrine created for tank destroyers by the first months of 1942 was a mixture of offense and defense. While the overall mission of tank destroyers was defensive, their tactics were aggressive. After locating an enemy armored force, tank destroyers were expected to move aggressively to mass their firepower against the enemy tanks.

Massed firepower was the cornerstone of tank destroyer doctrine. Their advocates never claimed that tank destroyers were superior to tanks in a one-to-one confrontation. Instead, using superior mobility, the tank destroyers were expected to mass predominant combat power at the time and place of their choosing. The Tank Destroyer Center provided group and brigade headquarters to enable the separate TD battalions to be massed. Perhaps the essence

of tank destroyer doctrine is best expressed by the motto of those units: Seek, Strike, Destroy.

The organization of tank destroyer battalions reflected their doctrine. Organic reconnaissance provided a capability to seek the enemy. Organic security assets were necessary since the battalions would operate behind the mass of friendly infantry. Tank Destroyer companies had heavy firepower to strike and ultimately destroy the enemy force. To do this, the guns of the companies needed superior mobility and this requirement forced the Tank Destroyer Center to become involved in the process of developing equipment, principally self-propelled guns. Unfortunately, development of equipment proved to be more time consuming than the writing of doctrine.

The technological problem of the Tank Destroyer Center was combining a heavy gun with a vehicle that could out-maneuver enemy tanks. Employing a twofold solution, the Tank Destroyer Center adapted the best equipment that was immediately available while starting the development of their desired weapon from scratch. Existing trucks and half-tracks were modified to carry 37-mm or 75-mm guns. Using available equipment, the first tank destroyers were inadequate expedients which the Tank Destroyer Center admitted could not fulfill tank destroyer doctrine. However, the exigencies of war forced the first tank destroyer battalions to enter combat with those expedients.

The experiences of the American Army in North Africa forced the Tank Destroyer Center to modify doctrine, organization, and

equipment. Dissatisfaction with existing tank destroyer units from commanders in the field, although those same commanders persistently misused tank destroyer units, forced the Center to adapt their organizations to accept towed guns. The Center had consistently held the view that towed guns did not have sufficient mobility to use tank destroyer doctrine. In addition, doctrine had to be modified to reflect the dispersal of tank destroyer battalions, such dispersal being the reality faced by tank destroyer units in combat. In addition to doctrinal changes, combat experience forced new efforts toward developing equipment. The inadequacies of the earliest tank destroyer weapons contributed to the general dissatisfaction with the units.

Not surprisingly, the hastily constructed M-3's and M-6's proved to be less than perfect when facing German tanks. General Bruce had recognized the weakness of those weapons from the start and had begun the development of the "ideal" tank destroyer, the M-18, in the first days of 1942. However, the normal problems of technological development kept the M-18 off the battlefield until 1944. Despite General Bruce's complaints about the recalcitrance of the Ordnance Department, the industry-ordance team developed the M-18 in a remarkably short time, considering the technological innovations of that vehicle. The fact that 2 years was a short development period underlines the inherent, technological difficulties of producing military hardware.

One point demonstrated by the history of the M-18 is that it is possible to shorten the development process if waste is

acceptable. By rushing into production before the vehicle was standardized, the M-18 was made available for combat earlier than it otherwise would have been. If production of the M-18 had been delayed until the vehicle was standardized, its arrival on the battlefield probably would have been delayed by 6 months or more. However, the extensive modifications required by early production M-18's undoubtedly wasted funds. Such waste would probably have been unacceptable in peacetime. Despite the speed with which the M-18 was completed, the period was still not short enough to assuage General Bruce's discontent with the Ordnance Department.

General Bruce's dissatisfaction with the Ordnance Department was amplified by the M-10. The Tank Destroyer Center was not an independent organization, and its senior headquarters (AGF) agreed with the Ordnance Department and forced General Bruce to accept the M-10, which the latter regarded as another expedient. Despite General Bruce's complaints, however, the M-10 proved to be an effective weapon, popular with the troops.

Participation from AGF in the development of tank destroyer equipment was also evident in the efforts to complete a 90-mm antitank gun. Despite opposition from the Tank Destroyer Center, AGF pressed efforts to complete both towed and self-propelled 90-mm guns. The self-propelled version, the M-36, ultimately proved to be the best antitank weapon in the hands of troops during the bitter fighting in the Ardennes. On the other hand, the towed version's development was fraught with technical difficulties. Ultimately, the towed gun, the T-5E2, was completed just in time to be rejected

by the commanders in the field.

Developed and issued as a result of experience in North Africa, towed guns in tank destroyer units were abandoned as a result of experience in Europe. The effectiveness of towed antitank guns in the open terrain of North Africa could not be duplicated in the woods and hills of Europe. In addition, the relatively small guns used in the desert war had grown immensely heavier by 1944. Lack of mobility caused heavy losses of towed guns, with little success against German tanks. The experiences of tank destroyer units in North Africa and Europe were alike in that they were not employed according to their doctrine in either place.

Despite intentions to employ tank destroyers according to FM 18-5, the tactical situation after D-day quickly resulted in disregard for proper tank destroyer doctrine. Piecemeal commitment of German tanks caused tank destroyer units to be dispersed. Commanders proved to be unwilling or unable to concentrate tank destroyers on those occasions when massed German armor appeared. More disheartening, the guns of tank destroyer units, even those units with the M-18, proved wanting in the face of the Panthers and Tigers.

The failure of the US Army to properly assess the effectiveness of its antitank weapons against German tanks defies explanation. While the Ordnance Department must accept most of the guilt for this failure, the Tank Destroyer Center is certainly not blameless. It would seem that an organization dedicated to destroying enemy tanks would have left no stone unturned to assure that its weapons were

adequate for the task. In retrospect, the complacency of the Tank Destroyer Center with regard to the effectiveness of the 3-inch and 76-mm guns is astounding. Certainly, the inadequacies of the guns on tank destroyers were part of the reason that tank destroyers were abandoned, particularly since tanks proved capable of carrying the larger guns while being generally more useful than tank destroyers.

While the US Army disbanded its tank destroyer units, it is impossible to conclude that tank destroyers failed. Tank Destroyer doctrine was never really tested in combat. While the tactics of tank destroyer units at the company or battalion level proved to be successful when used, the basic concept of tank destroyers--mobile antitank formations operating in mass--was never employed. Thus, the doctrine of FM 18-5 was never given an opportunity to prove itself.

The primary reason that the concepts of FM 18-5 remained unproven was that the threat that those concepts were designed to meet did not exist by the time the American Army was heavily involved in combat. Despite the concern caused by the defeat of France, destroying enemy tanks was not the number one problem of the US Army during World War II. Tank destroyer doctrine was defensive, but from 1942 to 1945 the United States was almost continuously continuously conducting offensive operations. In defense of the commanders who misemployed tank destroyers, it must be pointed out that proper employment would have left a combat asset sitting idly in reserve most of the time. Of course, combat commanders are loath to

waste combat power, and therefore tank destroyers were frequently employed in missions other than antitank ones. Thus, tank destroyers were measured largely against their ability to substitute for tanks or artillery. The inadequacies of tank destroyers when compared to tanks was a major factor in the demise of the former.

The offensive character of the US Army's operations throughout most of the war often forced tanks to assume the role of tank destroyers. Instead of destroying attacking German tanks, the Army's greater problem proved to be the destruction of defending German tanks. American tanks were in the forefront of this battle, while the thinly armored tank destroyers had to support from the rear. Towed guns, of course, were almost useless against tanks during attacks and were effective only as supporting artillery.

Despite the relative inadequacy of a defensive organization (tank destroyers) in an army almost continuously on the offensive, the conclusion does not follow that creating the tank destroyers was a mistake. The presence of tank destroyers provided the Army with a large number of effective antitank guns—the 3-inch, 76-mm, and 90-mm—long before those guns were available in tanks. Without tank destroyers, the Army's ability to deal with German tanks would have been much weaker. Although the tank destroyers were unable to prove all their concepts, they were a valuable asset to the American Army during World War II.

Even though tank destroyers were abandoned, their experience yielded valuable lessons. Probably most important, combat developers should realize that it takes years to make drastic changes in

doctrine. In addition to the time required for the development of new equipment that may be required, a great deal of time is necessary to educate the Army about the capabilities and limitations of a new type of unit. Also, education must encourage the doubters to use the new unit according to the doctrine designed to insure that unit's success. Much of the misemployment of tank destroyer units was due to the fact that many commanders were ignorant of tank destroyer doctrine or disagreed with it.

Of course, the interval between the introduction of tank destroyer doctrine and the appearance of the equipment designed for that doctrine contributed to wartime dissatisfaction with tank destroyers. Tactical concepts can be written into doctrine much faster than weapons can be created.

Perhaps the important lesson that can be drawn from the difficulties encountered during the development of tank destroyer equipment is that the development of military equipment is not strictly the province of engineers and scientists. Conversely, technological realities can force the bureaucracy to change doctrine. Combat experience and the enemy's technological achievements impact directly on doctrine and development programs. The development of tank destroyers was constantly influenced by doctrine, bureaucratic politics, and combat experience.

Initially, development programs for tank destroyers were a direct result of new doctrine. In the case of tank destroyers, doctrine definitely drove technology and not the reverse. Tank destroyers were not created to take advantage of some dramatic

technological advance such as guided missiles. Indeed, the threat was not a strictly technical one. By 1940, virtually every army had solved the technical problem of destroying a tank. The new threat was a doctrinal change that massed tanks in large organizations. America's answer to the threat was a doctrinal response that massed antitank weapons into tank destroyer organizations, but the new doctrine demanded mobility not available from American antitank weapons of 1941. Doctrine had to be qualified to reflect the fact that technology initially could not provide the weapons desired by the Tank Destroyer Center. Consequently, the Tank Destroyer Center became heavily involved in the development of new equipment intended to meet doctrinal requirements.

Events quickly demonstrated that the Tank Destroyer Center would not dictate the course of its development programs. Institutional rivals with their own axes to grind, AGF and the Ordnance Department, proved capable and willing to alter development efforts. On some issues, the Tank Destroyer Center found itself completely overruled. In addition, overseas commanders, whose views were furbished with the credentials of combat experience, also influenced the development of tank destroyers.

Pressure from overseas involved the Tank Destroyer Center in the development of a new type of weapon, the towed gun. The Tank Destroyer Center had to modify both doctrine and organizations to incorporate the new weapon. Basic doctrine had to be modified to reflect the views from overseas. Significantly, overseas commanders did not demand heavier guns for tank destroyers despite their

experiences with heavy German tanks.

Within the American Army, the initiative for heavier guns came almost entirely from the Ordnance Department, with help from AGF. Reacting to the technological threat of heavy German tanks, development programs had to incorporate heavier weapons than those desired by the Tank Destroyer Center. However, the Ordnance Department failed to discover the true dimensions of the technological threat, and the rest of the Army gave them little impetus to improve in this area. The Army's failure to realize the technological problem posed by Germany's Tiger and Panther tanks makes this the saddest part of the record of the development of tank destroyers.

In conclusion, it is clear that the history of equipment development is not confined to the records of the technicians in factories, laboratories, or proving grounds. Technology is the metronome of development, governing its pace. However, doctrine, institutions, or experience can divert or stop the path of technological development.

APPENDIX

TECHNICAL DATA

This appendix is intended to provide the reader with a reference for the technical characteristics of various American antitank/tank guns and gun motor carriages (tank destroyers).

I. Guns.

37-mm. This gun was America's standard antitank gun at the beginning of the war and also equipped various tanks and armored cars.[1]

Weight (M-3A1)	912 lb.
Projectile weight	1.92 lb.
Muzzle velocity	2900 fps.
Penetration (homogenous armor in mm angled at 30 degrees) at range (yards):	
0	65
500	57
1000	50
1500	43
2000	36

57-mm. This gun was an American version of the British 6-pounder antitank gun, and the two versions did not differ greatly.[2]

Weight (M-1A3)	3053 lb.
Projectile weight	6 lb. 4 3/4 oz.
Muzzle velocity	2800 fps.
Penetration:	
0	100
500	84
1000	73
1500	60
2000	48

75-mm. This gun was used in the M-3. The towed version was not issued as an antitank weapon but the weight is listed for comparative purposes.[3]

Weight (M-1897A4)	3007 lb.
Projectile weight	14.92 lb.
Muzzle velocity	2050 fps.
Penetration:	
0	76
500	68
1000	60
1500	52
2000	47

3-inch. This gun equipped the M-10 and also existed in a towed version, the M-6.[4]

Weight (M-6)	5850 lb.
Projectile weight	15.43 lb.
Muzzle velocity	2600 fps.
Penetration:	
0	108
500	98
1000	90
1500	81
2000	74

76-mm. This gun equipped some Sherman tanks and the M-18. No towed version was mass produced. Projectile weight and ballistic data are the same as the 3-inch gun.

90-mm. This gun equipped the M-26 tank and M-36. A towed version also existed but did not become standard equipment.[5]

Weight (T-5E2)	7800 lb.
Projectile weight	23.56 lb.
Muzzle velocity	2600 fps.
Penetration:	
0	123
500	113
1000	104
1500	95
2000	87

II. Vehicles.

M-6, 37-mm Gun Motor Carriage. This was the 37-mm gun mounted on a 3/4 ton, 4 x 4 truck.[6]

Weight	3.28 tons
Speed	55 mph

Armor	1/4 inch (gunshield only)
Armament	37-mm gun

M-3, 75-mm Gun Motor Carriage. This was the 75-mm gun mounted in a half-track.

Weight	8.92 tons
Speed	45 mph
Armor	1/4 inch (front) 5/8 inch (sides)
Armament	75-mm gun

M-10, 3-inch Gun Motor Carriage. This was an adaptation of the Sherman tank's chassis.[8]

Weight	33 tons
Speed	30 mph (level) 20 mph (3 percent grade)
Armor	1/2--2 inches (hull front) 3/4--1 inch (hull sides) 2 1/2 inches (turret front) 1 inch (turret sides)
Armament	3-inch gun Cal. .50 Machine Gun (antiaircraft)

M-18, 76-mm Gun Motor Carriage. This was the carriage which the Tank Destroyer Center desired as the ideal tank destroyer.[9]

Weight	20 tons
Speed	50 mph (level) 15 mph (10 percent grade)
Armor	1/2 inch (hull front and sides) 3/4--1 inch (turret front) 1/2 inch (turret sides)
Armament	76-mm gun Cal. .50 Machine Gun (antiaircraft)

M-36, 90-mm Gun Motor Carriage. This was the M-10 modified to carry the 90-mm gun.[10]

Weight	31 tons
Speed	30 mph (level) 12 mph (10 percent grade)
Armor	1 1/2--2 inches (hull front) 3/4--1 1/2 inches (hull sides) 3 inches (turret front) 1 1/4 inches (turret side)
Armament	90-mm gun Cal. .50 Machine Gun (antiaircraft)

ENDNOTES

[1]Peter Chamberlain and Terry Gander, Antitank Weapons: WW 2 Fact Files (New York: Arco Publishing Co., 1974), p. 47 and Table appended to "Agenda, Tank and Tank Destroyer Conference, Army War College," dtd. 26 January 1945, AGF (470.8), hereafter cited as Data. The table of ballistic performance notes is based on Inclosure 1, Military Attache Report No. 2473-44. The data is from firing tests in England and penetrations are based on fifty percent success against homogenous armor. In addition, the table contains the precaution that, due to variables in quality of plates, production shot, and errors in range estimation, the perforation thicknesses should not be interpreted as being exact.

[2]Data and Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. II: Artillery and Aircraft Armament, dtd. 1 October 1944, p. 167, hereafter cited as Ord. Cat. II. Data lists six different rounds for the British 6-pounder but none for the American 57-mm although their ammunition was apparently interchangable. Ord. Cat. II states that the muzzle velocity of the 57-mm gun was 2700 fps. and penetration of homogenous armor angled at 20 degrees was as follows:

500 yd.	3.4 in.
1000 yd.	2.7 in.
1500 yd.	1.9 in.

[3]Data and Ord. Cat. II, p. 158. The penetration data mentions the 75-mm tank gun. The reader is asked to accept the resulting, small error in penetration, as it would apply to the M-1897A4 gun (MV-2000 fps.), in order to be able to compare penetration data from a single source.

[4]Data and Ord. Cat. II, p. 169.

[5]Data and E. D. Stahr, ed., Artillery, an unpublished manuscript in OHF, National Archives. The muzzle velocity listed is from Data but some sources give the muzzle velocity as 2650 fps.

[6]Peter Chamberlain and Terry Gander, Self-Propelled Anti-tank and Anti-aircraft Guns: WW 2 Fact Files (New York: Arco Publishing Company, 1975), p. 50.

[7]Ibid., p. 51.

[8]Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. I: Tank and Automotive,

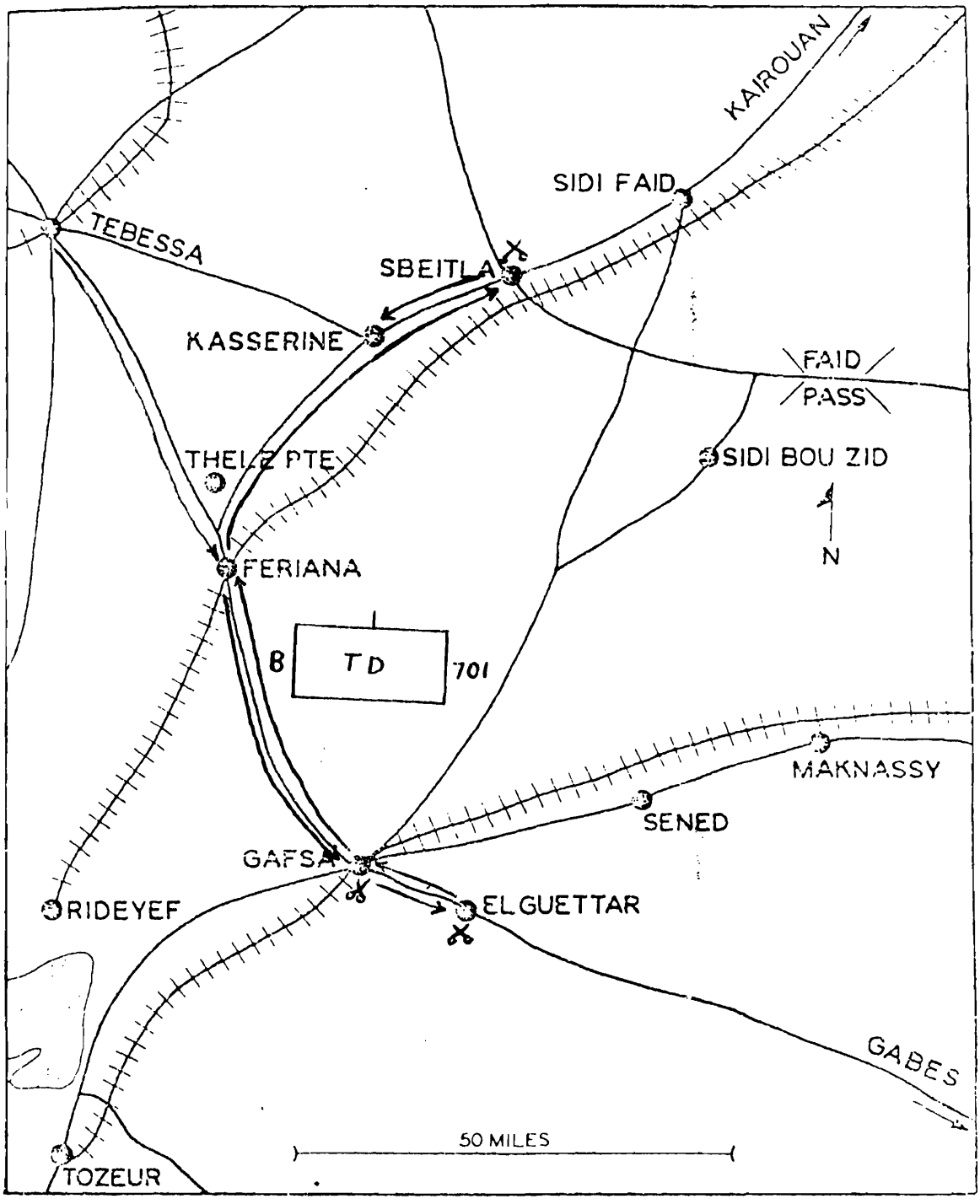
dtd. 1 December 1944, p. 42.

[9]Ibid., p. 49.

[10]Ibid., p. 51.

MAPS

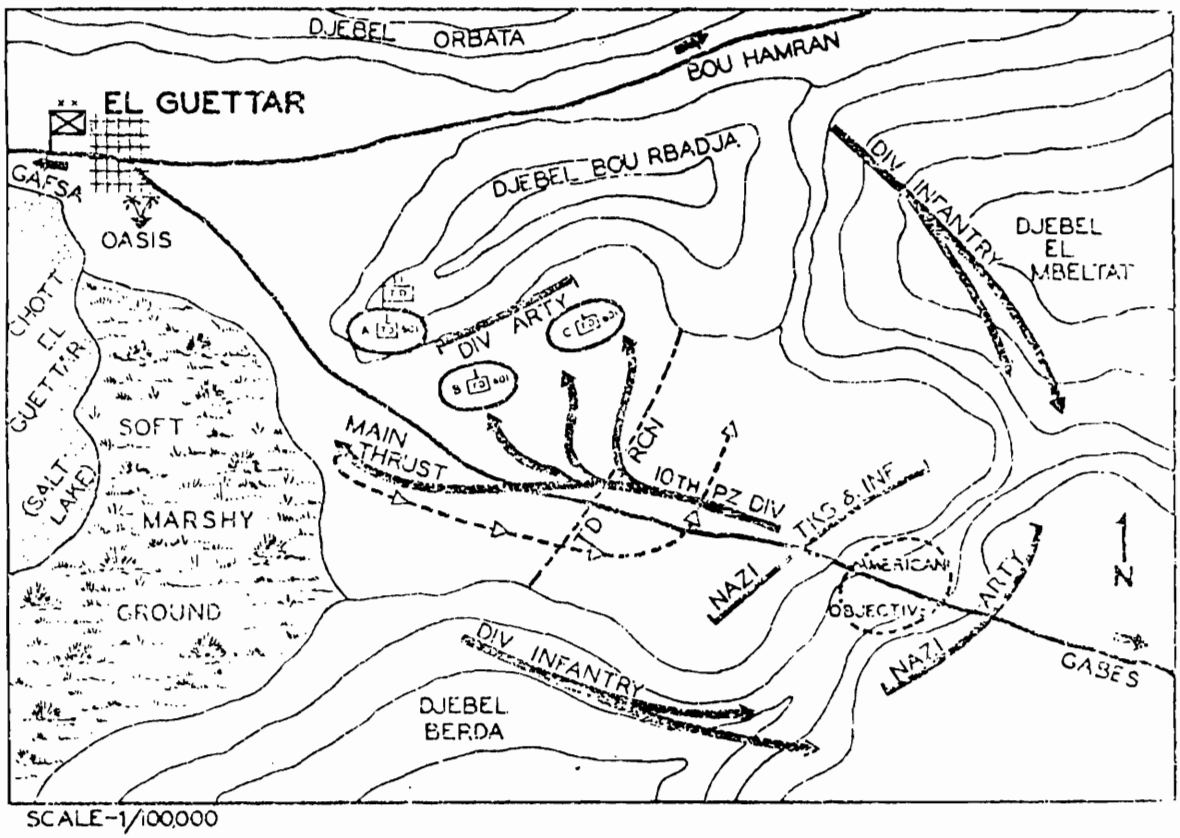
Map 1



CENTRAL TUNISIA

Map from Captain Gilbert A. Ellman, "Gafsa and Sbeitla," TD Combat in Tunisia, dtd. January 1944, Bruce, p. 3.

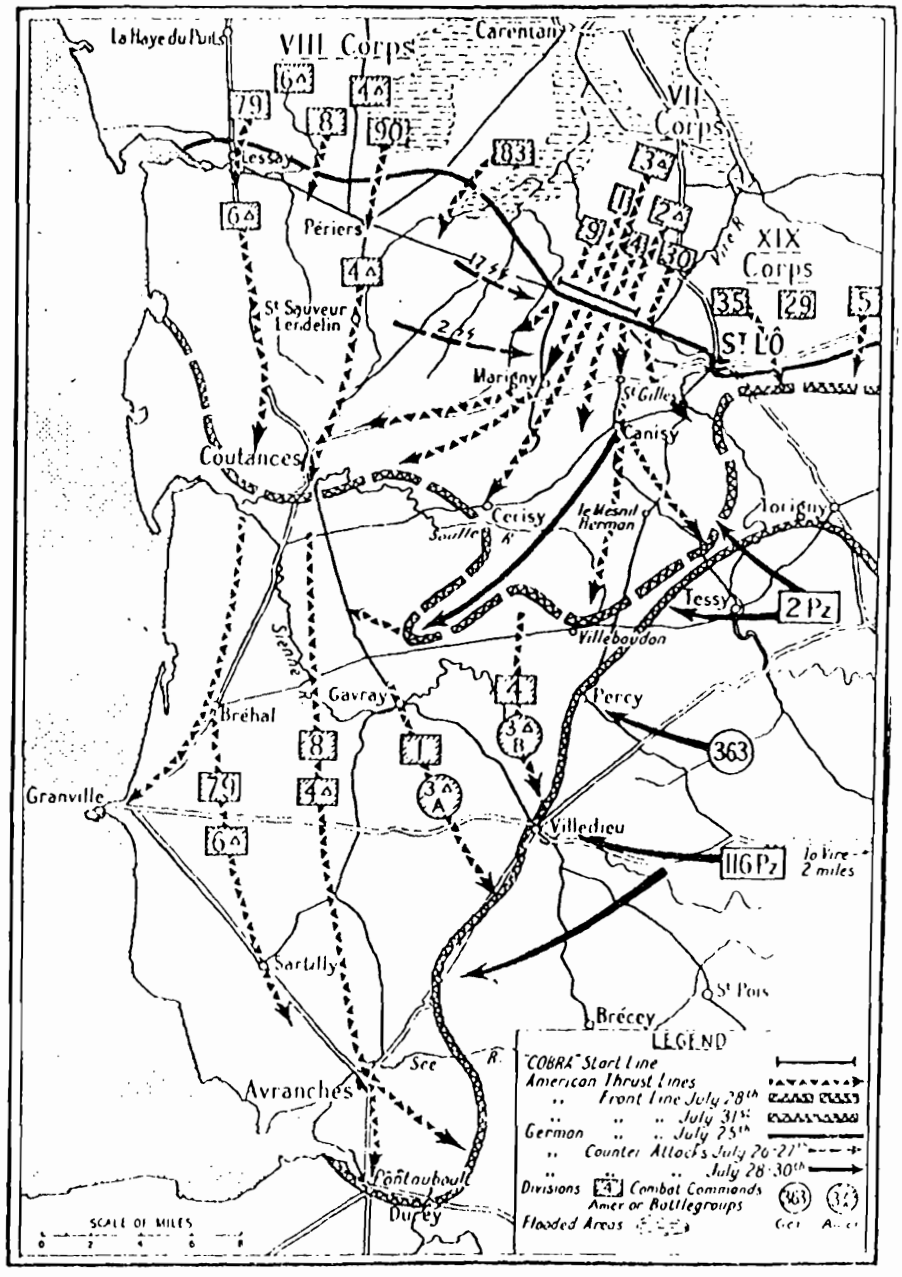
Map 2



EL GUETTAR

Map from Lieutenant Colonel H. D. Baker, CO, 601st TD Battalion, "El Guettar," TD Combat in Tunisia, dtd. January 1944, Bruce, p. 18.

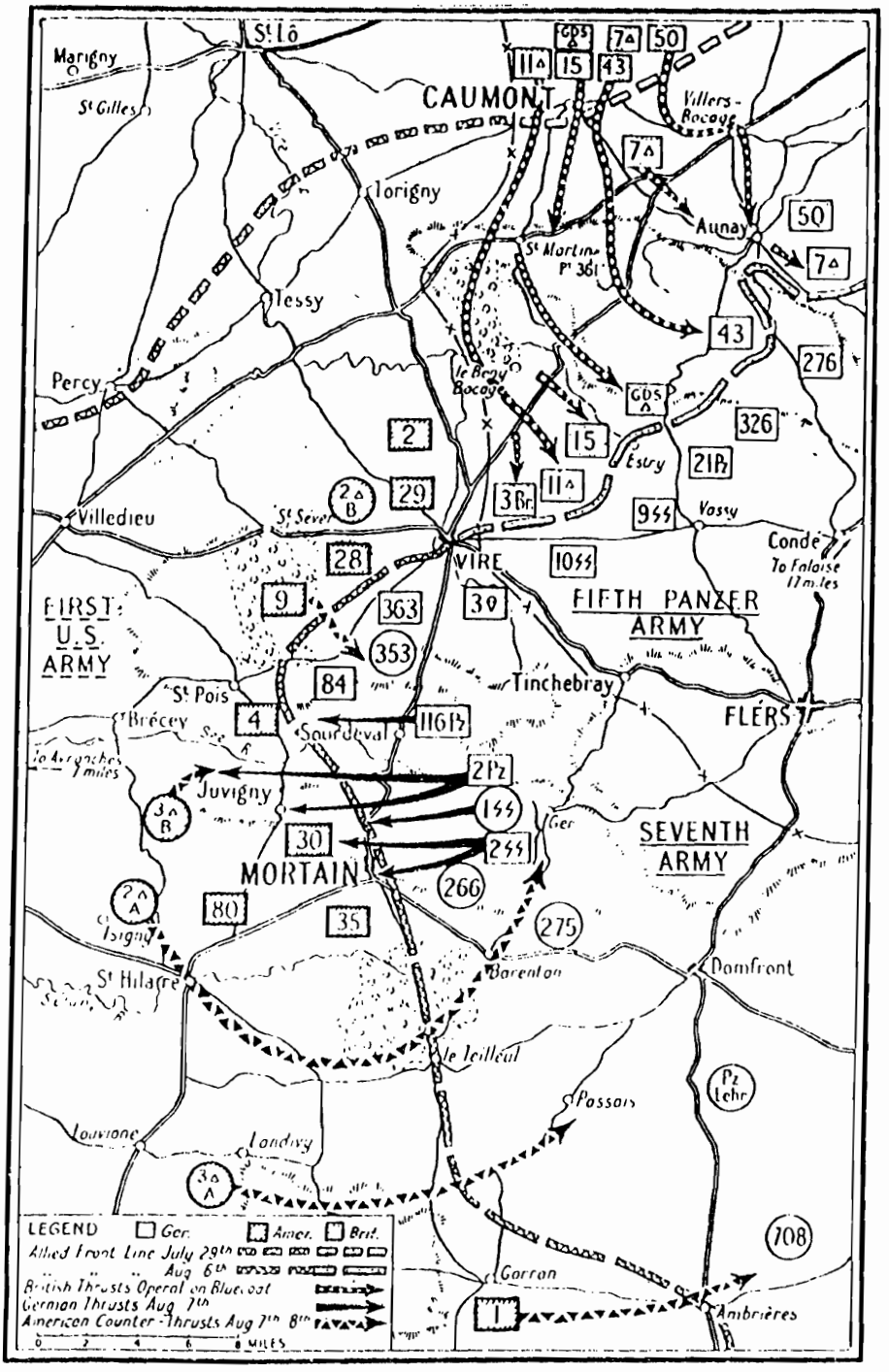
Map 3



OPERATION COBRA, JULY 25TH-31ST

Map from Chester Wilmot, The Struggle for Europe (New York: Harper & Brothers, 1952), facing page 384.

Map 4



THE MORTAIN COUNTER-ATTACK, AUGUST 7TH-8TH

Map from Chester Wilmot, The Struggle for Europe (New York: Harper & Brothers, 1952), facing page 385.

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